Dr.Babasaheb Ambedkar Marathwada University
Chhatrpati Sambhajinagar – 431 004, Maharashtra, India
NACC 'A^{+}' Grade

स्थापना वर्ष : १९५८

डॉ. बाबासाहेब आंबेडकर मराठवाडा विद्यापीठ
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संदर्भ क्र./अभ्यासक्रम विभाग/ ६५१ दिनांक :-२८ / ०५ / २०२५

प्रति,
मा. विभाग प्रमुख,
इलेक्ट्रॉनिक्स विभाग,
डॉ. बाबासाहेब आंबेडकर मराठवाडा विद्यापीठ,
छत्रपती संभाजीनगर.

विषय:- बी. एस्सी. इलेक्ट्रॉनिक्स (एईआरडिपी) या नवीन अभ्यासक्रमाबाबत.
संदर्भ :- मा. विद्यापरिषदेने दिनांक ०९/ ०५/ २०२५ रोजी घेतलेल्या ठरावान्वये.

महोदय,

उपरोक्त संदर्भिय विषयाच्या अनुषंगाने आपणास कळविण्यात येते की, "4 Years B. Sc. Electronics (Honours) subject (Major) - Industrial Electronics Minor in Sensor Technology /Energy Storage Devices for Apprenticeship Embedded/Research Degree Programme (AERDP's) in the Department of Electronics " **या नविन अभ्यासक्रमास मा. विद्यापरिषदेने दिनांक ०९ मे २०२५ रोजी मान्यता दिलेली आहे.**

करिता, आपल्या माहितीस्तव तथा पुढिल योग्य त्या कार्यवाहीस्तव कळविण्यात येत आहे.

उपकुलसचिव,
अभ्यासक्रम विभाग.

Dr. Babasaheb Ambedkar Marathwada University
Chhatrapati Sambhajinagar- 431004

Course Structure (All four year)

And

Syllabus (First year)

For

B.Sc. Electronics (Honours)

(AS PER NEP-2020)

Subject (Major): Industrial Electronics

Minor in

Sensor Technology/Energy Storage Devices

For

Apprenticeship Embedded/Research Degree Programs (AERDPs)

Effective from 2025-26

Preface

Forging Future-Ready Scientists / Engineers: The 4-Year Apprenticeship-Embedded / Research Degree Programme (AERDP), B.Sc. Electronics (Hons), with Major in Industrial Electronics and Minor in Sensor Technology / Energy Storage Devices.

We stand at a defining moment in the evolution of higher education in India, as the **National Education Policy 2020 (NEP 2020)** charts a bold and transformative vision. Rooted in principles of flexibility, multidisciplinarity, equity, and excellence, NEP 2020 heralds a shift toward learner-centered, skills-integrated education. The **Bachelor of Science (Honours) 4-Year Degree Program**, with embedded apprenticeship and research opportunities, is a direct response to this visionary mandate.

This pioneering program has been **carefully designed in consultation with the Electronics Industries** to ensure alignment with current and emerging industry needs. The syllabus integrates **academic foundations with industry-relevant competencies**, offering students a robust scientific education alongside valuable hands-on experience. Furthermore, the program will be **implemented in active collaboration with Electronics Industries**, providing access to skill training resources, apprenticeship networks, and certification pathways recognized across the electronics and allied sectors.

The curriculum blends **academic rigor with practical relevance**, preparing students to meet contemporary scientific, technological, and societal challenges. True to the spirit of NEP 2020, it emphasizes **multidisciplinary and interdisciplinary learning**, critical thinking, innovation, and ethical reasoning. Students are encouraged to break out of traditional disciplinary silos and engage in learning that is dynamic, applied, and globally informed.

A key highlight of this program is its **experiential fourth year**, which offers students **two distinct pathways**:

1. **Industry Apprenticeship Track: A One-year (during 4th year) apprenticeship in a relevant industry**, enabling students to gain hands-on experience, workplace skills, and industry insights under real-world conditions—facilitated through NAPS (National Apprenticeship Promotion Scheme) apprenticeship frameworks and partnerships (Apart from a 6-months mandatory **apprenticeship in a relevant industry during 3rd year).**

2. **Research Track in Sensor Technology**: A one-year **specialized research training program** in **sensor technology**, providing students with the opportunity to work on cutting-edge research problems under the guidance of experts in the field (Apart from a 6-months mandatory **apprenticeship in a relevant industry during 3rd year).**

This flexible structure empowers students to tailor their learning journey—whether their goal is professional employment or advanced research in high-impact areas such as sensing systems, electronics, and sustainable technologies.

The program also upholds NEP 2020's unwavering commitment to **inclusivity, equity, and excellence in education**. It fosters a vibrant and supportive environment where students from diverse backgrounds are encouraged to thrive. Ethical awareness, environmental responsibility, and social impact are woven throughout the curriculum, shaping graduates into **responsible citizens and compassionate leaders**.

By promoting **a culture of inquiry, practical engagement, and lifelong learning**, this program prepares students not only to excel in their chosen domains but also to contribute meaningfully to the advancement of knowledge, innovation, and nation-building.

As we align higher education with national priorities and global trends, this **4-Year B.Sc. Electronics (Hons) Program** stands as a model of future-ready, skill-integrated science education. Guided by the principles of NEP 2020, we are confident that this initiative will nurture a new generation of scientists, innovators, and changemakers—equipped to shape a more resilient and sustainable future.

Programme Educational Objectives (PEOs)

B.Sc. Electronics (Hons), with Major in Industrial Electronics and Minor in Sensor Technology / Energy Storage Devices (Apprenticeship-Embedded / Research Track).

In alignment with the **National Education Policy 2020** and developed in consultation with the **Electronics Industries**, the Programme Educational Objectives (PEOs) for the B.Sc. (Hons) in Industrial Electronics are designed to ensure that graduates are equipped with academic excellence, industry readiness, and research competence. These objectives are as follows:

1. **Mastery of Industrial Electronics and Applied Sciences**

   Graduates will demonstrate a strong foundation in core principles, systems, and technologies related to industrial electronics. They will be able to apply theoretical and practical knowledge to analyze, design, and troubleshoot electronic systems across industrial applications.

2. **Industry and Research Integration**

   Graduates will gain significant hands-on experience through a **structured fourth-year apprenticeship in industry or specialized research training in sensor technology**. This dual-track model ensures they develop relevant professional competencies, research skills, and adaptability to thrive in either industrial or academic environments.

3. **Interdisciplinary and Skill-Based Proficiency**

   Graduates will integrate concepts from electronics, instrumentation, computing, and emerging technologies to solve real-world problems. Through collaboration with **Electronics industries**, they will acquire domain-specific skills and certifications aligned with national skill development goals.

4. **Critical Thinking, Innovation, and Problem-Solving**

   Graduates will be trained to think critically, use analytical tools, interpret data, and engage in design thinking. They will apply scientific reasoning to drive innovation in industrial systems, automation, and sensor-based technologies.

5. **Leadership, Ethics, and Professionalism**

   Graduates will demonstrate leadership, entrepreneurship, and teamwork skills. They will uphold ethical practices, professional responsibility, and environmental sustainability while addressing industry and societal needs.

6. **Global Outlook and Lifelong Learning**

   Graduates will exhibit global awareness, cultural sensitivity, and the ability to work in diverse environments. They will be prepared for continuous learning, higher studies, or evolving careers in industrial electronics, automation, embedded systems, and sensor technologies.

Programme Outcomes (POs)

B.Sc. Electronics (Hons), with Major in Industrial Electronics and Minor in Sensor Technology / Energy Storage Devices (Apprenticeship-Embedded / Research Track).

This innovative four-year degree program integrates strong academic foundations with hands-on industry training and specialized research exposure, preparing students to meet the needs of rapidly evolving electronics and sensor-based industries. The following Programme Outcomes reflect the core vision of **NEP 2020** and the structure of this **Electronics Industries -linked** program:

- **PO1. Scientific and Societal Responsibility**

  Apply domain knowledge in **industrial electronics and sensor technology** to analyze and address complex real-world problems while being mindful of ethical, societal, economic, and environmental implications in both local and global contexts.

- **PO2. Environmental Sustainability**

  Demonstrate understanding of sustainable practices in electronics manufacturing, embedded systems, and sensor applications, and advocate for solutions that promote ecological balance and responsible resource use.

- **PO3. Ethics and Professional Integrity**

  Integrate ethical reasoning into scientific inquiry and industrial practice; uphold professional ethics, intellectual honesty, and a commitment to social responsibility in technology-driven environments.

- **PO4. Teamwork and Leadership in Multidisciplinary Settings**

  Work effectively as an individual, in teams, and in leadership roles within **multidisciplinary projects** involving electronics, instrumentation, and sensor systems; demonstrate collaborative skills in both **industrial apprenticeships and research laboratories**.

- **PO5. Communication and Documentation Skills**

  Communicate complex scientific and technical ideas clearly and effectively through oral presentations, technical writing, and design documentation. Engage with industry professionals, researchers, and society at large to disseminate knowledge.

- **PO6. Innovation, Project Management, and Entrepreneurship**

  Demonstrate the ability to plan, execute, and manage **industry-applied or research-based projects** in electronics and sensor technology, incorporating basic principles of innovation, entrepreneurship, time management, and financial planning.

- **PO7. Lifelong Learning and Technological Adaptability**

  Exhibit readiness for **lifelong learning** and continuous professional development in a technology-driven world. Adapt to emerging tools, platforms, and research trends in electronics, automation, and smart sensing systems.

  These outcomes empower graduates to be **technically competent, ethically grounded, and professionally versatile**, whether they choose to pursue careers in industry, research, entrepreneurship, or higher studies.

Programme Specific Outcomes (PSOs)

B.Sc. Electronics (Hons), with Major in Industrial Electronics and Minor in Sensor Technology / Energy Storage Devices (Apprenticeship-Embedded / Research Track)

Graduates of this four-year program will demonstrate the following specific outcomes upon successful completion:

- **PSO1. Core and Advanced Domain Expertise**

  Apply foundational and advanced knowledge of **industrial electronics and sensor technology** to analyze, model, and develop comprehensive solutions for real-world and emerging challenges in automation, control systems, embedded systems, and smart sensing.

- **PSO2. Problem Analysis and Application Orientation**

  Identify and analyze electronics-related problems of varying complexity using a conceptual and practical understanding of circuit design, instrumentation, signal processing, and sensor integration; formulate solutions that are technically sound and industry-relevant.

- **PSO3. Design and Development of Technological Solutions**

  Design and develop **innovative hardware and software-based solutions** in the domains of industrial electronics and sensor systems, addressing current and future needs of stakeholders, including industries, research labs, and society.

- **PSO4. Experimental Skills and Research Capability**

  Plan and conduct experiments using scientific methods; collect, analyze, and interpret data from laboratory investigations or field-based studies to draw meaningful conclusions, particularly in the context of **sensor applications or electronics-based research and development**.

- **PSO5. Application of Modern Tools and Industry Practices**

  Select and apply modern electronic design automation (EDA) tools, programming platforms, simulation software, and sensor technologies to address complex technical tasks. Understand the capabilities and limitations of these tools in **both industrial and research environments**, especially during the fourth-year **apprenticeship or research specialization**.

These PSOs are designed to produce **industry-ready professionals and research-oriented graduates** with capabilities in core electronics, smart sensing technologies, and system integration, aligned with the evolving needs of the **electronics sector and national innovation priorities**.

Eligibility:

Candidates who have passed **12th Science**, **MCVC**, or completed **2-year ITI** in a relevant branch shall be considered eligible for admission.

Course Fees:

Rs. 28020 per year

Number of Seats:

The Intake capacity of BSc. Electronics (Honours) will be 40 as under 'Self Finance Mode'

Admission / Promotion Process:

In response to the advertisement for registration, interested students will have to register themselves. One of the following methods will be adopted for admission.

- Admission will be done on the basis of performance of students at Common Entrance Test (CET). The CET will be conducted in the month of June every year.

OR

- Admission process declared by the University

Promotion rules will be as per the University scheme of examination for undergraduate programme

Choice Based Credit System (CBCS):

The choice based credit system is going to be adopted by the University. This provides flexibility to make the system more responsive to the changing needs of our students, the professionals and society. It gives greater freedom to students to determine their own pace of study. The credit based system also facilitates the transfer of credits.

Credit-to-contact hour Mapping:

- One Credit would mean equivalent of 15 contact hours each for theory lecture.
- One Credit would mean equivalent of 30 contact hours for lab course/ workshops/internship/field work/project.

Attendance:

Students must have 75 % of attendance in each course for appearing examination, otherwise he / she will be strictly not allowed for appearing the semester examination of each course. Frequent absence from regular lecture/practical course may lead to disqualification from continuous internal assessment (CIA) process in respective subject.

Departmental Committee:

The Departmental Committee (DC) of the Department will monitor smooth functioning of the program.

Results Grievances / Redressal Committee

Grievances / redressal committee will be constituted in the department to resolve all grievances relating to the evaluation. The committee shall consist of Head of the department, the concerned teacher of a particular course and senior faculty member of Department of Committee. The decision of Grievances / redressal committee will have to be approved by Department committee.

Evaluation Methods:

Evaluation methods will be as per the University scheme of examination for undergraduate programme.

Duration

Duration of the BSc Electronics Apprenticeship Embedded / Research Degree Programme (AERDP) shall be 3 years/ 6 semesters. (132 Credits) & BSc Electronics Honours – Apprenticeship Embedded / Research Degree Programme (AERDP) shall be 4 years/ 8 semesters. (176 Credits)

Programme Structure and Credit Distribution

Award Level	Minimum Credits	NSQF Level	Duration
UG Certificate	44	Level 5	One Year
UG Diploma	88	Level 6	Two Years
UG (BSc) Degree	132	Level 7	Three Years
UG (BSc Honours) Degree	176	Level 8	Four Years

Tripartite Agreement for Apprenticeship (Mandatory)

A formal agreement for Apprenticeship will be signed between:

- University Department
- Industry/Company/Startup
- Student (Apprentice)

Structure of the 4-Year Apprenticeship-Embedded / Research Degree Program (AERDP) B.Sc. Electronics (Hons)

(Major in Industrial Electronics and Minor in Sensor technology / Energy Storage Devices)

B.Sc. Electronics First Year: 1st Semester (NSQF Level 5.0)

\Course Type	Course Code	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Scheme of Examination		
			Theory	Practical	Theory	Practical	CIE	SEE	Total
Department Specific Course DSC (Major) Mandatory	SUB/DSC/T/100	Fundamental of Analog Electronics	2		2		20	30	50
	SUB/DSC/P/125	Practical based on (SUB/DSC/T/100)		4		2	20	30	50
	SUB/DSC/T/101	Fundamental of Digital Electronics	2		2		20	30	50
	SUB/DSC/P/126	Practical based on (SUB/DSC/T/101)		4		2	20	30	50
	SUB/DSC/T/102	Network Analysis and Semiconductor Devices	2		2		20	30	50
	SUB/DSC/P/127	Practical based on (SUB/DSC/T/102)		4		2	20	30	50
Generic / Open Elective (GE/OE) (Choose any one from pool of courses) **It should be chosen compulsorily from the faculty other than that of Major**	SUB/GE/OE/T/100	Choose any one course from GE/OE Basket	2		2		20	30	50
SEC (Skill Enhancement Courses) **(Choose any one from SUB/SEC/P/125 and SUB/SEC/P/126)**	SUB/SEC/P/125	Consumer Electronics		4		2	20	30	50
	SUB/SEC/P/126	Electrical Wiring		4		2	20	30	50
AEC, VEC, IKS	SUB/AEC/T/100	**English** (Common for all the faculty)	2		2		20	30	50
	SUB/IKS/T/101	Choose any one from pool of courses (IKS Basket)	2		2		20	30	50
OJT/ FP/CEP/CC/RP	SUB/CC/P/125	Health and Wellness (Common for all the faculty)		4		2	20	30	50
			12	**20**	**12**	**10**	**220**	**330**	**550**

GE/OE-1: Introduction to Electronics and Everyday Technology (This course will be available for the students of other faculty (other than Faculty of Science and Technology)

B.Sc. Electronics First Year: 2nd Semester (NSQF Level 5.0)

Course Type	Course Code	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Scheme of Examination		
			Theory	Practical	Theory	Practical	CIA	SEE	Total
Department Specific Course DSC (Major) Mandatory	SUB/ DSC/T/ 150	Linear Integrated Circuits	2		2		20	30	50
	SUB/DSC/P/ 175	Practical based on (SUB/ DSC/T/ 150)		4		2	20	30	50
	SUB/DSC/T/ 151	Power Electronics	2		2		20	30	50
	SUB/DSC/P 176	Practical based on (SUB/DSC/T/ 151)		4		2	20	30	50
	SUB/DSC/T/ 152	Measurements and Instrumentations	2		2		20	30	50
	SUB/DSC/P/ 177	Practical based on (SUB/DSC/T/152)		4		2	20	30	50
Generic / Open Elective (GE/OE) (Choose any one from pool of courses) **It should be chosen compulsorily from the faculty other than that of Major**	SUB/GE/OE/ T/ 150	Choose any one course from GE/OE Basket	2		2		20	30	50
VSC (Vocational Skill Courses) (Choose any one from SUB/VSC/P/175 and SUB/VSC/P/176)	SUB/VSC/P/ 175	PCB design and fabrication		4		2	20	30	50
	SUB/VSC/P/ 176	Power Supplies		4		2	20	30	50
AEC, VEC, IKS	SUB/AEC/T/ 150	Modern Indian Language (MIL-1) (Choose any one from pool of language courses)	2		2		20	30	50
	SUB/VEC/T /151	Constitution of India (Common for all the faculty)	2		2		20	30	50
OJT/ FP/CEP/CC/RP	SUB/CC/P/ 175	Yoga Education / Sports and Fitness (Common for all the faculty)		4		2	20	30	50
			12	**20**	**12**	**10**	**220**	**330**	**550**
Exit Option : Award of UG Certificate in Electronics with 44 credits and an additional 4 credits of core NSQF course / Internship OR continue with Major and Minor									

GE/OE-2 Introduction to DIY Solar & Smart Tech for Everyday Life (This course will be available for the students of other faculty (other than Faculty of Science and Technology)

B.Sc. Electronics Second Year: 3rd Semester (NSQF Level 6.0)

Course Type	Course Code	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Scheme of Examination		
			Theory	Practical	Theory	Practical	CIA	SEE	Total
Department Specific Course DSC (Major) Mandatory	SUB/DSC/ T/ 200	8086 Microprocessor and Programming	2		2		20	30	50
	SUB/DSC/ P/ 225	Practical based on (SUB/DSC/T/ 200)		4		2	20	30	50
	SUB/DSC/ T/ 201	Signals and Systems	2		2		20	30	50
	SUB/DSC/ P/ 226	Practical based on (SUB/DSC/T/ 201)		4		2	20	30	50
Minor	SUB/Mn/T/ 200	Sensor Fundamentals	2		2		20	30	50
	SUB/Mn/T/ 201	Fundamentals of Energy Storage Devices	2		2		20	30	50
Generic / Open Elective (GE/OE) (Choose any one from pool of courses) **It should be chosen compulsorily from the faculty other than that of Major**	SUB/GE/ OE/T/200	Choose any one course from GE/OE Basket	2		2		20	30	50
VSC (Vocational Skill Courses) (Choose any one from SUB/VSC/P/ 225 and SUB/VSC/P/ 226)	SUB/VSC/ P/ 225	Inverter-I		4		2	20	30	50
	SUB/VSC/ P/ 226	E-V Technology		4		2	20	30	50
AEC, VEC, IKS	SUB/AEC/ T/200	**English** (Common for all the faculty)	2		2		20	30	50
	SUB/VEC/ T/201	Environmental Studies	2		2		20	30	50
OJT/ FP/CEP/CC/RP	SUB/CC/P/ 225	Cultural Activity / NSS, NCC (Common for all the faculty)		4		2	20	30	50
			14	**16**	**14**	**8**	**220**	**330**	**550**

GE/OE-3: Introduction to Air Conditioners (This course will be available for the students of other faculty (other than Faculty of Science and Technology)

B.Sc. Electronics Second Year: 4th Semester (NSQF Level 6.0)

Course Type	Course Code	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Scheme of Examination		
			Theory	Practical	Theory	Practical	CIA	SEE	Total
Department Specific Course DSC (Major) Mandatory	SUB/DSC/T/ 250	8051 Microcontroller and Programming	2		2		20	30	50
	SUB/DSC/P/ 275	Practical based on (SUB/DSC/T/ 250)		4		2	20	30	50
	SUB/DSC/T/ 251	Embedded Systems (SUB/DSC/P/ 275)	2		2		20	30	50
	SUB/DSC/P/ 276	Practical based on (SUB/DSC/T/ 251)		4		2	20	30	50
Minor	SUB/Mn/T/ 250	Renewable Energy Sources	2		2		20	30	50
	SUB/Mn/T/ 251	Fundamentals of Solar Energy Systems	2		2		20	30	50
Generic / Open Elective (GE/OE) (Choose any one from pool of courses) **It should be chosen compulsorily from the faculty other than that of Major**	SUB/GE/OE/T /250	Choose any one course from GE/OE Basket	2		2		20	30	50
SEC (Skill Enhancement Courses) (Choose any one from SUB/SEC/P/ 275 and SUB/SEC/P/ 276) and corresponding Practical's	SUB/SEC/P/ 275	Inverter-II		4		2	20	30	50
	SUB/SEC/P/ 276	Arduino Programming and Interfacing		4		2	20	30	50
AEC, VEC, IKS	SUB/AEC/T/ 250	Modern Indian Language (MIL-2) (Choose any one from pool of language courses)	2		2		20	30	50
OJT/ FP/CEP/CC/RP	SUB/FP/P/ 275	Field Project-1		4		2	20	30	50
	SUB/CC/P/ 276	(Fine/ Applied/ Visual/ Performing Arts) (Common for all the faculty)		4		2	20	30	50
			12	**20**	**12**	**10**	**220**	**330**	**550**
Exit Option : Award of UG Diploma in major and minor with 88 credits and an additional 4 credits NSQF course (related to major / minor) / Internship during summer vacation OR Continue with Major and Minor									

GE/OE-4: Introduction to Refrigeration (This course will be available for the students of other faculty (other than Faculty of Science and Technology)

B.Sc. Electronics Third Year: 5th Semester (NSQF Level 7.0)

Course Type	Course Code	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Scheme of Examination		
			Theory	Practical	Theory	Practical	CIA	SEE	Total
Department Specific Course DSC (Major) Mandatory	SUB/DSC/T/ 300	Industrial Robotics	2		2		20	30	50
	SUB/DSC/P/ 325	Practical based on (SUB/DSC/T/ 300)		4		2	20	30	50
	SUB/DSC/T/ 301	Control System	2		2		20	30	50
	SUB/DSC/P/ 326	Practical based on (SUB/DSC/T/ 301)		4		2	20	30	50
	SUB/DSC/T/ 302	Industrial IoT	2		2		20	30	50
Discipline Specific Electives (DSE) (Choose any one from SUB/DSE/T/ 300 and SUB/DSE/T/ 301) and corresponding Practical's	SUB/DSE/T/ 300	Optical Fiber Communication	2		2		20	30	50
	SUB/DSE/P/ 325	Practical based on (SUB/DSE/T/ 300)		4		2	20	30	50
	SUB/DSE/T/ 301	PLC and SCADA	2		2		20	30	50
	SUB/DSE/P/ 326	Practical based on (SUB/DSE/T/ 301)		4		2	20	30	50
Minor	SUB/Mn/T/ 300	Temperature and Humidity Sensor	2		2		20	30	50
	SUB/Mn/T/ 301	Fundamentals of Batteries and Fuel cell	2		2		20	30	50
VSC (Vocational Skill Courses) (Choose any one from SUB/VSC/P/ 325 and SUB/VSC/P/ 326)	SUB/VSC/P/ 325	Industrial Automation and Control		4		2	20	30	50
	SUB/VSC/P/ 326	Sensor Technology		4		2	20	30	50
OJT/ FP/CEP/CC/RP (Choose any one from pool of courses)	SUB/FP/CEP /P/325	Field Project-2		4		2	20	30	50
			12	**20**	**12**	**10**	**220**	**330**	**550**

B.Sc. Electronics Third Year: 6th Semester (NSQF Level 7.0)

Apprenticeship
Mandatory Apprenticeship Program in 6th Semester

To bridge the gap between academic knowledge and practical industry experience, an apprenticeship program has been made compulsory for all students in the 6th semester. This initiative aims to ensure that students gain hands-on exposure to real-world applications in their respective fields of study. Students will be advised to join the respective Industry anywhere across the country as per opportunities found on NAPS, NATS, BOAT and BOPT portal.

Course Name	Teaching Scheme (Hrs / Week)	Credits Assigned	Scheme of Examination		
			CIA	SEE	Total
Apprenticeship-1	44	22	220	330	550

Exit option : Award of UG degree in Major with 132 credits and an additional 4 credits Internship during summer vacation OR continue to fourth year apprenticeship in Industry / research oriented courses in the Department

In the 4th year student will have two options,

1. **One year apprenticeship in Industry** **(Students will get Four Year Apprenticeship Embedded Under graduate Degree in Major and Minor with 176 Credits)**
2. **Extensive research training through the following curriculum** **(Students will get Four Year UG Honours Degree with Research in Major and Minor with 176 Credits)**

Option 1. Industry Apprenticeship Track: A full-year **apprenticeship in a relevant industry**, enabling students to gain hands-on experience, workplace skills, and industry insights under real-world conditions—facilitated through NAPS apprenticeship frameworks and Industry partnerships **(44 Credits).** Students will be advised to join the respective Industry anywhere across the country as per opportunities found on NAPS, NATS, BOAT and BOPT portal.

B.Sc. Electronics Fourth Year: 7th Semester (NSQF Level 8.0)

Apprenticeship
Mandatory Apprenticeship Program in 7th Semester

To bridge the gap between academic knowledge and practical industry experience, an apprenticeship program has been one of the options for the students in the 7th semester. This initiative aims to ensure that students gain hands-on exposure to real-world applications in their respective fields of study.

Course Name	Teaching Scheme (Hrs / Week)	Credits Assigned	Scheme of Examination		
			CIA	SEE	Total
Apprenticeship-2	44	22	220	330	550

B.Sc. Electronics Fourth Year: 8th Semester (NSQF Level 8.0)

Apprenticeship
Mandatory Apprenticeship Program in 8th Semester

To bridge the gap between academic knowledge and practical industry experience, an apprenticeship program has been one of the options for the students in the 8th semester. This initiative aims to ensure that students gain hands-on exposure to real-world applications in their respective fields of study.

Course Name	Teaching Scheme (Hrs / Week)	Credits Assigned	Scheme of Examination		
			CIA	SEE	Total
Apprenticeship-3	44	22	220	330	550
Four Year UG Honours Degree in Major and Minor with 176 Credits					

Option 2. Research Track in Sensor Technology: A one-year **specialized research training program** in **sensor technology**, providing students with the opportunity to work on cutting-edge research problems under the guidance of experts in the field. The course structure for this option is as below.

B.Sc. Electronics Fourth Year (UG Honours with Research Degree): 7th Semester (NSQF Level 8.0)

Course Type	Course Code	Course Name	Teaching Scheme (Hrs/Week)		Credits Assigned		Scheme of Examination		
			Theory	Practical	Theory	Practical	CIA	SEE	Total
Department Specific Course DSC (Major) Mandatory	SUB/DSC/T/ 400	Synthesis Techniques for Advanced Materials	2		2		20	30	50
	SUB/DSC/P/ 425	Practical based on Synthesis Techniques for Advanced Materials SUB/DSC/T/400		4		2	20	30	50
	SUB/DSC/T/ 401	Characterisation of Materials: Techniques and Applications - I	2		2		20	30	50
	SUB/DSC/P/ 426	Practical based on Characterisation of Materials: Techniques and Applications – I Practical SUB/DSC/T/ 401		4		2	20	30	50
	SUB/DSC/T/ 402	Properties of Materials: Fundamentals	2		2		20	30	50
Discipline Specific Electives (DSE) (Choose any one from SUB/DSE/T / 400 and SUB/DSE/T / 401) and corresponding Practical's	SUB/DSE/T / 400	Electrochemical Sensors: Principles and Applications	2		2		20	30	50
	SUB/DSE/T / 401	Vacuum systems and gages	2		2		20	30	50
	SUB/DSE/P / 425	Practical based on Electrochemical Sensors: Principles and Applications SUB/DSE/T / 400		4		2	20	30	50
	SUB/DSE/P / 426	Practical based on Vacuum systems and gages SUB/DSE/T / 401		4		2	20	30	50
Research Project	SUB/RP/P/ 425	Research Project-I		16		8	80	120	200
			08	**28**	**08**	**14**	**220**	**330**	**550**

B.Sc. Electronics Fourth Year (UG Honours with Research Degree): 8th Semester (NSQF Level 8.0)

Course Type	Course Code	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Scheme of Examination		
			Theory	Practical	Theory	Practical	CIA	SEE	Total
Department Specific Course DSC (Major) Mandatory	SUB/ DSC/T/ 450	Energy Storage Devices: Principles and Applications	2		2		20	30	50
	SUB/ DSC/T/ 451	Characterisation of Materials: Techniques and Applications - II	2		2		20	30	50
	SUB/ DSC/P/ 475	Practical based on Energy Storage Devices: Principles and Applications SUB/ DSC/T/ 450		4		2	20	30	50
	SUB/ DSC/P/ 476	Practical based on Characterisation of Materials: Techniques and Applications – II SUB/ DSC/T/ 451		4		2	20	30	50
	SUB/ DSC/T/ 452	Device Fabrication Technology	2		2		20	30	50
Discipline Specific Electives (DSE) (Choose any one from SUB/DSE/T/ 450 and SUB/DSE/T / 451) and corresponding Practical's	SUB/DSE/T / 450	Electrocatalysis: Principles and Applications	2		2		20	30	50
	SUB/DSE/T / 451	Chemiresistive & Chem-FET Gas Sensors: Principles and Applications	2		2		20	30	50
	SUB/DSE/P / 475	Practical based on Electrocatalysis: Principles and Applications SUB/DSE/T / 450		4		2	20	30	50
	SUB/DSE/P / 476	Practical based on Chemiresistive & Chem-FET Gas Sensors: Principles and Applications SUB/DSE/T / 451		4		2	20	30	50
Research Project	SUB/RP/P / 475	Research Project-II		16		8	80	120	200
			08	**28**	**08**	**14**	**220**	**330**	**550**
Four Year UG Honours Degree with Research in Major and Minor with 176 Credits									

Syllabus of Semester I

	SUB/DSC/T/100: Fundamental of Analog Electronics (Credit: 02 Contact Hrs: 30 Marks: 50)	
	Course objectives: 1. Understand the fundamental concepts of solid-state physics and how they relate to the behavior of semiconductor materials. 2. Analyze the characteristics and applications of basic semiconductor devices like diodes, BJTs, and MOSFETs. 3. Design and evaluate basic analog circuits including amplifiers, filters, and oscillators. 4. Apply knowledge of operational amplifiers in signal conditioning and processing circuits. 5. Study and interpret frequency response, gain, and bandwidth in analog amplifier designs. 6. Incorporate feedback mechanisms in amplifier circuits for stability and performance improvements. 7. Implement real-world analog interfacing solutions and explore practical analog system applications.	
	Course Outcomes: By the end of this course, students will be able to: 1. Describe the structure of solids, bonding, and energy band concepts to distinguish between conductors, semiconductors, and insulators. 2. Identify and explain the behavior of basic electrical quantities and passive components in AC and DC circuits. 3. Analyze semiconductor device characteristics such as PN junctions, diodes (Zener, LED, photodiode), and BJTs under different biasing conditions. 4. Compare the operation of BJTs and MOSFETs, and apply them in circuit designs including switches and voltage regulators. 5. Design and analyze single and multi-stage amplifiers using BJT and MOSFET configurations. 6. Evaluate amplifier performance using small-signal models, gain calculations, and frequency response. 7. Utilize operational amplifiers in analog circuit applications like amplifiers, filters, oscillators, and signal conditioning circuits. 8. Demonstrate an understanding of negative feedback and its impact on amplifier performance. 9. Propose and implement a mini project applying the principles of analog and semiconductor devices.	
Unit 1	**Foundations of Semiconductor Devices and Circuit Elements** 1.1 Structure of solids, structure of an atom, atomic number, energy level diagram, Bonding in Solids, Energy Bands, Insulator, Conductor and Semiconductor. 1.2 Basic Electrical Quantities: Voltage, current, power, energy, DC vs AC signals Passive components: Resistors, capacitors, inductors (RC, RL, RLC networks) 1.2 Semiconductor Physics Review: Charge carriers, doping, PN junction, Behavior under biasing (forward/reverse) 1.3 Analog Devices: Diodes: Zener, LED, photodiode – characteristics and applications, BJTs (Bipolar Junction Transistors): perating modes (cutoff, active, saturation) DC biasing techniques, Load line analysis 1.4 MOSFETs (Intro): Enhancement & Depletion types CMOS basics, Comparisons with BJTs, Mini Project Idea: Design a voltage regulator using Zener diode or transistor switch circuit	**10 L**

Unit 2	**Analog Amplifier Design and Frequency Response** 2.1 BJT and MOSFET biasing techniques 2.2 Single-stage amplifiers: CE, CB, CC (BJT); CS, CD, CG (MOSFET) 2.3 Concept of small-signal models and gain calculation 2.4 Multistage amplifiers and coupling methods 2.5 Mid-band frequency response and bandwidth 2.6 Introduction to noise and distortion in analog circuits 2.7 Feedback in amplifiers: negative feedback, advantages, and analysis	**10 L**
Unit 3	**Operational Amplifiers and Analog Applications** 3.1 Ideal vs practical Op-Amps: characteristics and limitations 3.2 Op-Amp applications: inverting, non-inverting, summing, subtractor 3.3 Integrator, differentiator, comparator, and Schmitt trigger 3.4 Active filters: low-pass, high-pass, and band-pass design 3.5 Oscillators: Phase shift and Wien bridge oscillator 3.6 Analog signal conditioning and real-world interfacing	**10 L**

Suggested Readings:

1) R.S.Sedha , Applied Electronics-S. Chand
2) Albert Malvino, David J Bates, Electronics Principles, Malvino Bates
3) Sedra & Smith, Microelectronic Circuits, Oxford University Press – A comprehensive book on both analog and digital circuits with strong treatment of Op-Amps and amplifiers.
4) Millman & Halkias, Electronic Devices and Circuits – Classical text covering the fundamentals of semiconductor devices and circuits.
5) Boylestad & Nashelsky, Electronic Devices and Circuit Theory – Suitable for foundational understanding and practical insights.

	SUB/DSC/P/125: Practical based on Fundamental of Analog Electronics (Credit: 02 Contact Hrs.: 60 Marks: 50)	
	1. Use of CRO, function generator, DMM 2. Study of Active and passive components and there testing using multimeter 3. Calculation of resistance by color-code method and using multimeter 4. VI Characteristics of a PN Junction Diode 5. Zener Diode as a Voltage Regulator 6. Input and Output Characteristics of a BJT in CE Configuration 7. Design and Analysis of a Single-Stage CE Amplifier 8. MOSFET Characteristics (Enhancement Mode) 9. Op-Amp as Inverting and Non-Inverting Amplifier 10. Op-Amp Applications: Summing, Subtractor, Integrator, Differentiator 11. Design of RC Phase Shift Oscillator using Op-Amp 12. Active Filter Design (Low-pass, High-pass, or Band-pass)	

	SUB/DSC/T/101: Fundamental of Digital Electronics (Credit: 02 Contact Hrs.: 30 Marks: 50)	
	Course objectives: 1. To introduce students to various fundamental concepts of digital electronics. 2. To make them understand the concept of number system, logic gates and combinational logic circuits. 3. To enable students to design and construct circuits based on various logic gates and combinational logic circuits.	
	Course Outcomes **By the end of this course, students will be able to:** 1. Apply the basic concepts of number system logic gates and combinational logic circuits to solve the complex problem in electronics circuits. 2. Analyze various logic gates and combinational logic circuits to identify various issues in digital networking. 3. Design various digital circuits using logical gates and combinational logic circuits. 4. Design and develop a cost-effective digital devices based on adder and subtractor.	
Unit 1	**Digital Logic Fundamentals:** Decimal, Binary, Octal and Hexadecimal number and their conversions, Binary arithmetic; addition, subtraction, Multiplication and division, 1's and 2's complement method for binary subtraction, gray code, Excess-3 addition. Positive and negative logic gates (AND, OR, NOT, NAND, NOR) using diode & transistor, Ex-OR and Ex-NOR gate. Boolean algebra: Boolean laws, De-Morgan's Theorem, SOP and POS form of Boolean expression. Simplification of Boolean Expression, Karnaugh Map (K-map up to four variables only). De morgan's Theorems.	**10 L**
Unit 2	**Semiconductor Logic Circuits and IC Implementation:** NAND and NOR gates Universal building blocks, half adder, Full adder, half subtractor, Full subtractor, 4-bit parallel adder and subtractor, 2's complement adder / subtractor, Multiplexer and their use in combinational logic design-combinational logic design using multiplexers-Demultiplexer and its use in combinational logic design encoder-priority encoders-Decoder, and drivers for display devices. Introduction to logic Families-Bipolar logic Families and unipolar logic Families Characteristics of Digital IC's-TTL NAND gate-CMOS, NAND, NOT, NOR gates-open collector TTL not gate-Tristate Concept-Tristate TTL NOT gate.	**10 L**
Unit 3	**Digital Sequential Circuits** Flip-Flop: Flip flops (SR, D, JK and T) [using gates], Methods of triggering flip flops, Edge triggered flip flops (SR, D, JK and T), Asynchronous inputs, Master slave JK flip flop, Operating characteristics. Counters: Concept of counter, Asynchronous Counters (three and four bit), Synchronous Counters (three and four bit), decade Counter (asynchronous), Up/Down Synchronous Counter (three bit only). Shift Registers: Shift functions, Serial in Serial Out shift Register, Serial in Parallel Out Shift Register, Parallel in Serial Out Shift Registers Parallel, In Parallel Out Shift Register, Bidirectional S Register, Ring Counter, Buffer Register.	**10 L**

Suggested Readings:

1 Digital Fundamentals – Thomas L. Floyd, Universal Book Stall New Delhi.
2 Digital Electronics and Microcomputer -R. K. Gaur.
3 Digital Analog Techniques – Navanath, Kale and Gokhale, Kitab Mahal.
4 Digital Electronics with Practical Approach – G N Shinde, Shivani Publications Nanded.
5 Digital Principal and Circuits – C. B. Agarwal, Himalaya Publishing House

	SUB/DSC/P/126: Practical Based on Fundamental of Digital Electronics (Credit: 02 Contact Hrs.: 60 Marks: 50)	
	1. Build and study NOT, OR, AND gates using Diodes/Transistors or IC 74XX 2. Build and study NAND and NOR gates using Diodes/Transistors or IC 74XX 3. Build and study XOR and XNOR gates using Diodes/Transistors or IC 74XX 4. Build and study universal properties of NAND gate 5. Build and study universal properties of NOR gate 6. Build and study Half Adder and Half Subtractor using logic gates 7. Build and study Full Adder and Full Subtractor using logic gates 8. Build and study JK, T, and D Flip-Flops using IC 7476 9. Build and study 4-bit Binary Parallel Adder using IC 7483	

	SUB/DSC/T/103: Network Analysis and Semiconductor Devices (Credit: 02 Contact Hrs.: 30 Marks: 50)	
	Course objectives: 1. To introduce students to various components, network theorems, diodes, transistors and power supplies 2. To make them understand the concept of network analysis, types of diodes, transistor configuration and various aspects of regulated power supply. 3. To enable students to design and construct circuits based of various network theorems, transistor configurations and half wave rectifiers.	
	Learning Outcomes **By the end of this course, students will be able to:** 1. Apply the basic concepts of network theorems, diodes, transistors and power supplies to solve the complex problem in electronic circuits. 2. Analise various networks, diode and transistors configuration and identify various issues of regulated power supply. 3. Design an electronics circuit using networks, diodes and transistor. 4. Design and develop a low-cost power supply.	
Unit 1	**Components and Network Theorems:** Electronic passive and active components, Concept of Voltage and Current divider theorem, Ideal constant voltage sources, Ideal constant current sources, Superposition theorem, Thevenin's, Norton's, Maximum Power Transfer theorem.Circuit Diagrams and Wiring Basics: Introduction to circuit diagrams, Reading wiring diagrams and interpreting layouts, Electrical component symbols, Wiring color codes and safety standards,Network Theorems (DC and AC Analysis): Thevenin's Theorem, Norton's Theorem,Thevenin's-Norton's Equivalence, Superposition Theorem, Maximum Power Transfer Theorem, Application to resistive and reactive circuits Numerical Problem Solving: Step-by-step calculations using theorems, Practice with both DC and AC circuitsPractical Application and Analysis: Circuit diagram drawing, Verification of theorems through simulations or labs	**10 L**
Unit 2	**Diodes and Transistors:** P-N junction diode, Biasing a semiconductor diode, Ideal and practical diodes, Zener diode, Reverse saturation current, Zener and avalanche breakdown. Tunnel diode, Light emitting diode and photo diode. Transistors: Transistor, transistor action, characteristics of transistor in common base (CB), Common emitter (CE), Common collector (CC), transistor current gains α and β, relation between α and β.	**10 L**
Unit 3	**Power supplies:** Block diagram of Regulated Power supply, half wave and Full wave rectifiers, and their efficiency, bride rectifier, and its efficiency, Zener diode as voltage regulator, transistor series voltage regulator.	**10 L**
Suggested Readings: 1) Electrical technology – B. L. Theraja (S. Chand 2004) 2) Semiconductor Electronics – A. K. Sharma New age international 1996. 3) Principles of Electronics – V. K. Mehta (S. Chand and Co. 2004) 4) Basic Electronic (Solid state) – B. L. Theraja devices (S. Chand and Co. 2012) 5) Electronic Devices and Circuits- David A. Bell 5th Edition, Oxford Uni. Press, 2015		

	SUB/DSC/P/127: Practical based on Network Analysis and Semiconductor Devices (Credit: 02 Contact Hrs.: 60 Marks: 50)	
	Experiments: 1. Study of PN junction diode characteristics, determination of ac and dc resistance. 2. Study of Zener diode characteristic, determination of VZ, IZ ZZ. 3. Study of transistor characteristics in CE configuration, determination of α. 4. Study of JFET characteristics, determination of parameters. 5. Built and study of Full wave rectifier. 6. Built and study shunt regulator using Zener diode, line and load regulation. 7. Built and study power supply with capacitor filter. 8. Built of study two stage CE amplifier 9. To study and experimentally verify the Thevenin's Theorem through circuit analysis and practical measurement." 10. To study and experimentally verify the Nortan's Theorem through circuit analysis and practical measurement." 11. To study and experimentally verify the Maximum Power Transfer Theorem through circuit analysis and practical measurement."	

	Sub/GE/OE/T/100: Open elective (GE/OE) **(Chose any one from pool of courses)** **It should be chosen compulsorily from the faculty other than that of Major** **(Credit: 02 Contact Hrs.: 30 Marks: 50)**	
	Generic / Open Elective (GE/OE) (Choose any one from pool of courses of GE/OE Basket) It should be chosen compulsorily from the faculty other than that of Major SUB/GE/ OE/T/100 Choose any one course from other faculty (GE/OE Basket)	

	SUB/SEC/P/125: Consumer Electronics (Credit: 02 Contact Hrs.: 60 Marks: 50)	
	Course objectives: 01. In this paper Student will learn basic concepts of sensors, transducers, oscillators, speakers and modern TV.	
	Learning Outcomes **By the end of this course, students will be able to:** 1. Understand various sensors and their application. 2. Understand various parts and their functions of microphone, speakers. 3. Understand working of Amplifier, mp3 players: 4. Understand working of TV.	
Unit 1	**Unit I:** **Sensor and Transducer:** Definition, Active and passive sensors, specifications, Types-Temperature, pressure, pH, humidity, optical, displacement, IR, tilt sensor etc. Amplifiers & Oscillators: Amplifiers: History, Principle, Types: Power amplifier, operational amplifier, distributed amplifier. Application. Oscillators: Construction & working, Basic types of oscillators.	**20 L**
Unit 2	**Speakers & Car mp3 players: Speakers:** Introduction, History, Drive design, Driver types: Full range driver, Woofer, Tweeter, specification, electrical characterization, Car mp3 players: Various types of m/c, Various Audio systems e.g. 2.1ch, 5.1 etc, Standard specification of Audio system, mp3 players used in cars.	**20 L**
Unit 3	**TV System:** Colour TV Block diagram, various sections of colour TV-viz -vertical section, various type of Monitor, Various new types (except CRT type) of TV's-plasma, LCD, LED, OLED, QLED, Curved, foldable, 3D, Smart TV.	**20 L**
Suggested Readings: 1. Audels Home appliances servicing – Edwin P. Anderson 2. Micro Electronic Circuit, Oxford University Press VIth Edition –Sedra & Smith 3. Basic electronics – By V. K. Mehate 4. Electronic Devices and Circuits McGraw Hill Millman, Halkias and Jit 5. Electronic Devices & Circuit Pearson Education – Boylestad & Nashelsky 6. Introducing Electronic Devices & Circuit, Pearson Education VIIth Edition – Robert T. Paynter 7. Electronic Devices & Circuit – Tata McGraw Hill-S. Salivahanan, N. Suresh Kr,A.Vallavara		

	Students are expected to do the following Hands-on Practices apart from theoretical understanding of the topics mentioned above	
	1. Study of Temperature Sensor. 2. Testing & repairing of Amplifier. 3. Testing & repairing of Speaker. 4. Testing & repairing of Microphone. 5. Study of Testing & Repairing of mp3 player. 6. Study of various section of TV. 7. Testing & repairing of Testing & repairing of TV. 8. Testing & repairing of Smart TV. (LED). 9. Visit to Shop & Market Survey.	

	SUB/SEC/P/126: Electrical Wiring (Credit: 02 Contact Hrs.: 60 Marks: 50)	
	Course objectives: 1. Understanding the basic concept of Safety precautions and shock treatment and how to handing Electrical Tools. 2. Understanding the basic principle, working of testing and installation of domestic wiring. 3. Understanding the concept and use of various electrical tools and Earthing formats for electrical connections.	
	Learning Outcomes **By the end of this course, students will be able to:** 1. Identify and comprehend the key principle of electrical wiring. 2. Evaluate and select appropriate electrical wiring components. 3. Testing the performance of common and domestic electrical wiring. 4. Locating the fault at the electrical wiring level.	
Unit 1	**Safety precautions and shock treatment:** Workplace Discipline, Electrical shocks and procedure for separating person form contact with live wire, First Aid different methods of artificial respiration, Electric fire, Fire extinguishers	**20 L**
Unit 2	**Electrical Tools:** Pliers, combination, side cutting, round nose, long nose, Screw drivers, connectors, electrical knife, neon tester, test lamp.	**20 L**
Unit 3	**Common electric wiring and Domestic (House) Wiring:** DC Circuits, Series circuit, Parallel circuit, Ohm's law, Kirchhoff's current and voltage law. Printed circuit board, introduction, types and testing. Types of wires, lamp holders, distribution wire. Introduction of Domestic wiring, selection of wiring, types of wiring, rules of domestic wiring, testing and installation of domestic wiring, Earthing formats for electrical connections.	**20 L**
Suggested Readings: 1. Electrical Wiring Estimating & Costing. - S. L. Uppal. 2. Electrical Wring Estimating & Costing. - J. D. Gupta. 3. Indian Electricity Rules. - Nausheer Bharocha. 4. Basic Electrical Engineering. - PHI. – S. N. Singh.		

	Students are expected to do the following Hands-on Practices apart from theoretical understanding of the topics mentioned above	
	1. Study of Safety precautions while working on electrical installations & necessity of earthing (Grounding). 2. Personal protection, basic injury prevention, symbol & sign for danger, warning & caution and elementary first aid. 3. Artificial respiration techniques of separating person in contact with & live wire 4. Demonstration of use of Fire Extinguishers 5. Demonstration and use of electrical tools. 6. Demonstration of different types of wires. 7. Study of Series circuit, Parallel circuit and Ohm's law. 8. Study of Kirchhoff's current and voltage law. 9. Design and testing of Switch Board. 10. Study of Domestic Electrical Wiring.	

	SUB/AEC/T/100: English (Credit: 02 Contact Hrs.: 30 Marks: 50)	
	English (Common for all the faculty) Syllabus of this subject will be taken from the common syllabus of Dr. Babasaheb Ambedkar Marathwada University, which is available on the university website.	

	SUB/IKS/T /101: Choose any one from pool of IKS courses (Credit: 02 Contact Hrs.: 30 Marks: 50)	
	IKS (Common for all the faculty) Student can choose one of the IKS courses from IKS basket which is available on the university website.	

	SUB/CC/P/125: Healthy and Wellness (Credit: 02 Contact Hrs.: 30 Marks: 50)	
	Healthy and Wellness (Common for all the faculty) Syllabus of this subject will be taken from the common syllabus of Dr. Babasaheb Ambedkar Marathwada University, which is available on the university website.	

Syllabus of Semester II

	SUB/ DSC/T/ 150: Linear Integrated Circuits (Credit: 02 Contact Hrs.: 30 Marks: 50)	
	Course objectives: 1. To understand the basic concepts of operational amplifier and its various applications. 2. To understand the basics of oscillators and its practical applications. 3. To study IC 555 timer and its use in different applications. 4. Identify and explain the functions of various LIC components such as op amps and timers 5. Design and analyze active filter circuits using op amps, including firs order and second order filters	
	Learning Outcomes **By the end of this course, students will be able to:** 1. Understand and analyze the IC 741 operational amplifier and its characteristics. 2. Design the solution for linear & non-linear applications using IC741. 3. Apply linear integrated circuits in various electronic system, including audio amplifiers, power supplies, and signal processing system 4. Explain the principles of oscillation and design various oscillator circuits. 5. Understand and analyze the IC 555 and its use in various applications.	
Unit 1	**Operational Amplifier** Differential amplifier-Dual input balanced output differential amplifier, block diagram of typical Op-Amp, schematic symbol, the ideal Op-Amp, equivalent circuit of an Op-Amp, Op-Amp Parameters-Input-Impedance, Output impedance, input offset voltage, Open Loop Voltage gain, input bias current, slew rate.	**10 L**
Unit 2	**Operational Amplifier Applications** Voltage series feedback amplifier, Voltage shunt feedback amplifier, virtual ground, error voltage, gain of op-amp, Op-amp as inverting and non-inverting amplifier, buffer amplifier, adder, subtractor, integrator, differentiator, basic comparator, Schmitt trigger.	**10 L**
Unit 3	**Oscillators and the 555 Timer** Oscillator principle, types of oscillations, frequency stability, phase shift oscillator, Wien Bridge oscillator, square wave generator, triangular wave generator, saw tooth wave generator, voltage-controlled oscillator. Introduction, Basic block of IC 555 timer and function of each block, IC 555 as monostable multivibrator, and applications, IC 555 as an astable multivibrator, applications, Free running ramp generator.	**10 L**
Suggested Readings: 1. Op-Amps & Linear Integrated Circuits (Second Edition) [Chapters 1 to 4], Ramakant Gaikwad, Prentice Hall of India. 2. Electronics Principles and Applications (Fifth edition) [Chapters 1and 2.], John D Ryder 3. Linear Integrated Circuits D Roy Choudhry &Shail B Jain, New Age International Publishing 4. Electronic Devices (Sixth Edition) Floyd, Pearson Education 5. Op Amps & Linear Integrated Circuits James M Fiore, Thomson Learning 6. Integrated Circuits, K R Botkar, Khanna Publishers, New Delhi.		

	SUB/ DSC/P/ 175: Practical Based On Linear Integrated Circuits (Credit: 02 Contact Hrs.: 60 Marks: 50)	
	1. Study of Op – Amp as a non-inverting amplifier. 2. Study of Op – Amp as an inverting amplifier. 3. Study of Op – Amp as an inverting adder. 4. Study of Op – Amp as an inverting subtractor. 5. Study of Op – Amp as an integrator. 6. Study of Op – Amp as a differentiator. 7. Study of Op – Amp as a Schmitt trigger. 8. Study of Op – Amp as an analogue computer to solve simple equation. 9. Study of Op – Amp as Low voltage DC voltmeter 10. Built and study Wien Bridge oscillator using Op – Amp. 11. Built and study phase shift oscillator using Op – Amp.	

	SUB/ DSC/T/ 151: Power Electronics (Credit: 02 Contact Hrs.: 30 Marks: 50)	
	Course objectives: 1. To introduce fundamental concepts of power semiconductor devices and their applications. 2. To understand the working of controlled rectifiers, inverters, and choppers. 3. To study the use of electronic circuits in industrial control and automation systems. 4. To develop basic skills in implementing and simulating PLC-based industrial systems. 5. To familiarize students with real-world applications of industrial electronics in motor control and automation.	
	Learning Outcomes By the end of this course, students will be able to: 1. Identify and describe the characteristics of power electronic devices like SCR, TRIAC, MOSFET, and IGBT. 2. Analyze and construct circuits for rectification, inversion, and voltage control. 3. Explain the principles of motor control using power electronic converters. 4. Program and simulate basic PLC logic for industrial operations. 5. Apply knowledge of industrial electronics to solve automation problems in real-world scenarios.	
Unit 1	**Power Semiconductor Devices and Circuits** Introduction to Power Electronics Power Diodes and their Applications Bipolar Junction Transistors (BJTs) Power BJTs: Switching Characteristics and Applications Thyristors (SCR): Structure, Operation, and Characteristics Triggering and Commutation Techniques for SCR TRIAC and DIAC Unijunction Transistor (UJT) and Relaxation Oscillator Protection of Semiconductor Devices	**10 L**
Unit 2	**Controlled Rectifiers and Inverters** Half-controlled and Fully-controlled Rectifiers (Single-phase and Three-phase) Line Commutated Converters Performance Parameters of Converters Choppers – Classifications and Applications Inverters – Voltage Source and Current Source Inverters Series and Parallel Inverters Forced Commutation Techniques Cycloconverters – Principle and Operation AC Voltage Controllers using SCR and TRIAC	**10 L**
Unit 3	**Industrial Applications and Automation** Industrial Applications of Converters and Inverters Speed Control of DC Motors using Converters Speed Control of AC Motors using Inverters and AC Controllers Introduction to PLCs – Architecture and Programming Basics Interfacing with Industrial Sensors and Transducers Industrial Signal Conditioning Opto-electronic Devices in Industrial Circuits	**10 L**

Suggested Readings:

1) P.S. Bimbhra – Industrial Electronics
2) M.D. Singh & K.B. Khanchandani – Power Electronics
3) V.R. Moorthy – Power Electronics: Devices, Circuits and Industrial Applications

	SUB/ DSC/P/ 176: Practical Based On Power Electronics (Credit: 02 Contact Hrs.: 60 Marks: 50)	
	Course objectives: 1. Study of SCR characteristics 2. UJT relaxation oscillator 3. TRIAC and DIAC characteristics 4. Half-controlled single-phase rectifier using SCR 5. Full-controlled bridge rectifier 6. DC chopper circuit using IGBT/MOSFET 7. Basic inverter using power transistors 8. Phase control using TRIAC 9. AC voltage controller using SCR 10. Speed control of DC motor using SCR 11. Speed control of AC motor using TRIAC	

	SUB/ DSC/T/ 152: Measurements and Instrumentations (Credit: 02 Contact Hrs.: 30 Marks: 50)	
	Course objectives: 1. To understand the fundamental principles of measurement and instrumentation systems. 2. To introduce various types of sensors and transducers used in industry. 3. To develop knowledge of signal conditioning and data acquisition techniques. 4. To provide hands-on experience with basic and digital measurement tools. 5. To explore real-world applications of instrumentation in electronics and industry.	
	Learning Outcomes By the end of this course, students will be able to: 1. Explain basic measurement principles, errors, and instrument characteristics. 2. Select and use appropriate transducers for measuring physical quantities. 3. Design and analyze signal conditioning circuits for sensor outputs. 4. Use modern measurement devices such as CROs, DMMs, and DAQs. 5. Integrate measurement systems with data acquisition and digital display units.	
Unit 1	**Fundamentals of Measurement and Error Analysis** Introduction to Measurement Systems Functional Elements of an Instrumentation System Static and Dynamic Characteristics of Instruments Types of Errors: Gross, Systematic, and Random Statistical Analysis: Mean, Standard Deviation, Accuracy, and Precision Calibration of Instruments Standards of Measurement: Primary and Secondary Standards	**10 L**
Unit 2	**Sensors, Transducers, and Signal Conditioning** Classification of Sensors and Transducers Resistive, Capacitive, and Inductive Transducers Thermocouples, RTDs, and Thermistors Piezoelectric, Photovoltaic, and Hall Effect Transducers Signal Conditioning Circuits: Amplification, Filtering, Isolation Bridge Circuits: Wheatstone Bridge, Maxwell and Schering Bridge A/D and D/A Conversion Techniques Introduction to Digital Instrumentation	**10 L**
Unit 3	**Display, Recording, and Data Acquisition** Display Devices: Analog and Digital Meters, 7-segment, LCD/LED Recorders: Strip Chart, XY Recorders, Digital Recorders Oscilloscopes: CRO and DSO – Block Diagram and Operation Digital Multimeter (DMM) and LCR Meter Data Acquisition Systems (DAS) – Architecture and Applications Interfacing of Sensors with Microcontroller/DAQ Modules Industrial Applications of Measurement Systems	**10 L**
Suggested Readings: 1) A.K. Sawhney – A Course in Electrical and Electronic Measurements and Instrumentation (Dhanpat Rai & Co.) 2) E.O. Doebelin – Measurement Systems: Application and Design (McGraw-Hill) 3) David A. Bell – Electronic Instrumentation and Measurements (Oxford University Press) 4) H.S. Kalsi – Electronic Instrumentation (Tata McGraw-Hill) 5) R.K. Rajput – Electrical and Electronic Measurements and Instrumentation (S. Chand)		

	SUB/ DSC/P/ 177: Measurements and Instrumentations (Credit: 02 Contact Hrs.: 60 Marks: 50)	
	1. Calibration of a voltmeter using a potentiometer 2. Measurement of resistance using Wheatstone Bridge 3. Characteristics of LVDT (Linear Variable Differential Transformer) 4. Measurement of temperature using RTD 5. Use of thermocouple for temperature measurement 6. Study of CRO – measurement of frequency and phase 7. Use of strain gauge with signal conditioning 8. Measurement using digital multimeter (DMM) and LCR meter 9. A/D conversion and data acquisition using microcontroller or DAQ	

	SUB/GE/OE/T/150: Open elective (GE/OE) (Chose any one from pool of courses) It should be chosen compulsorily from the faculty other than that of Major (Credit: 02 Contact Hrs.: 30 Marks: 50)	
	Generic / Open Elective (GE/OE) (Choose any one from pool of courses) **It should be chosen compulsorily from the faculty other than that of Major** **(GE/OE Basket)**	

	SUB/VSC/P/175: PCB Design and Fabrication (Credit: 02 Contact Hrs.: 60 Marks: 50)	
	Course objectives: In this paper student will learn basic of PCB designing and tools such as soldering and de-soldering of electrical circuits, to design PCB and identification of faults in various instruments.	
	Learning Outcomes By the end of this course, students will be able to: 1. Understand the fundamentals of electronic components commonly used in PCBs. 2. Explain the basic electronic circuits used in PCB designing. 3. Demonstrate proficiency in layout planning for PCBs, considering general rules and parameters. 4. Identify considerations for ground conductors and thermal issues in PCB design. 5. Perform checks and inspections of artwork for PCBs.	
Unit 1	Introduction to Printed circuit board: Fundamental of electronic components, basic electronic circuits of printed circuit board designing: Layout planning, general rules and parameters, ground conductor considerations, thermal issues, check and inspection of artwork.	**20 L**
Unit 2	Design rules for PCB: Design rules for Digital circuit PCBs, Analog circuit PCBs, high frequency and fast applications. Power electronics, microwave applications. Soldering and De Soldering Stations: Different types of Soldering Guns related to Temperature and wattages, types of tips, Solder materials and their grading. Soldering and De Soldering Stations and their Specifications, Preparing Component for Soldering. De soldering tools-De soldering Basic Components	**20 L**
Unit 3	Identification of Faults: Identification of loose/dry solder, broken tracks on printed wire assemblies & discrete components mounted circuit boards, Join the broken PCB track and test, De soldering using Pump and wick, Introduction of SMD Components.	**20 L**

Suggested Readings:

1) Printed circuit Board Design, Fabrication Assembly and Resing. R.S Khanpure,TMH-2006.
2) Printed circuit Board Design and Technology, Walter C. Bosshart, TMH-1983.
3) PCB Design for Real-World EMI Control, Bruce R. Archambeault and James Drewniak, Springer Science.
4) Complete PCB Design Using or Cad Capture and Layout, Kraig Mitzner, Newnes Pub.

	Students are expected to do the following Hands-on Practices apart from theoretical understanding of the topics mentioned above	
	1. To study the basic of PCB and its fabrication method. 2. Etching of various PCB. 3. Soldering and de-soldering of various components on PCB. 4. Study of soldering and de-soldering tools and machinery (any tools) 5. Assemble the components (any 3 components) 6. De-Assembled the components (any 3 components)	

	SUB/VSC/P/176: Power Supplies (Credit: 02 Contact Hrs.: 60 Marks: 50)	
	Course objectives: In this paper Student will learn basic concepts of Rectifiers and filters, Regulated power supply, Inverters and UPS.	
	Learning Outcomes By the end of this course, students will be able to: 1. Understand various components used in power supply. 2. Understand the specification, use of Inverter and UPS. 3. Analyse various types of power supplies 4. Design and develop a power supply.	
Unit 1	**Rectifier and filters Circuits**: Half wave, Full wave, Bridge, Merits, Demerits. Filters, Reactance, Capacitor, Inductor, RC, RL, RLC and their types. Regulated Power supply: Avalanche breakdown, Zener breakdown, Zener Characteristics. Power Supply: Block diagram, line regulation, load regulation, series & shunt regulation.	**20 L**
Unit 2	**Stabilizer:** Block diagram, Principle, working, specification, maintenance & trouble shooting. IC 78XX & 79XX regulator: Block diagram, working and design of series / shunt regulation.	**20 L**
Unit 3	**Inverter:** Principle & block diagram, working, various parts and their use, types specification, maintenance and trouble shooting. UPS: Block diagram, Principle, working, various parts and their use, type's specification, UPS-Online, offline, maintenance and trouble shooting.	**20 L**
Suggested Readings: 1. Electrical Engineering – B. L. Theraja P – I, II, III, IV 2. Maintenance of Domestic Appliances – R. B. Lal 3. Basic Electrical Engineering (PHI) – S.N.Singh Electronic Devices and Circuits McGraw Hill Millman, Halkias and Jit 4. Electronic Devices & Circuit – Tata McGraw Hill-S.Salivahanan, N.Suresh Kr,& A.Vallavar 5. Modern Digital Inverter Basic Servicing and Fault finding by Manahar Lotia BPB Publication. 6. Modern UPS Introduction, Servicing and Fault finding by Manahar Lotia BPB Publication.		

	Students are expected to do the following Hands-on Practices apart from theoretical understanding of the topics mentioned above	
	1. Study of Half wave rectifier 2. Bridge Rectifier 3. Study of passive filters 4. Study of 1) Line Regulation 2) Load Regulation in laboratory power supply 5. Study and testing of laboratory stabilizer. 6. To design, build and test IC regulated power supply 7. Study and testing of Inverter 8. Study and testing of UPS	

	SUB/AEC/T/150: Modern Indian Language (MIL-1) (Chose any one from pool of language courses) (Credit: 02 Contact Hrs.: 30 Marks: 50)	
	1) Marathi 2) Hindi 3) Pali and Buddhism 4) Urdu 5) Arabic 6) Sanskrit Students can choose any one from above courses. Syllabus of these courses is available on university website.	

	SUB/AEC/T/151: Constitution of India (Credit: 02 Contact Hrs.: 30 Marks: 50)	
	Constitution of India : Common for all the faculty Syllabus of this subject will be taken from the common syllabus of Dr. Babasaheb Ambedkar Marathwada University, which is available on the university website.	

	SUB/CC/P/175: Yoga Education/Sports and Fitness (Credit: 02 Contact Hrs.: 60 Marks: 50)	
	Yoga Education/Sports and Fitness: Common for all the faculty Syllabus of this subject will be taken from the common syllabus of Dr. Babasaheb Ambedkar Marathwada University, which is available on the university website.	

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