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. III & VI)

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

The Syllabi of B. Sc. in Electronics (Third and Fourth Semesters) as per **NATIONAL EDUCATION POLICY – 2020 (2024 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 (S.Y.B.Sc.Electronics)

Under Choice Based Credit System (CBCS)

and

as per NEP-2020 Guidelines

[w.e.f.AcademicYear: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 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 Electroncis 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 structuredtodevlope practical skills as per reqirementin 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 S.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 III, Level – 5.0											
DSC-5	DSC	ELE-DSC-231	Analog Electronics and Applications	2	2	---	2	20	---	30	---
DSC-6	DSC	ELE-DSC-232	Digital Circuit Design	2	2	---	2	20	---	30	---
DSC-7	DSC	ELE-DSC-233	Practical on Analog and Digital Electronics Circuits	2	---	4	4	---	20	---	30
SEC-1	SEC	ELE-SEC-231	Networking and Hardware	2	2	---	2	20	---	30	---
CEP	CEP	ELE-CEP-231	Community Engagement Program	2	---	4	4	50	---	---	---
MIN-1	MIN	ELE-MIN-231	Advanced Digital Electronics	2	2	---	2	20	---	30	---
MIN-2	MIN	ELE-MIN-232	Computer Architecture	2	2	---	2	20	---	30	---
MIN-3	MIN	ELE-MIN-233	Practical on Digital Electronics & Computer Architecture	2	---	4	4	---	20	---	30
OE-4	OE	ELE-OE-231	E-vehicle Components	2	2	---	2	20	---	30	---
Semester IV, Level – 5.0											
DSC-8	DSC	ELE-DSC-241	Linear Integrated Circuits	2	2	---	2	20	---	30	---
DSC-9	DSC	ELE-DSC-242	8085 Microprocessor	2	2	---	2	20	---	30	---
DSC-10	DSC	ELE-DSC-243	Practical on Linear IC and 8085 Microprocessor	2	---	4	4	---	20	---	30
SEC-2	SEC	ELE-SEC-241	ARDUINO programming	2	2	---	2	20	---	30	---
SEC-3	SEC	ELE-SEC-242	Practical on ARDUINO board	2	---	4	4	---	20	---	30
FP	FP	ELE-FP-241	Field Project	2	---	4	4	50	---	---	---
MIN-4	MIN	ELE-MIN-241	Introduction to Embedded System	2	2	---	2	20	---	30	---
MIN-5	MIN	ELE-MIN-242	Practical on Embedded System	2	---	4	4	---	20	---	30
OE-5	OE	ELE-OE-241	Battery Technology	2	2	---	2	20	---	30	---

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-III

S.Y. B.Sc. Electronics (Major)
Semester-III
ELE-DSC-231: 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 diode circuits and its applications. • Understand the transistor configuration. • Design transistor amplifier for the application. • Understand power amplifier and Oscillator and its applications.	
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, its role in power supply, Shunt capacitor filter, output waveform, and working. Zener diode as voltage regulator, Wave shaping circuit design and applications: Clipper and Clamper.	**9**
Unit II	**Transistors** Working of Transistor: PNP and NPN transistor, transistor configuration: CE, CB, CC, Characteristics of CE connection, Comparison, DC loads line, Q point, Transistor Biasing: its need, types, Voltage divider Bias method, stabilization, numericals	**9**
Unit III	**Amplifiers:** Transistor as an Amplifier in CE configuration, Frequency response of Single stage Amplifier, gain, decibel gain, bandwidth Multistage amplifier: Coupling its types and Comparison, Small Signal and High Signal Amplifier	**5**
Unit IV	**Power Amplifier and Oscillator** 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 Concept of Feedback, Positive feedback in Oscillator, Barkhausen Criteria, types of oscillators, Phase Shift Oscillator, Crystal Oscillator.	**7**
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.	

S.Y. B.Sc. Electronics (Major)
Semester-III
ELE-DSC-232: Digital Circuit Design

Total Hours: 30 **Credits: 2**

Course Objectives	• To describe sequential logic circuits in digital electronic circuits. • To describecounters and shift registers • To understand designing of electronic circuit using K-map. • To understand the concept of convertors.	
Course Outcomes	After successful completion of this course, students are expected to: • Understand and analyses sequential circuits. • Understand and demonstrate the counters and shift registers. • Design digital system for real time applications. • Illustrate the converters and its applications.	
Unit	**Contents**	**Hours**
Unit I	**Sequential Circuits** Flip-Flop: RS FF, Clock RS FF, JK FF, T FF, D FF(Operation, Truth Table, Applications) concept of master slave FF	6
Unit II	**Counters and Shift registers:** Counter: asynchronous and Synchronous Counter, Decade Counter, Ripple Counter, Ring Counter, Application of Counter Shift Register: Introduction, Types and applications of Shift Registers	8
Unit III	**K-map:** Sum-of-Products Method, Product-of-sums Method, Truth Table to Karnaugh Map, Pairs, Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions, logic diagram, implementation using NAND gate.	**8**
Unit IV	**Digital to Analog Converter:** Concept, specifications, types, Resistive divider, R-2R Ladder, Applications **Analog and Digital Converter:** Concept, Specification, types, Dual Slop, Simultaneous A/D, Counter type, Successive approximation, applications Numericals on resolutions.	**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.	

S.Y. B.Sc. Electronics (Major)
Semester-III
ELE-DSC-233: Practical on Analog and Digital Electronics Circuits

Total Hours: 60 **Credits: 2**

Course Objectives	• To plot the characteristics of diode and applications. • To understand performance of transistor amplifier 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: • Handle electronics circuit of diode and transistor. • Design amplifier and oscillator. • Construct and verify sequential circuits. • Apply the knowledge in real life problem.	
Sr. No.	**Contents**	**Hours**
1	Study of the I-V Characteristics of P-N junction Diode.	**4**
2	Study of the I-V Characteristics of Zener Diode	**4**
3	Build and test Zener diode as a voltage regulator.	**4**
4	Build and test Half Wave Rectifier.	**4**
5	Build and test Full Wave Rectifier. (Two diode)	**4**
6	Build and test Full Wave Bridge Rectifier.	**4**
7	Build and test clipping/ clamping circuit	**4**
8	Build and test transistor amplifier.	**4**
9	Study of Voltage divider bias for transistor.	**4**
10	Build and test Phase shift Oscillator	**4**
11	Build and test crystal oscillator	**4**
12	Build and test emitter follower using transistor.	**4**
13	Study of Clocked RS FF.	**4**
14	Study of T FF..	
15	Study of D FF.	**4**
16	Study of Decade Counter.	**4**
17	To build and test Shift Register using D-type/JK Flip-Flop ICs.	4
18	Study of R-2R ladder D/A convertor.	4
19	Mapping of K-map for given truth table.	4
20	Build and test logic circuit using NAND for a given truth table. (k-map)	4
21	Study of ADC.	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.	

S.Y. B.Sc. Electronics (Major)
Semester-III
ELE-SEC-231: Networking and Hardware

Total Hours: 30 **Credits: 2**

Course Objectives	▪ Familiar with concept of data communication ▪ To provide foundational knowledge of networking and standards. ▪ To aware the role of networking devices in data communication. ▪ To provide knowledge of practical skills in setting up network.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Understand the key concept of data communication. ▪ Learn basic network types, topologies and the importance of IP addressing ▪ Understand the role of different networking devices such as routers, switches, hubs and modems. ▪ Understand and able to resolve troubles while setting network.	
Unit	**Contents**	**Hours**
Unit I	**Data Communication:** Introduction, Communication protocols, Characteristics, Components of data communication, Data transmission: Simple, Half duplex, Full duplex.	**06**
Unit II	**Networking Basics:** Basic Networking Concepts, Introduction to Networking: Definition and Importance, Types of Networks: LAN, WAN, MAN, PAN Network Topologies: Star, Ring, Bus, Mesh, Basics of IP Addressing and Subnet Mask	**08**
Unit III	**Introduction to Networking Devices:** Importance of networking devices in communication, Overview of Router, Switch, Hub and Modem (Definition, types and role in a network) Types of routers: Wired and Wireless. Types of switches: Managed vs. Unmanaged. Types of hubs: Active, Passive, and Intelligent. Types of modems: DSL, Cable, and Fiber Difference between switches and hubs. Modem vs. Router: Key differences.	**08**
Unit IV	**Network Setup and Configuration:** Setting Up a Home/Office Network, Introduction to Wireless Networking (Wi-Fi, Bluetooth), Network Cabling: Ethernet Cables, Crimping Tools, and Connectors, Configuration of Routers and Switches, Troubleshooting Basic Network Issues	**08**
Study Resources	▪ Sinha, P., Pradeep, K. (2004).Computer Fundamentals, Sinha: BPB Publications, New Delhi ▪ Manjunath, G., (2010).Computer Basics,Vasan Publications, Bangalore ▪ Kurose, J., Keith, R. (2022).Computer Networking, 8th Pearson Education ▪ Tanenbaum, (2003). Computer Networks, 4thPearson Publication.	

S.Y. B.Sc. Electronics (Major)
Semester-III
ELE-CEP-231: Community Engagement Program

Total Hours: 60 **Credits: 2**

In alignment with the National Education Policy (NEP) 2020, Moolji Jaitha College (Autonomous), Jalgaon is introducing the Community Engagement Program at the undergraduate level. The NEP 2020 emphasizes holistic development, inclusivity, and integrating vocational education with academic learning, aiming to nurture socially responsible individuals. Inspired by NEP 2020, the Community Engagement Program aim to produce knowledgeable, compassionate, and proactive graduates, contributing to a more just, equitable, and sustainable society. This course fosters a strong connection between education and socioeconomic problems of real-world. Students will learn about the challenges faced by vulnerable households and appreciate local wisdom and lifestyles.

Objectives

- To engage students in activities that promote emotional, social, and intellectual growth, fostering a well-rounded approach to personal and academic development.
- To provide hands-on experiences that complement classroom learning, enabling students to apply their knowledge insocioeconomic problems of real-world.
- To instil a sense of responsibility towards the community by encouraging students to actively participate in social and environmental initiatives, appreciate rural culture, lifestyle, and wisdom.

Outcomes

After completing this course, students will be able to

- Understand rural and/or urban culture, ethos, and socioeconomic realities.
- Develop a sense of empathy with the local community while appreciating the significant contributions of local communities to society and the economy.
- Learn to value the local community wisdom and identify opportunities for contributing to the community's socioeconomic improvements.

Activities

- Conduct workshops and interactive sessions on emotional intelligence and social skills.
- Organize debates, discussions, and intellectual challenges that stimulate critical thinking and socioeconomic problem-solving using concern subject.
- Organize field visits where students can work on real-world problems, such as environmental conservation, rural and/or urban planning, or community health.
- Organize internships or service-learning opportunities with local businesses, NGOs, or government agencies.
- Facilitate project-based learning activities that require students to use their academic knowledge to develop solutions to community issues.
- Engage students in community service activities that address local social and environmental issues.
- Organize cultural exchange programs or field trips to rural areas to foster an appreciation of rural culture and wisdom.
- Facilitate collaborative projects involving students, educators, and community members to develop solutions for local challenges, promoting teamwork and collective problem-solving.

- Conduct educational sessions on the status of various agricultural and development programs and the challenges faced by vulnerable households, ensuring inclusivity and accessibility for all students.

S. No.	Module Title	Module Content	Assignment submission	Teaching/ Learning Methodology
1	**Appreciation of Rural Society**	Rural lifestyle, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of "soul of India lies in villages', rural infrastructure.	Prepare a map (physical, visual or digital) of the village you visited and write an essay about inter-family relations in that village.	– Classroom discussions – Field visit – Assignment
2	**Understanding rural and local economy and livelihood**	Agriculture, farming, land ownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets, migrant labour.	Describe your analysis of the rural house hold economy, its challenges and possible pathways to address. Circular economy and migration patterns.	– Field visit – Group discussions in class – Assignment
3	**Rural and local Institutions**	Traditional rural and community organisations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), Nagarpalikas and municipalities, local civil society, local administration.	How effectively are Panchayati Raj and Urban Local Bodies (ULBs) institutions functioning in the village? What would you suggest to improve their effectiveness? Present a case study (written or audio-visual).	– Classroom – Field visit – Group presentation of assignment
4	**Rural and National Development Programmes**	History of rural development and current national programmes in India: SarvaShikshaAbhiyan, BetiBachao, BetiPadhao, Ayushman Bharat, Swachh Bharat, PM AwaasYojana, Skill India, Gram Panchayat Decentralised Planning, National Rural Livelihood Mission	Describe the benefits received and challenges faced in the delivery of one of these programmes in the local community; give suggestions about improving the implementation of the programme for the poor. Special focus on the urban	– Classroom – Each student selects one program for field visit – Written assignment

	(NRLM), Mahatma Gandhi National Rural Employment Guarantee Act 2005 (MGNREGA), SHRAM, Jal Jeevan Mission, Scheme of Fund for Regeneration of Traditional Industries (SFURTI), AtmaNirbhar Bharat, etc.	informal sector and migrant households.

Note: The modules are suggestive in nature and students can opt any oneactivities for community engagement program and field project based on topic appropriate to their regional community context.

Some additional suggestive themes for field-based / community engagement activities are listed below:

- Management curriculum may include aspects of micro-financing in a rural context;
- Chemistry syllabus can have a component of conducting water and soil analysis in surrounding field areas;
- Political science syllabus could include a mapping of local rural governance institutions and their functioning.
- Environment education will include areas such as climate change, pollution, waste management, sanitation, conservation of biological diversity, management of biological resources and biodiversity, forest and wildlife conservation, and sustainable development and living
- Understanding panchayats and constitutional mandate of local governance
- Panchayat administration, Gram Sabha, Mahila Sabha, Gram Panchayat Development Plan (GPDP), local planning of basic services.
- Micro-finance, SHGs, system of savings and credit for local business, linkages to banks, financial inclusion.
- Rural – entrepreneurship, opportunities for small business in local communities, access to financial and technical inputs to new entrepreneurs.
- Renewable energy, access to household and community level solar and bio-mass systems for sustainable energy use.
- Participatory Monitoring and evaluation of socio-economic development programmes, and cost-benefit analysis of project proposals.
- Migrant workers' livelihood security and social services.
- Hygiene and sanitation, improving health and personal behaviours, locally manageable decentralised systems and awareness against stubble burning.
- Water conservation, traditional practices of storage and harvesting, new systems of distribution and maintenance.
- Women's empowerment, gender inequality at home, community and public spaces, safety of girls and women, access to skills, credit and work opportunities.
- Child security, safety and good parenting, nutrition and health, learning and training for child care.

- Rural Marketing, market research, designing opportunities for rural artisans and crafts, and new products based on demand assessment.
- Community Based Research in Rural Settings, undertaking research that values local knowledge, systematises local practices and tools for replication and scale-up.
- Peri-urban development of informal settlements, mapping and enumeration, design of local solutions.

Assessment:

- Readings from related literature including e-content and reflections from field visits should be maintained by each student in the form of Field Diary (20 Marks)
- Submission of assignments based on modules assignment submission (details mentioned above) (20 Marks)
- Oral/ Group discussion/ Presentation (10 Marks)

S.Y. B.Sc. Electronics (Minor)
Semester-III
ELE-MIN-231: Advanced Digital Electronics

Total Hours: 30 **Credits: 2**

Course Objectives	▪ To understand combinational logic circuits ▪ To understand sequential logic circuits in digital electronic circuits. ▪ To understand convertors. ▪ To understand the computer system.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Design and analyse sequential circuits. ▪ Design and analyse combinational circuits. ▪ Familiar with data conversion system. ▪ Gain fundamental Knowledge of Computer System	
Unit	**Contents**	**Hours**
Unit I	**Sequential Circuits** Flip-Flop: Clock RS FF, JK FF, T FF, D FF (Operation, Truth Table,Applications) Counter: A synchronous and Synchronous Counter, Decade Counter, Ripple Counter, Ring Counter, Application of Counter Shift Register: Introduction, Types, Applications of Shift Registers	**09**
Unit II	**Combinational Logic Circuits:** Sum-of-Products Method, Product-of-sums , Karnaugh Map, minterm and maxterm, Pairs, Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions, Implemetation using NAND.	**09**
Unit III	**Converter:** Digital to Analog Converter: Types, R-2R Ladder, Accuracy and Resolution. Analog to Digital Converter: Types, Dual Slop, Simultaneous A/D, Accuracy and Resolution	**08**
Unit IV	**Computer fundamentals** CPU, Input/output devices and port Memory: RAM: static and dyanamic RAM ROM: memory cell, ROM architecture, types of ROM Flash memory, cache memory, USB flash drive	**04**
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.	

S.Y. B.Sc. Electronics (Minor)
Semester-III
ELE-MIN-232: Computer Architecture

Total Hours: 30 **Credits: 2**

Course Objectives	▪ Familiar with the architecture of computer system ▪ To provide the basic knowledge of moterhboards ▪ To study architecture of 8085 micrprocessor and its instruction set. ▪ Familiar with the advanced microporocessors and its features.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Understand the basic hardware of computer system. ▪ Learn the structure of motherboard. ▪ Describe the 8085 architecture and its instruction set. ▪ Learn different advanced microporocessors.	
Unit	**Contents**	**Hours**
Unit I	**Introduction to Computer System (PC) Hardware:** Introduction, Block diagram of Computer System. Study of basic I/O, systems, Types of Memories- Static RAM and Dynamic RAM,ROM, PROM, EPROM, EEPROM, CPU (Central Processing Unit)-ALU and control unit, Data storage devices	**06**
Unit II	**Motherboards:** Motherboards, Types of Motherboard, Configuration, CPU Sockets, Identifying Internal and External connectors, Types ofdata cables, Types of Processors	**06**
Unit III	**Microprocessor:** Introduction and Evolution of Microprocessors, The 8085 processor: Features, Block diagram, Function of each block, Registers, ALU, Stack memory, Stack Pointer, Program counter, Concept of Interrupt,Data and address buses, Machine Cycle, Instruction cycle, Addressing modes, Instruction set, assembly language programming	**10**
Unit IV	**Advanced Microprocessors:** Introduction, Harvard and Von-Neumann architecture, CISC and RISC, pipelining, memory paging, features of 8086, 80386, 80486, Pentium and modern processors	**08**
Study Resources	▪ Clements, A., (2000). The Principles of Computer Hardware, (3rd ed) Oxford University Press. ▪ Wilson, K.,(2022). Computer Hardware, (3rd ed) Ellumint Press.Ray, K.&Bhurchandi, K.M. (2013). Advanced Microprocessor &Peripherals, (3rded) Tata McGraw Hill. ▪ Chhabbra, B. S. (2018). 8085 Microprocessor & its Applications (1st ed.). Dhanpat Rai Books. ▪ Gaonkar, R. (2019). Microprocessor Architecture, Programming, and Applications with the 8085. Masood Books UP. ▪ Kani, N. (2021). 8085 Microprocessor and Applications (4 ed.). CBS publishers and distributors pvt ltd. ▪ Kaushik, d. K., prakash, o., & das , s. (2023). Programming on microprocessor–8085 and microcontroller - 8051. ekaksh publications.	

S.Y. B.Sc. Electronics (Minor)
Semester-III
ELE-MIN-233: Practical on Digital Electronics & Computer Architecture

Total Hours: 60 **Credits: 2**

Course Objectives	▪ To provide practical exposure on digital combinational circuits. ▪ To understand the concepts of flipflops, registers and counters. ▪ To understands the various addressing methods and instruction set of microprocessor. ▪ To learn program development tools and programming skills.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Construct and verify sequential circuits. ▪ Understand microprocessor 8085 programming. ▪ Develop the application programs of 8 bit microprocessor using 8085. ▪ Apply the knowledge in real life problem.	
Sr. No.	**Contents**	**Hours**
1	To build and test Shift Register (serial-in and serial-out) using D-type/JK Flip-Flop ICs.	**4**
2	Study of R-2R ladder D/A convertor.	**4**
3	Mapping of K-map for given truth table.	**4**
4	Study of Clocked RS FF.	**4**
5	Study of Decade Counter.	**4**
6	Study of T FF.	**4**
7	To build and test Shift Register (Paralle-in and serial-out) using D-type/JK Flip-Flop ICs.	**4**
8	Study of A/D convertor.	**4**
9	Simplify given K-map and verify the truth table by circiut.	**4**
10	Study of Clocked JK FF.	**4**
11	Study of differenent Mod Counter using IC 7490.	**4**
12	Study of D- flip flop.	**4**
13	Identification of Computer Hardware Parts.	**4**
14	Study of motherboard parts.	**4**
15	Installation of computer RAM and Hard disk.	**4**
16	Assembling of CPU.	**4**
17	Assembly Language Program for addition/subtraction of two 8-bit numbers using indirect addressing mode.	**4**
18	Assembly Language Program for addition/ subtraction of two 8-bit numbers using direct addressing mode.	**4**
19	Assembly Language Program to multiply 8-bit unsigned number by 8-bit unsigned number using repeated addition	**4**
20	Assembly Language Program to calculate the sum of the series of number using subroutine	**4**
21	Assembly Language program to convert the hex number into an ASCII character.	**4**
22	Assembly Language to find smallest/largest number from series of numbers.	**4**

23	Assembly Language program to organize series of numbers in ascending order.	**4**
24	Assembly Language program to find number of 1's and 0's in 8-bit number stored at memory location.	**4**
25	Assembly Language program to find the 1's and 2's of 8-bit number stored at memory location.	**4**
Study Resources	▪ Malvino, A.P., Leach D.P. &Saha. (2011). Digital Principles and Applications. Tata McGraw. ▪ Venugopal, K. R. (2011). Digital Circuits and systems, Tata McGraw Hill Education. ▪ Taub, H. & Schilling, D. (1985). Digital Integrated Electronics, McGraw Hill. ▪ Ray, K.&Bhurchandi, K.M. (2013). Advanced Microprocessor &Peripherals, (3rded) Tata McGraw Hill ▪ Chhabbra, B. S. (2018). 8085 Microprocessor & its Applications (1st ed.). Dhanpat Rai Books. ▪ Gaonkar, R. (2019). Microprocessor Architecture, Programming, and Applications with the 8085. Masood Books UP. ▪ Clements, A., (2000). The Principles of Computer Hardware, (3rd ed) Oxford University Press. ▪ Wilson, K.,(2022). Computer Hardware, (3rd ed) Ellumint Press.	

S.Y. B.Sc. Electronics (Open Elective)
Semester-III
ELE-OE-231: E-vehicle Components

Total Hours: 30 **Credits: 2**

Course Objectives	▪ To provide brief idea about electric vehicles with performance parameters and its importance. ▪ To understand DC motor and controllers ▪ To understand battery and battery management system for electric vehicles. ▪ To acqiure knowledge of charging of battery.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Identifyvarious componentsofan EV. ▪ Understand EV parameters and operations. ▪ PerformmotorpowerandtorquecalculationstoselectamotortobuildtheirownEV. ▪ Analyze the concept of battery management system and charging.	
Unit	**Contents**	**Hours**
Unit I	**IntroductiontoElectricVehicles** Overview of EVs and challenges - components of EVs - architecture of EVs, Performance, currentdemandinEVindustry, opportunities oskilledEVengineers, scope for EV industry in India.	**6**
Unit II	**Motorcontrollerbasics** Dc motor – diagram,parts of DC motor – armature, stator, commutator, working of DC motor, types of DC motor, brushed DC motor , Brushless DC motor, application of DC motor. Motor controller – types of DC motor controller, application of DC motor controllers	**8**
Unit III	**UnderstandingBatteries** Basics of battery, types of batteries, working principle of batteries, selection of batteries, safetymeasurses of battery uses, swapping of battery, building abatterymonitoringcircuitthatmonitorsvariousparameterslikecurrent,voltage,temperature and energy consumption of the battery pack they have built using alkalinebatteries.	**8**
Unit IV	**ChargingTechnologyandImplementation** basics of charging technology, charging process, types of chargers, rapid chargind process, charging station scenario in India	**4**
Study Resources	▪ Larminie,J. and Lowry, J. (2003). Electric Vehicle Technology Explained. John Wiley & Sons Ltd ▪ Khajepour, A., Fallah, S. and Goodarzi, A. (2014). Electric and Hybrid VehiclesTechnologies, Modelling and Control: A Mechatronic Approach.John Wiley & Sons Ltd ▪ Ehsani, M., Gao, Y. and Emadi, A. (2010). Modern Electric, Hybrid Electric, and Fuel Cell Vehicles Fundamentals, Theory, and Design. (2nd ed.) CRC Press ▪ https://www.pupilfirst.school/courses/641/curriculum ▪ https://en.wikipedia.org/wiki/Electric_vehicle	

	▪ https://intellipaat.com/blog/electric-vehicle-components/ ▪ https://www.omazaki.co.id/en/electric-vehicle-components/ ▪ https://yocharge.com/faq/the-main-components-of-electric-vehicles/ ▪ https://skill-lync.com/blogs/main-components-of-ev-parts-of-ev ▪ https://www.mdpi.com/1996-1073/10/8/1217 ▪ https://vin.dataonesoftware.com/vin_basics_blog/electric-vehicle-key-components.	

SEMESTER-IV

S.Y. B.Sc. Electronics (Major)
Semester-IV
ELE-DSC-241: Linear integrated Circuits

Total Hours: 30 **Credits: 2**

Course Objectives	▪ To understand various op-amp parameters and their importance in design. ▪ To introduce various op-amp application circuits. ▪ To introduce various timing circuits. ▪ Familiar with fundamentals working of voltage regulators.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Learn op-amp parameters and its significance in design. ▪ Explore the applications of op-amp and implementation of it in real life. ▪ Design different timming signal using IC-555 ▪ Describe functioning of power supply.	
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.	**08**
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.	**08**
Unit III	**Clock and Timer (IC 555)** Multivibrator, Types of mutivibrator, Block diagram of IC 555, Astable, Monostable and Bistable multivibrator circuits using IC555, Period and frequency of multivibrators, Problems	**07**
Unit IV	**Voltage Regulators** Introduction to Voltage regulation, voltage follower, addustable output regulator, LM 317& LM337, Intergrated circuits regulators, IC 723, DC-DC convertor, SMPS	**07**
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, (3rded), Oxford University Press. ▪ Tocci, R.J. &Widmer,N.S.(2001)Digital Systems: Principles and Applications, PHI. ▪ Bakshi, U.A. &Godse, A.P (2007). Linear Integrated Circuits & Applications, Technical publications. ▪ Fiore, J. M. (2010). OpAmps and Linear Intergrated Circuits, (1sted), Cengage Learning.	

S.Y. B.Sc. Electronics (Major)
Semester-IV
ELE-DSC-242: 8085 Microprocessor

Total Hours: 30 **Credits: 2**

Course Objectives	▪ To famillier with the basic of microprocessor. ▪ To introduce basic architecture of microprocessor. ▪ To understands the various addressing methods and instruction set of microprocessor. ▪ To learn program development tools and programming skills.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Know the fundamental of microcomputer. ▪ Understand the internal architecture of basic microprocessor 8085. ▪ Understand microprocessor 8085 addressing mode and instructions. ▪ Develop Assembly Language Programs of 8 bit microprocessor using 8085.	
Unit	**Contents**	**Hours**
Unit I	**Fundamentals of Microcomputer** Simple Microcomputer Architecture, Input/output Devices, Address bus, Data bus, Control bus, Data storage (idea of RAM and ROM), Computer memory, Memory Interfacing, Memory Map, High level language, Low level language, Assembler, Compiler.	**06**
Unit II	**Architecture of 8085 Microprocessor** Features of 8085, Block diagram, function of each block, Registers, ALU, Stack Pointer, Program counter, instruction decoder & machine cycle encoder, Timing & control unit, Concept of Interrupt, Hardware/software interrupts, serial communication control, Pin-out diagram of 8085, function of each pin, Data and 4 address buses, De-multiplexing the Bus AD7-AD0, Timing states (T-state), Machine Cycle, Instruction cycle. Timing diagram for Read and write operation (MOV A,M and MOV M,A) , Concept of Stack .	**08**
Unit III	**Instruction set of 8085 Microprocessor** Study of addressing mode for 8085:-Implied Addressing, Register Addressing, Immediate Addressing, Direct Addressing, Register Indirect Addressing, Instruction set: Data transfer instructions, Arithmetic Instructions, Logical Instructions, Branching Instructions, Stack, I/O and Machine Control Instructions.	**08**
Unit IV	**Assembly Language Programming** Assembly Language Format, Arithmetic Programs: - 8-bit addition, 8-bit subtraction, Decimal addition and subtraction of two 8-bit numbers, 8-multiplication, one's and two's complement of 16-bit numbers, find largest and smallest Number from a series of given number. Code Conversion Programs: Hex to ASCII conversion, BCD to binary conversion	**08**
Study Resources	▪ Chhabbra, B. S. (2018). 8085 Microprocessor & its Applications (1st ed.). Dhanpat Rai Books. ▪ Gaonkar, R. (2019). Microprocessor Architecture, Programming, and Applications with the 8085. Masood Books UP. ▪ Kani, N. (2021). 8085 Microprocessor and Applications (4 ed.). CBS PUBLISHERS AND DISTRIBUTORS PVT LTD. ▪ Kaushik , D. K., Prakash, O., & Das , S. (2023). PROGRAMMING ON MICROPROCESSOR–8085 AND MICROCONTROLLER – 8051. Ekaksh Publications.	

S.Y. B.Sc. Electronics (Major)
Semester-IV
ELE-DSC-243: Practical on Linear IC and 8085 Microprocessor

Total Hours: 60 **Credits: 2**

Course Objectives	▪ To provide hand on for electronics instruments ▪ To make the student have a clear knowledge of the basic laws governing the operation of the instruments, relevant circuits and their working. ▪ To understands the various addressing methods and instruction set of microprocessor. ▪ To learn program development tools and programming skills.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Handleelectronics instruments line CRO, Function genetator. ▪ Measureelectrical quantities. ▪ Understand microprocessor 8085 programming. ▪ Develop the application programs of 8 bit microprocessor using 8085.	
Sr. No.	**Contents**	**Hours**
1	Study op-amp parameters. (o/p impedance, gain, offset null arrangement)	**4**
2	To design an inverting amplifier using Op-amp (741/351) for dc voltage of given gain.	**4**
3	To design inverting amplifier using Op-amp (741/351) and study its frequency response.	**4**
4	To add two dc voltages using Op-amp in inverting and non-inverting mode.	**4**
5	To design an non inverting amplifier using Op-amp (741/351) for dc voltage of given gain	**4**
6	To investigate the use of an op-amp as an Integrator.	**4**
7	To investigate the use of an op-amp as a Differentiator.	**4**
8	To design a Wien bridge oscillator for given frequency using an op-amp.	**4**
9	Design a Butterworth Low Pass active Filter (1st order) and study Frequency Response	**4**
10	Design a Butterworth High Pass active Filter (1st order) and study Frequency Response	**4**
11	Design and test dual power supply.	**4**
12	Design DC variable power supply.	**4**
13	To design an AstableMultivibrator of given specification using IC 555 Timer.	**4**
14	To design a MonostableMultivibrator of given specification using IC 555 Timer.	**4**
15	Assembly Language Program for addition/ subtraction of two 8-bit numbers using direct addressing mode.	**4**
16	Assembly Language Program to multiply 8-bit unsigned number by 8-bit unsigned number using repeated addition	**4**
17	Assembly Language Program to calculate the sum of the series of number using subroutine	**4**
18	Assembly Language program to convert the hex number into an ASCII character.	**4**
19	Assembly Language to find smallest/largest number from series of numbers.	**4**

20	Assembly Language program to find number of 1's and 0's in 8-bit number stored at memory location.	**4**
21	Assembly Language Program to division 8-bit unsigned number by 8-bit unsigned number using repeated subtraction.	**4**
22	Assembly Language program to convert the packed BCD into an unpacked BCD.	**4**
23	Assembly Language program to convert the BCD to Binary.	**4**
Study Resources	▪ Rangan, C.S., Sarma, G.R. and Mani,V.S.(1998). Instrumentation Devices and Systems, Tata McGraw Hill. ▪ Sawhney, K. (2004). A Course in Electrical &Electronic Measurements & Instrumentation. Dhanpat Rai and Co. ▪ Carr, J.J. (2019). Elements of Electronics Instrumentation and Measurement. Pearson India ▪ Kani, N. (2021). 8085 Microprocessor and Applications (4 ed.). CBS PUBLISHERS AND DISTRIBUTORS PVT LTD. ▪ Kaushik , D. K., Prakash, O., & Das , S. (2023). PROGRAMMING ON MICROPROCESSOR–8085 AND MICROCONTROLLER - 8051. Ekaksh Publications.	

S.Y. B.Sc. Electronics (Major)
Semester-IV
ELE-SEC-241: ARDUINO programming

Total Hours: 30 **Credits: 2**

Course Objectives	▪ To provide a comprehensive understanding of ARDUINO and standard functions. ▪ To familier with the basic of ARDUINOprogramming. ▪ To know sensor interfacing with ARDUINO. ▪ To communication protocols and external modules for building IoT-based systems using ARDUINO.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Demonstrate the ability to set up and work with Arduino boards and basic electronic components to create simple circuits. ▪ Write and debug Arduino programs using control structures, functions, and programming concepts to control hardware. ▪ Interface various sensors and actuators with Arduino, enabling the development of sensor-based systems and output control. ▪ Understand and apply communication protocols such as I2C, SPI, and UART to integrate external modules and devices with Arduino.	
Unit	**Contents**	**Hours**
Unit I	**Introduction to Arduino** Overview of Arduino: History, boards, and components, Introduction to microcontrollers and their role in Arduino, Setting up Arduino IDE and writing the first program (Blink LED),Understanding input and output: digitalRead(), digitalWrite(), analogRead(), analogWrite(), Basic components: LED, push buttons, resistors, and their use in circuits.	**08**
Unit II	**Arduino Programming and Control Structures** Basics of Arduino programming (C/C++), Structure of an Arduino program: Setup() and Loop() functions, Variables, data types, and constants, Control structures: If-else, loops (for, while), Functions and modular programming in Arduino, Practical exercises: Writing programs for simple tasks (e.g., blinking multiple LEDs, controlling motors).	**08**
Unit III	**Interfacing Sensors and Actuators** Understanding analog and digital signals, Interfacing sensors: Temperature, light, and distance sensors, Using potentiometers, buttons, and switches with Arduino, Controlling output devices: LEDs, motors, buzzers and servos, Pulse-width modulation (PWM) for controlling brightness and motor speed, Practical project: Building a sensor-based system (e.g., temperature monitoring system).	**08**
Unit IV	**Arduino Communication** Introduction to communication protocols: I2C, SPI, UART, Using external modules: Bluetooth, Wi-Fi, GSM, and sensors (e.g., GPS), Interfacing LCDs and displays with Arduino, Building wireless-controlled devices and IoT projects, Debugging techniques and error handling in Arduino projects.	**06**
Study Resources	▪ Wild,M. E. J. (2022). Arduino Step by Step: The Ultimate Beginner's Guide with Basics on Hardware, Software, Programming & DIY Projects, 3dtech, publication ▪ Hassa, E. (2023). Arduino Beginners Guide Book - Basic Robotics Book,	

	Learn Innovation with Arduino - Step by Step Learning with pictorial method,Prayog Tech Publication. ▪ Cheich,M. (2021). Arduino Book for Beginners,Open Hardware Design Group LLC. ▪ Barnwal,R. (2023). Arduino Programming Projects,BPB Publications, New Delhi	

S.Y. B.Sc. Electronics (Major)
Semester-IV
ELE-SEC-242: Practicals on ARDUINO board

Total Hours: 60 **Credits: 2**

Course Objectives	▪ To provide a comprehensive understanding of ARDUINO and standard functions. ▪ To familier with the basic of ARDUINO programming. ▪ To know sensor interfacing with ARDUINO., ▪ To communication protocols and external modules for building IoT-based systems using ARDUINO.
Course Outcomes	After successful completion of this course, students are expected to: ▪ Able to write and execute basic Arduino programs to control LEDs and other components using digital and analog functions. ▪ Proficient in reading and processing input from sensors such as potentiometers, ultrasonic sensors, and temperature sensors. ▪ Capable to interface with advanced components like keypads and buzzers to create more complex Arduino applications. ▪ Compete in integrating multiple components and sensors to design and build mini-projects using Arduino.

Sr. No.	Contents	Hours
1	Write a simple program to blink a LED using the digitalWrite() function.	**4**
2	Write program to Control an LED with a push button (digital input and output).	**4**
3	Write program to Read multiple analog inputs	**4**
4	Program an LED to blink with a delay of 1 second using the delay() function to create simple timing delays	**4**
5	Write program to Vary the brightness of an LED using PWM and a potentiometer.	**4**
6	Write program to Read an analog input from a potentiometer and control an LED based on its value.	**4**
7	Create a program to blink multiple LEDs in a sequence using a for loop and digitalWrite()	**4**
8	Write program to Use the analogWrite() function to control the brightness of an LED	**4**
9	Write a program to interface DC motor to rotate continuously.	**4**
10	Write a program to interface DC motor and control the speed of motor.	**4**
11	Write program to Use an ultrasonic sensor (HC-SR04) to measure distance and display it on the Serial Monitor.	**4**
12	Write program to Measure temperature with the LM35 sensor and display it on the Serial Monitor.	**4**
13	Write program to Use a light-dependent resistor (LDR) to control an LED based on ambient light intensity.	**4**
14	Program a buzzer to emit sound based on a sensor input	**4**
15	Write program to Read input from a 4x4 keypad and use it to control an LED or display a message on the Serial Monitor.	**4**

16	Program an LED to turn on or off based on a light sensor reading using if-else statements to create conditional logic.	**4**
17	Write a program to ON buzzer if the switch is pressed.	**4**
Study Resources	▪ WildM. E. J. (2022). Arduino Step by Step: The Ultimate Beginner's Guide with Basics on Hardware, Software, Programming & DIY Projects, 3dtech, publication ▪ Hassa E. (2023). Arduino Beginners Guide Book - Basic Robotics Book, Learn Innovation with Arduino - Step by Step Learning with pictorial method,Prayog Tech Publication. ▪ CheichM. (2021). Arduino Book for Beginners,Open Hardware Design Group LLC. ▪ BarnwalR. (2023). Arduino Programming Projects,BPB Publications, New Delhi	

S.Y. B.Sc. Electronics (Major)
Semester-IV
ELE-FP-241: Field Project

Total Hours: 60 **Credits: 2**

Preamble

In alignment with the National Education Policy (NEP) 2020, Moolji Jaitha College (Autonomous), Jalgaon is introducing the Field Project at the undergraduate level. The NEP 2020 emphasizes holistic development, inclusivity, and integrating vocational education with academic learning, aiming to nurture socially responsible individuals. This course fosters a strong connection between education and real-world applications. These initiatives aim to bridge the gap between theoretical knowledge and practical experience, helping students develop critical thinking, problem-solving skills, and a sense of civic responsibility.

Objectives

- To provide students with practical exposure in rural and urbansocioeconomic context.
- To develop students abilities to apply subject knowledge to address real world problems
- To foster critical thinking and innovative approaches to solve socioeconomic issues.

Outcomes

After completing this course, students will be able to

- Participate actively in filed projects that benefit local communities and promote sustainable development practices.
- Analyse the socio economic data using appropriate methods showcasing improved problem-solving skills, technical proficiency.
- Demonstrate the ability to apply theoretical knowledge to real-world situations effectively and exhibit communication skills.

Course structure

The course is divided in to four probable phases

I] Orientation and preparation

- Introduce to the course, objectives and expectation
- Overview of socioeconomic development issues in rural and urban context
- Training on working methodology and data collection techniques
- Review existing literature related to topic to understand the background and context.

II] WorkplanandFieldvisit

- Visit the potential sites to get a sense of the environment and logistical requirements.
- Create a detailed project plan outlining the steps, timeline, resources needed, and roles of team members.
- Obtain necessary approvals (Ethical/ local authorities/organizations/communities)
- Gather materials and resources (recording devices, cameras, notebooks and supplies)
- Conduct Preliminary Survey, choose appropriate methods for data collection and analysis (e.g., surveys, interviews, observations).

III] Data collection and analysis

- Pilot test to identify issues with data collection.
- Collect data systematically, ensuring consistency and accuracy.
- Keep detailed records of all data (field notes, recordings, photographs etc)
- Organize and analyse the data (manual/ software)

IV] Interpretation and Reporting

- Interpret your findings in the context to objectives.

- Write and submit a comprehensive report detailing your methodology, findings, analysis, and conclusions. (Include visuals - charts, graphs, and photographs).
- Prepare a presentation to share findings with peers/ instructors/ community.

Assessment

- Field work participation, field note book, team work etc. (10 Marks)
- Data Collection and Analysis (15 Marks)
- Field project report (15 Marks)
- Presentation of Findings(10 Marks)

Examples of activities to be conducted under field projects

- **Biodiversity Survey**: Conduct a biodiversity survey in a local park or nature reserve, documenting plant and animal species.
- **Water Quality Testing**: Test water samples from different sources (e.g., rivers, lakes, groundwater) for pollutants and compare results.
- **Soil Analysis**: Collect soil samples from various locations and analyse their composition and quality.
- **Wildlife Tracking**: Use camera traps or tracking devices to monitor and study the behaviour of local wildlife.
- **Urban Heat Island Effect**: Measure and map temperature differences in various parts of a city.
- **Land Use Mapping**: Create maps showing different land uses in a region and analyze changes over time.
- **Cultural Heritage Documentation**: Document and analyze local cultural heritage sites or practices.
- **Community Interviews**: Conduct interviews with community members to understand social dynamics and traditions.
- **Ethnographic Study**: Participate in and observe community events to gather ethnographic data.
- **Crop Yield Analysis**: Study the factors affecting crop yield in different fields or under different farming practices.
- **Pest Management**: Investigate the effectiveness of various pest management techniques in local farms.
- **Sustainable Farming Practices**: Evaluate the impact of sustainable farming practices on soil health and crop productivity.
- **Community Needs Assessment**: Conduct surveys and interviews to identify the needs and concerns of a community.
- **Social Network Analysis**: Study the social networks within a community to understand relationships and influence.
- **Public Health Study**: Investigate public health issues in a community, such as access to healthcare or prevalence of diseases.
- **Infrastructure Survey**: Assess the condition and effectiveness of local infrastructure, such as roads, bridges, and buildings.
- **Renewable Energy Potential**: Evaluate the potential for renewable energy sources (e.g., solar, wind) in a specific area.
- **Water Management**: Study and improve local water management systems, including irrigation and drainage.
- **Literacy Program Evaluation**: Evaluate the effectiveness of local literacy programs and suggest improvements.
- **Educational Resource Assessment**: Assess the availability and quality of educational resources in local schools.
- **Market Analysis**: Conduct a market analysis for a local business or industry.
- **Entrepreneurship Project**: Develop a business plan for a local entrepreneurial venture
- **Local History Documentation**: Research and document the history of a local site, building, or community.
- **Oral History Project**: Conduct interviews with local residents to collect oral histories and preserve community memories.
- **Archival Research**: Explore local archives to uncover historical documents and artifacts related to a specific topic or period.

- **Community Mural**: Design and create a mural in collaboration with community members that reflects local culture and history.
- **Public Art Installation**: Develop and install a public art project that engages the local community.
- **Art Exhibit Curation**: Curate an exhibit featuring works by local artists, highlighting themes relevant to the community.
- **Music Documentation**: Record and document traditional or contemporary music from the local area.
- **Community Concerts**: Organize and perform in community concerts that showcase local musical talent.
- **Community Theatre Production**: Develop and produce a play that involves community members as actors and crew.
- **Site-Specific Theatre**: Create a theatrical performance that takes place in a non-traditional venue, such as a historic site or public space.
- **Cultural Mapping**: Map cultural resources and heritage sites within the community and analyze their significance.
- **Festival Documentation**: Document and analyze local festivals or cultural events, exploring their history and impact.
- **Ethnographic Study**: Conduct an ethnographic study of a particular cultural practice or community group.
- **Public Philosophy Discussions**: Organize and facilitate public discussions on philosophical topics relevant to the community.
- **Community Documentary**: Create a documentary film about a local issue, event, or group.
- **Digital Storytelling**: Develop digital storytelling projects that capture and share local stories.
- **Language Survey**: Conduct a survey of languages spoken in the community and analyze patterns of language use and change.
- **Dialect Study**: Study and document local dialects or accents, exploring their features and origins.
- **Language Preservation**: Work with community members to document and preserve endangered languages or dialects.
- **Gentrification Impact Study**: Examine the effects of gentrification on local communities, including displacement and economic changes.
- **Crime and Safety Analysis**: Study crime patterns and perceptions of safety within a community.
- **Ritual and Festival Study**: Participate in and document local rituals or festivals to understand their social and cultural significance.
- **Migration Patterns Study**: Analyze migration patterns and their effects on both the sending and receiving communities.
- **Food and Culture Study**: Investigate the role of food in cultural practices and social interactions within a community.
- **Local Governance Analysis**: Study the structure and functioning of local government and its impact on the community.
- **Political Participation Study**: Analyze patterns of political participation and engagement within a community.
- **Public Policy Impact Assessment**: Evaluate the impact of specific public policies on local communities.
- **Election Study**: Analyze voting behavior and patterns in local elections.
- **Mental Health Survey**: Conduct surveys to assess the mental health needs and resources in a community.
- **Social Behavior Observation**: Observe and analyze social behaviors in public spaces, such as parks or markets.
- **Stress and Coping Study**: Investigate sources of stress and coping mechanisms within a community.
- **Community Support Systems**: Study the role and effectiveness of community support systems and networks.
- **Youth Development Programs**: Evaluate the impact of youth development programs on community wellbeing.
- **Educational Equity Study**: Assess disparities in educational resources and outcomes in local schools.
- **Parent and Teacher Interviews**: Conduct interviews to understand perceptions of educational quality and challenges.
- **After-School Program Evaluation**: Evaluate the effectiveness of after-school programs in supporting student development.

- **Educational Attainment Study**: Analyze factors influencing educational attainment in a community.
- **Local Economy Analysis**: Study the structure and dynamics of the local economy, including key industries and employment patterns.
- **Small Business Survey**: Conduct surveys of local small businesses to understand their challenges and successes.
- **Economic Impact of Events**: Analyze the economic impact of local events or festivals on the community.
- **Income Inequality Study**: Investigate patterns and causes of income inequality within a community.
- **Housing Affordability Analysis**: Study housing affordability issues and their impact on residents.
- **Gender Roles and Expectations**: Study gender roles and expectations within a community and their impact on individuals.
- **Women's Health Study**: Investigate issues related to women's health and access to healthcare.
- **Gender-Based Violence Survey**: Conduct surveys to understand the prevalence and impact of gender-based violence.
- **Workplace Equality Study**: Analyze gender equality in local workplaces, including pay equity and job opportunities.
- **Urban Development Projects**: Study the impact of urban development projects on local communities.
- **Public Space Usage**: Analyze how public spaces are used and perceived by different community members.
- **Transportation Study**: Investigate transportation needs and challenges within a community.
- **Green Space Analysis**: Study the availability and usage of green spaces in urban areas and their impact on residents.

S.Y. B.Sc. Electronics (Minor)
Semester-IV
ELE-MIN-241: Introduction to Embedded System

Total Hours: 30 **Credits: 2**

Course Objectives	▪ Understand internal organization of Embedded system. Also aware about designing and selection parameters of Embedded Ssytem. ▪ 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 ▪ Implement program for embedded system using 8051. ▪ Impelement I/O interfacing of 8051 for real-time applications.	
Unit	**Contents**	**Hours**
Unit I	**Fundamental of Embedded System:** Embedded Systems, Purpose, Applications, Components: Hardware and Software, Characteristics, Factors to be consider in a selecting controller, Recent Trends in Embedded System Design	**06**
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.	**10**
Unit III	**Instructions and Programming:** Addressing modes, Data Transfer Instructions, Arithmetic Instructions, Logical Instructions, Jump Instruction, Loop Instructions, Call and Return Instruction, Boolean or Bit manipulation Instructions. Timer Programming: steps of programming, characteristics of mode1, (to generate square wave of a given frequency), delay subroutine	**10**
Unit IV	**I/O Interfacing:** Interfacing with 8051: LED, switch, Seven Segment Display, stepper motor, temperature sensor (LM35)	**04**
Study Resources	▪ Ayala, K.J. (2004). The 8051 Microcontroller Architecture, Programming, & Applications, THOMSON Delmar Learning, 2 nd edition, ISBN: 9812542612. ▪ Shah, S. (2010). 8051 Microcontrollers, Oxford University Press, ISBN: 9780198063575. ▪ Mazidi, M. A. (2017). 8051 Microcontroller and Embedded Systems, Pearson Education India, 2nd edition, 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.	

S.Y. B.Sc. Electronics (Minor)
Semester-IV
ELE-MIN-242: Practical on Embedded System

Total Hours: 60 **Credits: 2**

Course Objectives	▪ Understand basic concept of microcontroller programming ▪ To learn arithmetic programming of 8051 microcontroller. ▪ To implement addressing modes of 8051 microcontroller. ▪ To learn the interfacing of peripheral devices with 8051.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Understand 8-bit microcontroller program and execution. ▪ Get Expertiese in 8051 microcontroller programming. ▪ Implement interface external devices with 8051. ▪ Design tiny embedded system for real life applications.	
Sr. No.	**Contents**	**Hours**
1	Write a 8051 Assembly Language program to perform addition/subtraction of two 8 bit numbers	**4**
2	Write a 8051 Assembly Language program to perform addition/subtraction of two BCD numbers	**4**
3	Write a 8051 Assembly Language program to perform addition/subtraction of two 16 bit numbers	**4**
4	Write a 8051 Assembly Language program to find that the given numbers is prime or not.	**4**
5	Write a 8051 Assembly Language program to find the factorial of a number.	**4**
6	Write a 8051 Assembly Language program to covert an ASCII number to Hex number.	**4**
7	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**
8	Write a 8051 Assembly Language program to the organize array in acending /decending order of N 8 bit unsigned numbers (N is an 8 bit numbers).	**4**
9	Write a 8051 Assembly Language program to generate terms of Fibonacci series	**4**
10	Use one of the four ports of 8051 for interfacing eight LED. Simulate binary counter (8 bit) on LED	**4**
11	Interface OLED display with 8051 and display the message ‘Hello’ on it.	**4**
12	Interface one switch to Port and 8 LED’s to another port, Write a 8051 Assembly Language program to glow LED as switch is pressed (if first time switch is pressed then first LED will glow, second time switch is pressed then second LED will glow and so on)	**4**
13	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**
14	Write a 8051 Assembly Language program to covert packed BCD to ASCII number.	**4**
15	Write a 8051 Assembly Language program to covert binary to ASCII character.	**4**
16	Write a 8051 Assembly Language program to perform addition of series of 8	**4**

	bit numbers	
Study Resources	▪ Mazidi, M.A. (2017). 8051 Microcontroller and Embedded Systems. (2nd ed) Pearson Education India, ISBN: 978-8131710265. ▪ Ayala, K.J. (2004). The 8051 Microcontroller Architecture, Programming, & Applications. (2nd ed) THOMSON Delmar Learning, ISBN: 9812542612. ▪ Shah, S. (2010). 8051 Microcontrollers, Oxford University Press, ISBN: 9780198063575. ▪ 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.	

S.Y. B.Sc. Electronics (Open Elective)
Semester-IV
ELE-OE-241:Battery Technology

Total Hours: 30 **Credits: 2**

Course Objectives	▪ To understand the different types of energy storage system. ▪ To study about the battery characteristic & parameters. ▪ To know the concepts of battery management system and design the battery pack. ▪ To study about the battery testing, disposal and recycling.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Learn about the different types of energy storage system. ▪ know about the battery characteristic & parameters. ▪ Learn the concepts of battery management system and design the battery pack. ▪ Know about the battery testing, disposal and recycling.	
Unit	**Contents**	**Hours**
Unit I	**Introduction to Batteries** Overview of batteries: history, importance, and applications. Basic components of batteries: electrodes, electrolytes, and separators. Types of batteries: primary and secondary batteries. Energy storage metrics: voltage, capacity, and energy density.	**7**
Unit II	**Electrochemistry of Batteries** Electrochemical reactions: oxidation-reduction reactions and electron transfer.Battery cell configurations: galvanic cells and half-cell reactions. Electrode materials: properties and selection criteria. Electrolyte solutions: types and role in battery performance	**8**
Unit III	**Battery Performance** Charging and discharging processes: charge-discharge curves and voltage profiles.Internal resistance and impedance: impact on battery performance. Cycle life and degradation mechanisms: capacity fade and aging. Safety considerations: overheating and short-circuiting.	**8**
Unit IV	**Advanced Battery Technologies** Emerging battery technologies: lithium-ion, solid-state, and beyond. Nanomaterials in battery technology: synthesis and applications. Energy storage systems: applications in various industries.Environmental impact and sustainability: recycling and eco-friendly alternatives.	**7**
Study Resources	▪ Armand, M., &Tarascon, J. M. (Eds.). (2008). Building Better Batteries. Springer. DOI: 10.1007/978-0-387-34445-4 ▪ Goodenough, J. B., & Park, K. S. (2013). The Li-ion Rechargeable Battery: A Perspective. Springer. DOI: 10.1021/ja310466u ▪ Bruce, P. G., Freunberger, S. A., Hardwick, L. J., &Tarascon, J. M. (Eds.). (2012). Li-O2 and Li-S Batteries with High Energy Storage. Springer. DOI: 10.1038/nmat3223 ▪ Whittingham, M. S. (2012). History, Evolution, and Future Status of Energy Storage. Proceedings of the IEEE. DOI: 10.1109/JPROC.2011.2168369 ▪ Manthiram, A., Yu, X., & Wang, S. (Eds.). (2017). Lithium Battery Chemistries Enabled by Solid-State Electrolytes. Springer.	

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.