Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD

CIRCULAR NO.SU/Sci. & Tech./Colleges./NEP/24/2023

It is hereby inform to all concerned that, the syllabi prepared by the Board of Studies & Ad-hoc Boards and recommended by the Dean, Faculty of Science & Technology, the Hon'ble Vice-Chancellor has accepted **the following curriculum of Post Graduate Degree Courses as per Norms of National Education Policy – 2020 under the Faculty of Science & Technology run to the Affiliated Colleges, Dr.Babasaheb Ambedkar Marathwada University** in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith.

Sr.No.	Syllabi of Affiliated Colleges under BAMU, Aurangabad.	Semester
1.	M.Sc.Chemistry Specialization: Analytical Chemistry, Inorganic Chemistry, Physical Chemistry, Organic Chemistry, Polymer Chemistry and Drug Chemistry.	Ist and IInd Semester
2.	M.Sc.Electronics	Ist Semester
3.	M.Sc.Herbal Technology	Ist to IVth Semester
4.	M.Sc.Industrial Chemistry	Ist and IInd Semester
5.	MCA(Science)	Ist and IInd Semester

This is effective from the Academic Year 2023-24 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO.SU/NEP/2023/10551-59
Date:- 22.08.2023.

★★★★★

Deputy Registrar,
Academic Section

Copy forwarded with compliments to :-

1] **The Principal of all concerned affiliated Colleges, Dr. Babasaheb Ambedkar Marathwada University,.**
2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] The Director, Board of Examinations & Evaluation, Dr.BAMU,A'bad.
2] The Section Officer,[M.Sc.Unit] Examination Branch,Dr.BAMU,A'bad.
3] The Programmer [Computer Unit-1] Examinations, Dr.BAMU,A'bad.
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DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
AURANGABAD-431004 (MS), INDIA

FACULTY OF SCIENCE AND TECHNOLOGY

Master of Science in Electronics

(M. Sc. in Electronics)

(2 Years P.G. Program)

As Per

National Education Policy-2020

Course Structure and Curriculum
(Outcome-based Curriculum)

For

AFFILIATED COLLEGES

Dr. Babasaheb Ambedkar Marathwada University,
Aurangabad–431004, (M.S.)

Effective from the Academic Year 2023-24

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PREFACE

The National Education Policy (NEP) 2020, implemented in India, marks a significant stride towards a holistic and transformative educational framework. This policy aims to revolutionize the country's education system by fostering a learner-centric approach, promoting critical thinking, and nurturing creativity among students. With its emphasis on early childhood education, vocational training, and multi-disciplinary learning, the NEP 2020 seeks to equip students with relevant skills for the 21st-century world. It also focuses on bridging the digital divide and leveraging technology for effective teaching and learning. By encouraging flexibility in curriculum and assessment methods, promoting the mother tongue as a medium of instruction, and ensuring inclusive education, the NEP 2020 endeavors to build a robust and inclusive education ecosystem that prepares learners for the challenges and opportunities of the future.

On the other hand Outcome Based Education (OBE) is the educational approach which focuses on student centric education in the context of the development of personal, social, professional and knowledge (KSA) requirements in one's career and life. It is the decade ago curriculum development methodology. The educational triangle of *LEARNING-ASSESSMENT-TEACHING* is the unique nature of the OBE approach. The curriculum practices such as the Competency Based Curriculum, Taylor's Model of Curriculum Development, Spadys' Curriculum principles, Blooms taxonomy and further use of assessment methodologies like, Norm-reference testing and Criterion reference testing, etc is being practiced since decades. It is also interesting to know that, globally, different countries and universities adopts the curriculum development models/approaches such as, CDIO (Conceive-Design-Implement-Operate), Evidenced Based Education, Systems' Approach, etc as the scientific and systematic approaches in curriculum design.

The authorities of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (M.S.) in-lieu of accreditation standards of National Assessment and Accreditation Council, decided to opt for National Education and Policy and Outcomes Based Education (OBE). As the part of the decision, different meetings, workshops and presentations were held at the campus of university.

This document is the outcome of different meetings and workshops held at university level and department level. The detailed document is designed and the existing curriculum of the department is transformed in to the framework of NEP with OBE. This is the first step towards the implementation of NEP with OBE in the university departments and affiliated colleges. The document will serve all stakeholders in the effective implementation of the curriculum. The OBE is continuous process for quality enhancement and it will go a long way in order to enhance the competencies and employability of the graduates/Post-graduates of the university departments and affiliated colleges.

Course and Credit Distribution Structure for
Two Years Post Graduate Programme with Multiple Entry Exit Options

Class: M. Sc. First Year, Semester: First Semester, Subject: Electronics

Course Type	Course Code	Course Name	Teaching Scheme (Hrs./Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Discipline Specific Core Course (DSC) Mandatory	ELET/MJ/507	Electronic Devices	2	--	2	--	14
	ELET /MJ/508	Industrial Electronics	2	--	2	--	
	ELET /MJ/509	Sensor Fundamentals	2	--	2	--	
	ELET /MJ/510	Network Analysis and Synthesis	2	--	2	--	
	ELEP /MJ/531	Practical Based on ELET/MJ/507	--	4	--	2	
	ELEP /MJ/532	Practical Based on ELET/MJ/508	--	4	--	2	
	ELEP /MJ/533	Practical Based on ELET/MJ/509	--	4	--	2	
DSE (Choose any one from pool of Course)	ELET/DSE/511	Principle of Digital Electronics and circuits	2		2		4
	ELEP /DSE/534	Practical Based on ELET/DSE/511		4		2	
	OR						
	ELET/DSE/512	Control Systems	2		2		
	ELEP/DSE/535	Practical Based on PHYT/DSE/512		4		2	
RM	ELET/RM/547	Research Methodology	4	---	4	----	4
			14	26	14	8	22

Course and Credit Distribution Structure for
Two Years Post Graduate Programme with Multiple Entry Exit Options

Class: M. Sc. First Year, Semester: Second Semester, Subject: Electronics

Course Type	Course Code	Course Name	Teaching Scheme (Hrs./Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Discipline Specific Core Course (DSC) Mandatory	ELET/MJ/556	8086 Microprocessor and Programming	2	--	2	--	14
	ELET /MJ/557	Embedded System and Programming	2	--	2	--	
	ELET /MJ/558	Advanced Sensor Technology	2	--	2	--	
	ELET /MJ/559	Properties of Electronic Materials	2	--	2	--	
	ELEP /MJ/581	Practical Based on ELET /MJ/556	--	4	--	2	
	ELEP /MJ/582	Practical Based on ELET /MJ/557	--	4	--	2	
	ELEP /MJ/583	Practical Based on ELET /MJ/558	--	4	--	2	
DSE (Choose any one from pool of Course)	ELET /DSE/560	Interfacing of 8086 Microprocessor and 8051 Microcontroller	2		2		4
	ELEP /DSE/584	Practical Based on ELET /DSE/560		4		2	
	OR						
	ELET /DSE/561	Signal Conditioning Circuits	2		2		
	ELEP /DSE/585	Practical Based on ELET/DSE/561		4		2	
	OR						
OJT/FILED PROJECT	ELEP /OJT/FP/597		--	8	--	4	4
			10	24	10	12	22

Course and Credit Distribution Structure for
Two Years Post Graduate Programme with Multiple Entry Exit Options

Class: M. Sc. First Year, Semester: Third Semester, Subject: Electronics

Course Type	Course Code	Course Name	Teaching Scheme (Hrs./Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Discipline Specific Core Course (DSC) Mandatory	ELET/MJ/606	Programmable Logic Controllers	2	--	2	--	14
	ELET /MJ/607	Internet of Things	2	--	2	--	
	ELET /MJ/608	Electrical, Electrochemical and Spectroscopic Characterization Techniques for Electronic Devices	2	--	2	--	
	ELET /MJ/609	Fabrication Techniques for Electronic Devices	2	--	2	--	
	ELEP /DSC/631	Practical Based on ELET /MJ/606	--	4	--	2	
	ELEP /DSC/632	Practical Based on ELET /MJ/607	--	4	--	2	
	ELEP /DSC/633	Practical Based on ELET /MJ/608	--	4	--	2	
DSE (Choose any one from pool of Course)	ELET/DSE/610	Structural and Morphological Characterization Techniques for Electronic Devices	2		2		4
	ELEP /DSE/634	Practical Based on ELET /DSE/610		4		2	
		OR					
	ELET/DSE/611	Instrumentation in Process Control	2		2		
	ELEP/DSE/635	Practical Based on ELET /DSE/611		4		2	
OJT/FILED PROJECT	ELEP /OJT/FP/647		--	8	--	4	4
			10	24	10	12	22

Course and Credit Distribution Structure for

Two Years Post Graduate Programme with Multiple Entry Exit Options

Class: M. Sc. First Year, Semester: Forth Semester, Subject: Electronics

Course Type	Course Code	Course Name	Teaching Scheme (Hrs./Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Discipline Specific Core Course (DSC) Mandatory	ELET/MJ/655	Advance Communication Systems	2	--	2	--	14
	ELET /MJ/656	Fundamentals of Energy Storage Devices	2	--	2	--	
	ELET /MJ/657	Optoelectronics	2	--	2	--	
	ELEP /MJ/681	Practical Based on ELET /MJ/655	--	4	--	2	
	ELEP /MJ/682	Practical Based on ELET /MJ/656	--	4	--	2	
	ELEP /MJ/683	Practical Based on ELET /MJ/657	--	4	--	2	
DSE (Choose any one from pool of Course)	ELET /DSE/658	Electrochemical Energy Storage Systems	2		2		4
	ELEP /DSE/684	Practical Based on ELET /DSE/658		4		2	
	OR						
	ELET /DSE/659	Micro-electromechanical System and Applications	2		2		
	ELEP /DSE/685	Practical Based on ELET/DSE/659		4		2	
	OR						
OJT/FILED PROJECT	ELEP /OJT/FP/697		--	8	--	4	4
			10	24	10	12	22

Structure and Curriculum for Master of Science (M. Sc.) in Electronics

(As per NEP 2020)

Two-Year Post-graduate Program

Course and Credits Distribution of Two years/One Year PG/Master's Degree Program with Entry & Exit Option

Faculty of Science & Technology

Year / level	Sem.	Major subject		RM	OJT /FP	RP	Credits	Degree
		DSC Core Mandatory	DSE (Elective)					
First year 6.0	I	3(4) +2=14	4	4			22	PG Diploma (after 3 years degree)
	II	3(4) +2=14	4		4		22	
Cum. Cr. For PG Diploma		28	08	4	4		44	
Exit option with Post-graduate Diploma (44 credits) after first year or two semester with completion of courses equivalent to 44 credits								
Second Year 6.5	III	3(4)+2=14	4			4	22	PG Degree after 3 years UG or PG Degree after 4 years UG
	IV	3(4)=12	4			6	22	
Cum. Cr. For 1 year PG Degree		26	8			10	44	
Cum. Cr. For 2 years PG Degree		54	16	4	4	10	88	
2 Years -4 sem.PG Degree (88 credits) after three year UG Degree or 1 Year -2 sem. PG Degree (44 credits) after four year UG degree								
8.0			Course work Min.12 credits 3(4)		Training in teaching /education/pedogogy:4		16+ Ph.D. Work	Ph.D.in subject

Note- DSC-is Discipline specific Core courses and are mandatory

ABBREVIATION:

Major – Comprising Mandatory – based on core subjects
DSE- Discipline Specific Elective based on specialization
OJT – On-the- Job Training
FP – Field Project (Corresponding to the Major (Specialization) Subject
RP – Research Project (Corresponding to the Major (Specialization) Subject
Internship/Apprenticeship - (Corresponding to the Major (Specialization) Subject

Code Details:

1) Paper Codes have been started from 500 for Post Graduate first year and from 600 for Post Graduate second year
2) First Semester : Theory : 500 – 525 ; Practical : 526-545 ; Project : 546-549
3) Second Semester : Theory : 550 – 575 ; Practical : 576-595 ; Project : 596-599
4) Third Semester : Theory : 600 – 625 ; Practical : 626-645 ; Project : 646-649
5) Fourth Semester : Theory : 650 – 675 ; Practical : 676-695 ; Project : 696-699

Preamble:

Dr. Babasaheb Ambedkar Marathwada University proposes to offer a two years / one year Masterprogramme in Science (M. Sc.) in Electronics.The curriculum design of this program is undertaken in the following framework (assumptions).

a) Although there has been remarkable progress in all sectors of education in last couple of decades, there has been increasing crisis for truly able manpower to address the growing demands for work sectors. This has led to the widening gap between the supply and demand for skilled manpower across teaching institutions, R&D organizations and industries. Such inadequacy of knowledge acquisition and dissemination has translated directly into unemployment among an increasing number of post-graduates who pass-out every year and are forced to bare-trainedin order to become marketable.

   A scientifically designed framework, which will enable students at post graduate level to be ready to face the challenges of the demand driven socio-economic profile is therefore, a call of the day. Such a course should not be occupation specific and should enable students to choose from a variety of options for their career.

   This programme is designed to produce a skilled manpower in Electronics with Sensors and process control as specialized sectors of training to improve the opportunities for the unemployed youths in both the private and public sectors.

b) According to a study conducted by the Associated Chambers of Commerce and Industry of India (ASSOCHAM), there will be a deficit of 40 million working professionals and the employers would face the difficulty of filling positions because of the dearth of suitable talent and skilled person all in their industry. **This programme aims to provide some solution for this problem and this would facilitate to improve:**

   (i) Quality of training
   (ii) High drop-out rates
   (iii) Linkages with Universities and industry
   (iv) Inadequacy ofresources.

c) **This programme is intended to offer practical training and skills needed to pursue an occupation straight away. It will provide options to the students to be trained in directions which are directly aligned to land a job in a chosen profession or a skilled trade.**

d) **This program is intended to offer students with life-long independent and reflective learning skills in their career.**

Vision

To structure the Department of Electronics of University to be an Epitome of Excellence in Research and Development in the area of Sensor Technology by creating and imparting time responsive Quality Education to address Changing Scenario, keeping Research and Development at its core, for 'Anyone' at 'Anytime' and 'Anywhere'.

Mission

To achieve the vision, the Department will:

- Provide a platform for the students with broad spectrum of diversity to achieve Academic Excellence with in-built Employability in the area of Sensor Technology.
- Establish a unique learning environment to enable the students to face the challenges in the area of Sensor Technology.
- Identify the gaps between academics and industry, design the courses to impart technical and life skill as per the requirements of the region so as to improve employability and develop entrepreneurial capabilities.
- Adopt a perennial process for bringing in excellence in teaching pedagogy by providing ICT based state-of-the-art infrastructural facilitation
- Provide student centric learning environment and to establish platform for inclusive research leading to the development of creative thought process amongst research scholars keeping in mind societal needs.
- Establish centre of excellence in the area of Electronics devices (viz. Sensors, Sensor Networks, semiconductor devices, photovoltaic devices etc) to nurture innovative ideas shaping into products facilitating the spinoff and creating awareness to protect Intellectual Property (IP).
- Provide ethical and value based education by promoting activities addressing the societal needs.

Program Educational Objectives:

The objectives of M. Sc. (Electronics) program are to produce graduates who -

1. Are equipped with time relevant knowledge of Sensor Technology to address multi-disciplinary demands of R & D organizations, educational institutes and automated process in modern industries in capacity of Scientist, Education Professionals, System Developers and System Integrators.
2. Have sound background to practice advanced concepts of electronics in the areas sensor technology, Semiconductor Devices in R & D organizations, educational institutes, industry and Government settings meeting the growing expectations of stakeholders.
3. Have an ability to pursue higher studies and succeed in academic and professional careers.
4. Have the ability to address professional demands individually and as a team member communicating effectively in technical environment using modern tools.

5. Recognize the need for and possess the ability to engage in lifelong learning and will be sensitive to consequences of their work both ethically and professionally for productive professional career.

Programme Outcomes (POs):

Graduates of the M. Sc. (Electronics) program are expected to -

PO1. **The citizenship and society:** Apply broad understanding of ethical and professional skill in electronics technology in the context of global, economic, environmental and societal realities while encompassing relevant contemporary issues.

PO2. **Environment and sustainability**: Apply broad understanding of impact of electronics technology in a global, economic, environmental and societal context and demonstrate the knowledge of, and need for sustainable development.

PO3. **Ethics:** Apply ability to develop sustainable practical solutions for electronics technology related problems within positive professional and ethical boundaries.

PO4. **Individual and team work:** Function effectively as a leader and as well as team member in diverse/ multidisciplinary environments.

PO5. **Communication:** Communicate effectively on complex electronics technology related activities with the scientific community in particular and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO6. **Project management and finance**: Demonstrate knowledge and understanding of the first principles of electronics technology and apply these to one's own work as a member and leader in a team, to complete project in any environment.

PO7. **Life-long learning**: Recognize the need for lifelong learning and have the ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes:

PSO1. **Domain knowledge:** Apply the knowledge of electronics fundamental, Sensor Technology, and Semiconductor Devices to provide comprehensive solution of problems in complex electronics.

PSO2. **Problem Analysis:** Identify electronics related problems at varied complexity and analyze the same to formulate/ develop substantiated conclusion using first principles of Sensor Technology, Semiconductor Devices and scientific literature.

PSO3. **Design Development of solutions:** Design/ develop solutions for problems at varied complexity in the area Sensor Technology, and Semiconductor Devices to address changing challenges put forward by market demand/ stakeholder

PSO4. **Conduct Investigation of complex problems:** Use research-based knowledge and methods to design of experiments, analyze resulting data and interpret the same to provide valid conclusions.

PSO5. **Modern tools:** Create, select, and apply appropriate techniques, resources, and modern electronics and relevant IT tools including prediction and modeling to complex electronics technology related activities with clear understanding of the limitations

Course - Program outcome Matrix:

The Program Outcomes are developed through the curriculum (curricular/co-curricular-extra-curricular activities). The program outcomes are attained through the course implementation. As an educator, one must know, ***"to which POs his/her course in contributing?"*** So that one can design the learning experiences, select teaching method and design the tool for assessment. Hence, establishing the Course-PO matrix is essential step in the OBE. The course-program outcomes matrix indicates the co-relation between the courses and program outcomes. The CO-PO matrix is the map of list of courses contributing to the development of respective POs.

The CO-PO MATRIX is provided in the below table.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO 4	PSO5
DSC-1	√			√			√	√	√	√	√	√
DSC-3	√			√			√	√	√	√	√	√
DSC-5	√			√			√	√	√	√	√	√
DSC-7	√			√			√	√	√	√	√	√
DSE-1	√				√	√	√	√	√	√	√	√
DSC-2	√			√	√	√	√					
DSC-4	√			√	√	√	√					
DSC-6	√				√	√	√	√	√	√	√	√
RM-1	√				√	√	√	√	√	√	√	√
DSE-1	√											
DSC-8		√					√					
DSC-10		√		√			√	√	√	√	√	√
DSC-12		√		√			√	√	√	√	√	√

DSC-14		√		√			√	√	√	√	√	√
DSE-3		√		√			√	√	√	√	√	√
DSC-9		√		√			√	√	√	√	√	√
DSC-11		√			√	√	√	√	√	√	√	√
DSC-13		√			√	√	√	√	√	√	√	√
DSE-4		√			√	√	√	√	√	√	√	√
DSC-15			√	√			√	√	√	√	√	√
DSC-17			√	√			√	√	√	√	√	√
DSC-19			√	√			√	√	√	√	√	√
DSC-21			√	√			√	√	√	√	√	√
DSE-5			√	√			√	√	√	√	√	√
DSC-16			√	√			√	√	√	√	√	√
DSC-18	√	√	√		√	√	√	√	√	√	√	√
DSC-20	√	√	√		√	√	√	√	√	√	√	√
DSE-6	√	√	√		√	√	√	√	√	√	√	√
DSC-22		√		√	√	√	√	√	√	√	√	√
DSC-24		√		√			√	√	√	√	√	√
DSC-26		√		√			√	√	√	√	√	√
DSE-7		√			√	√	√	√	√	√	√	√
DSC-23		√			√	√	√	√	√	√	√	√
DSC-25	√	√	√		√	√	√	√	√	√	√	√
DSC-27	√	√	√		√	√	√	√	√	√	√	√

Target levels for Attainment of Course Outcomes:

The course outcome attainment is assessed in order to track the graduates' performance w.r.t target level of performance. The CO-PO attainment is the tool used for continuous improvement in the graduates' abilities through appropriate learning & teaching strategies. In order to assess students' performance with respect to abilities (at the end of course teaching/by the end of program) the course outcome attainment are measured/calculated. In order to calculate the program outcome attainment, the course outcome attainment is calculated. Prior to that, the course-program outcome mapping is done.

Target level for Attainment of Program Outcomes:

The program outcome attainment is assessed in order to track the graduates' performance w.r.t target level of performance. The CO-PO attainment is the tool used for continuous improvement in the graduates' abilities through appropriate learning and teaching strategies. In order to assess students' performance with respect to abilities (at the end of course teaching/by the end of program) the course outcome attainment and program outcome attainment is measured/calculated. The program outcome attainment is governed by curricular, co-curricular and extra-curricular activities including the stakeholders' participation. The direct method and indirect method is adopted to calculate the PO attainment. The direct method implies the attainment by course outcomes contributing to respective program outcomes. And indirect method is the satisfaction/feed-back survey of stakeholders. In order to calculate the program outcome attainment, the course outcome attainment is calculated. Prior to that, the course-program outcome mapping is done.

The set target level is the set benchmark to ensure the continuous improvements in the learners/ graduates' performance.

Course Attainment Levels:

a. CO attainment is defined/set at three levels;
b. The CO attainment is based on end term examination assessment and internal assessment;
c. The Co attainment is defined at three levels in ascending order-
    i. e.g. For end term and internal examination;
    ii. Level-1: 20% students scored more than class average
    iii. Level-2: 30% students score more than class average;
    iv. Level-3: 40% students score more than class average.
d. The target level is set (e.g. Level-2). It indicates that, the current target is level-2; 30% students score more than class average. The CO attainment is measured and the results are obtained. Based on the results of attainment, the corrective measures/remedial action are taken.
e. CO Attainment = 80% (Attainment level in end term examination) + 20% (Attainment level in internal examination).

Program attainment Level:

a. PO attainment is defined at five levels in ascending order;
b. The PO attainment is based on the average attainment level of corresponding courses (Direct Method) and feed-back survey (Indirect method);
c. The PO attainment levels are defined / set as stated below;
    i. Level-1: Greater than 0.5 and less than 1.0 (0.5>1) - Poor
    ii. Level-2: 1.0>1.5 - Average
    iii. Level-3: 1.5>2.0 - Good
    iv. Level-4: 2.0>2.5 - Very Good
    v. Level-5: 2.5>3.0 - Excellent
d. The PO attainment target level is set/defined (say, Level-4). It implies that, the department is aiming at minimum level-4 (very good) in the performance of abilities by the graduates. Based upon the results of attainment, the remedial measures are taken;
e. PO Attainment = 80% (Average attainment level by direct method) + 20% (Average attainment level by indirect method).

Examples of CO Attainment:

FOR EXAMPLE: COURSE CODE/TITLE: DSC-12

e.g. For end term and internal examination;

i. Level-1: 20% students scored more than class average
ii. Level-2: 30% students score more than class average;
iii. Level-3: 40% students score more than class average

Average of Total Marks in Examination: 61.00 % Students score more than 61 is 4/12 i.e. 33.33% i.e. Levl-2

A (CO) DSC-12 = 100(2)

= 2.00

Hence, the attainment level is Level-2 and the set target level is Level-2 and therefore the CO is fully attained.

Table No. 1.0: CO Attainment Level

Course Code	CO attainment Value	Attainment	Fully Attained/Not attained	Remedial measures
DSC-1	1	2	Not Attained	Assignment, tutorials, exercise and Remedial coaching.
DSC-3	2	2	Fully Attained	
DSC-5	1	2	Not Attained	Assignment, tutorials, exercise

				and Remedial coaching.
DSC-7	3	2	Fully Attained	
DSE-1	3	2	Fully Attained	
RM-1	2	2	Fully Attained	
DSC-8	0	2	Not Attained	Assignment, tutorials, exercise and Remedial coaching.
DSC-10	3	2	Fully Attained	
DSC-12	3	2	Fully Attained	
DSC-14	1	2	Not Attained	Assignment, tutorials, exercise and Remedial coaching.
DSE-3	3	2	Fully Attained	
DSC-15	2	2	Fully Attained	
DSC-17	3	2	Fully Attained	
DSC-19	0	2	Not Attained	Assignment, tutorials, exercise and Remedial coaching.

Example of PO Attainment:

The attainment of PO will have to be calculated after declaration of IInd year result every year.

Table No. 2.0 PO Attainment Level

PO/PSO number	Description of PO/PSO	Attainment level	Target level	Fully attained/ Not Attained	Remedial Measures

i) Planned Actions for Course Attainment:

ii) Planned Actions for Program Outcome Attainment:

After calculating attainment of COs and POs, gap needs to be identified and a comprehensive plan needs to be prepared for bridging the gaps.

Eligibility:

Candidates seeking admission to the first Semester of M. Sc. in Electronics must possess following eligibility criteria.

- Must have passed B. Sc., (10 + 2 + 3) degree with Electronics OR Physics as one of the optional subjects OR have passed B. Sc. (Hons.) with electronics OR Physics.

  OR

- Must have passed B. Voc degree with Industrial Automation

  OR

- Must have passed B. E. / B. Tech with Electronics & Telecommunication Engineering / Electronics Engineering / Instrumentation Engineering

Course Fees:

As per University norms

Number of Seats:__ _____

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

There is Full Carry on for M. Sc i.e. **irrespective** of individual performance in first year; a student will be promoted to Second Year. However, for obtaining M. Sc. Degree, a student will have to complete all semesters successfully within 4 years/08 semesters. It also offers multiple exit/entry. Students can exit after completion of one year and can enter into the system (second year) with 5 years from the date of first time registration.

Dropout students will be allowed to register for respective semester as and when the concerned courses are offered by the department, **HOWEVER HE / SHE SHOULD NOT EXCEED MORE THAN TWICE THE DURATION OF THE COURSE FROM THE DATE OF FIRST REGISTRATION AT PARENT DEPARTMENT / COLLEGE.** The admission of the concern student will be automatically cancelled if he / she fail to complete the M. Sc. degree within a period of maximum four years / eight semesters.

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. Students will have to earn 88 credits for the award of two years Master of Science (M. Sc.)

Credit-to-contact hour Mapping:

(a) One Credit would mean equivalent of 15 periods of 60 minutes each for theory lecture.

(b) For lab course/ workshops/internship/field work/project, the credit weightage for equivalent hours shall be 50% that for lectures /workshop

(c) For self-learning, based on e-content or otherwise, the credit weightage for equivalent hours of study should be 50% or less of that for lectures/workshops.

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 assessment test (CAT)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:

- The assessment will be based on **40:60 ratio** of **continuous assessment test (CAT) and end semester examination. Separate and independent passing in continuous assessment test (CAT) and end semester examination will be mandatory**. In case of failure in CAT of a particular course, students will have to appear for the same CAT, at his/her own responsibility in the next academic year, when the same course is offered during regular academic session. However, in case of failure in **end semester examination** in particular course(s), exam will be conducted in immediate subsequent semester.

- In case a student fails in certain course(s) in a particular semester and the same course(s) are modified/ revised/ removed from the curriculum in due course, the student will have to appear as per the newly framed curriculum and/or pattern in subsequent semester, at his/her own responsibility.

Continuous Assessment Test (CAT):

Three CAT, each of 20 marks would be conducted at different phases (25 %, 50 % and 75 % of completion of syllabus OR 25, 50 and 75 working days out 90 working days of the semester) throughout the semester. Each concurrent assessment (CAT-I, II, III) will be mapped to the course learning outcomes. Total performance in CAT (i.e. 40 %) would be based on best two out of three CAT examination. Course teacher will have liberty to choose from variety of assessment tools/ methods (class test, assignment,, tutorial, seminar, case study, field work, project work, quiz) which may be deemed to appropriate for assessing the relevant course outcome.

End Semester Examination:

- The question paper of end semester examination must be designed to test all levels of cognitive domain and should include all types questions- essay, short, quantitative problems/ numerical, MCQs etc.The end semester theory examination for each theory course will be of 60 marks. The total marks shall be 100 for 4 credit theory course (60 marks end semester examination + 40 marks CAT) and 50 for 2 credit theory course (30 marks end semester examination + 20 marks CAT)

- End Semester examination time table will be declared by the University (as per the university annual calendar).

- Pattern of semester end examination question paper will be as below:
    - The end semester examination of theory course will have two parts (20 + 40 = 60 Marks)
    - Part A will be consisting of 10 questions having 2 marks each (multiple choice questions / fill in the blanks/ answer in sentence) as compulsory questions and it should cover entire course curriculum (20 Marks)
    - Part B will carry 6 questions (10 marks for each question) (02 questions from each of 03 units) and students will have to attempt any 04 questions out of 06 (40 Marks).

- 20 to 30% weightage can be given to problems/ numerical wherein use of non-programmable scientific calculator may be allowed.
- Number of sub questions (with allotment of marks) in a question may be decided by the examiner.

Earning Credits:

At the end of every semester, a letter grade will be awarded in each course for which a student had registered. A student's performance will be measured by the number of credits that he/she earned by the weighted Grade Point Average (GPA). The SGPA (Semester Grade Point Average) will be awarded after completion of respective semester and the CGPA (Cumulative Grade Point Average) will be awarded at the final exit.

Grading System:

- The grading reflects a student-own proficiency in the course. A ten point rating scale shall be used for the evaluation of the performance of the students to provide letter grade for each course and overall grade for the Master Programme. Grade points are based on the total number of marks obtained by him / her in all heads of the examination of the course. The grade points and their equivalent range of marks are shown in Table-I

Table – I: Ten point grade and grade description

Marks Obtained (%)	Grade Point (GPA/CGPA)	Letter Grade	Description
90-100	9.00- 10	O	Outstanding
80-89	8.00-8.99	A^+	Excellent
70-79	7.00-7.99	A	Very Good
60-69	6.00-6.99	B^+	Good
55-59	5.50-5.99	B	Above Average
50-54	5.00-5.49	C	Average
40-49	4.00-4.99	P	Pass
Below 40	Below 4.0	F	Fail
Absent	Absent	Ab	Absent

- Non-appearance in any examination / assessment shall be treated as the students have secured zero marks in that subject examination / assessment.
- Minimum P grade (4.00 grade points) shall be the limit to clear / pass the course / subject. A student with F grade will be considered as "failed" in the concerned course and he / she has to clear the course by appearing in the next successive semester examinations.
- Every student shall be awarded grade points out of maximum 10 points in each subject (based on 10 point scale). Based on the grade points obtained in each subject, Semester Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) shall be computed. Results will be announced at the end of each semester and CGPA will be given at final exit.

Computation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average)

Grade in each subject / course will be calculated based on the summation of marks obtained in all five modules.

The computation of SGPA and CGPA will be as below

- Semester Grade Point Average (SGPA) is the weighted average points obtained by the students in a semester and will be computed as follows

$$SGPA = \frac{\text{Sum (Course Credits) X Number of Grade Points in concerned Course Gained by the Student}}{\text{Sum (Course Credits)}}$$

The SGPA will be mentioned on the grade card at the end of every semester.

- The Cumulative Grade Point Average (CGPA) will be used to describe the overall performance of a student in all semester of the course and will be computed as under.

$$CGPA = \frac{\text{Sum (All four Semester SGPA)}}{\text{Total Number of Semester}}$$

The SGPA and CGPA shall be rounded off to the second place of decimal.

Grade Card

Results will be declared by the Centre and the grade card (containing the grades obtained by the student along with SGPA) will be issued by the university after completion of every semester. The grade card will be consisting of following details.

- Title of the courses along with code opted by the student.
- Credits associated with the course.
- Grades and grade points secured by the student.
- Total credits earned by the student in a particular semester.
- Total credits earned by the students till that semester.
- SGPA of the student.
- CGPA of the student (at final exit).

Cumulative Grade Card

The grade card showing detail grades secured by the student in each subject in all semesters along with overall CGPA will be issued by the University at final exit.

Semester – I

Course Name: Electronics Devices

Course Code: ELET/MJ/507, Course Type: MJ,

Contact Hours: 30, Credits: 02, Hours/Week: 02, Max. Marks: 50

Course Objectives:

1. To introduce students to operation of FET, MOSFET, Op-amps, oscillators and converters
2. TO make them understand biasing and amplification as well as linear and non-linear applications of Op-amp
3. To enable students to design and construct filters and converters

Course Outcomes:

After completion of the course students will be able to –

1. Apply the basic concepts in Analog electronics to solve the complex problems in electronic circuits
2. Analyse datasheets and circuit diagrams and identify circuits locks such as Op-amps Amplifiers filters
3. Design an electronic circuits using Op-amp and FET's
4. Design and develop a low cost prototype electronic circuit to address frequently occurring issues in Industries

Course Contents:

Unit – I: Field Effect Transistors (Biasing and Amplifiers) (10 Hrs.)

Introduction to FET biasing, Biasing configuration (Fixed Bias, Self-bias, Voltage divider bias, Common gate bias), D & E type MOSFET biasing, combination networks, universal J-FET bias curve, application

Introduction to FET amplifier, JFET small signal model, various configuration, (Fixed bias, self-bias, Voltage Divider, Common gate, Common drain), D & E type MOSFET, Voltage Divider configuration of D & E type MOSFET, Designing FET amplifier network, Application.

Unit – II: Special Operational Amplifier, OP-AMP Application and Non-linear Function (10 Hrs.)

Circuits

High Voltage/high current amplifiers, chopper and choppers stabilized amplifier, instrumentation amplifier, isolation amplifier, bridge amplifier, Application.

Op-Amp application – DC voltmeters, V-I converter with floating load, LED Tester, Furnishing constant current to grounded load, short current measurement and I-V Conversion, Measurement of photoconductor current, current amplifier, Phase shifter, temperature to voltage converter

Nonlinear function circuit: limiters, log/anti-log multiplier/divider, peak detector, comparator Zero crossing detector with hysteresis, voltage level detector with hysteresis, On-OFF control, voltage level detector with independent adjustment of hysteresis, set-point controller, window detector), true RM/DC converter.

Unit – III: Oscillators, Signal Generator, Timers, Counters **(10 Hrs.)**

Sinusoidal and relaxation oscillators: phase shift oscillator, Ring oscillator, Wien-bridge oscillator, quadrature oscillator, crystal oscillator and clock circuits, voltage controlled oscillators – sine, square and triangle, frequency synthesizers, Application, Concept of free running and one shot configuration, triangular wave generator, saw tooth wave generator, balanced modulator/demodulator, Universal trigonometric function generator (AD639), Precision sine/square wave generator, application, Timing and counting circuits: digital counters, shift register, analog and digital timers, frequency counters, PLA and PLD applications.

References:

1. Sende, B. S. – Introduction to System design using Integrated Circuits, New Age International (P), New Delhi.
2. Fitchen, F. C. – Integrated Circuits and Systems, Van Nostrand, New York.
3. Robert S. Coughlin, Frederick F. Driscoll- Operational Amplifiers and Linear Integrated Circuits; Prentice Hall of India, New Delhi
4. Ramakant A Gaikwad; 2000; OP-AMP and Liner Integrated Circuits (Fourth Edition); PHI Learning PVT LTD; Delhi (India)
5. Boylestad R. L., Nashelsky L. – Electronic Devices and Circuit Theory, Pearson Education, New Delhi

Course Name: Industrial Electronics

Course Code: ELET/MJ/508, Course Type: MJ,

Contact Hours: 30, Credits: 02, Hours/Week: 02, Max. Marks: 50

Course Objectives:

1. To introduce students to power electronics components
2. To understand them the operating characteristics of these power devices
3. To enable students to design triggering ON-OFF circuits

Course Outcomes:

After completion of the course students will be able to –

a) Apply principles of SCR, Power MOSFET, IGBT, and UJT for various Industrial applications.
b) Design a single phase, three phase full wave and half wave rectifier circuits.
c) Analyse the complex problems in power electronic circuits providing solution to problem.
d) Develop a prototype based power electronic circuits showing the best solution towards a particular problem.

Course Contents:

Unit – I: Thyristor and related power Devices **(10 Hrs.)**

Thyristor fundamentals, Structure of thyristor, Principal of operation of SCR, Static anode cathode characteristics, Gate circuit parameter, Turn-On method of thyristor, Dynamic turn on switching characteristics, turn-off mechanism, TRIAC:the triac, triac firing circuit, Power MOSFET:Introduction, MOSFET characteristics, comparison of MOSFET with BJT.Insulated gate bipolar transistor (IGBT):Basic structure and working, IGBT characteristics, switching characteristics.Unijunction transistor: Introduction, UJT relaxation oscillator. Programmable UJT: Introduction, PUT relaxation oscillator.

Unit – II: Gate Triggering Circuits **(10 Hrs.)**

Introduction, firing of thyristor, pulse transformer, optical isolator, gate triggering circuit, resistance firing circuit, resistance capacitance firing circuit, resistance capacitor full-wave trigger circuit, UJT as an SCR trigger, synchronized triggering (ramp triggering), Phase controlled using pedestal and ramp triggering.

Unit – III: Phase Controlled Rectifiers **(10 Hrs.)**

Introduction,Phase angle control, Single phase half wave controlled rectifier with Resistive load, with inductive load,Effect of freewheeling diode.

Single phase half wave controlled rectifier: with Resistive load, with inductive load, Effect of freewheeling diode. Fully controlled bridge rectifier:with Resistive load, with resistive inductive load. With Resistive load, with inductive load,Effect of freewheeling diode

References:

1. Power Electronics – M. D. Singh, K. Khanchandani, (TMH) 2004, ISBN0-07463369-4
2. Power Electronics, M. S. Jamil Asghar, PHI, 2006, ISBN: 81-203-23963.
3. Principles of Electronics- V. K. Mehta, Rohit Mehta; S. Chand and company Ltd. 2012 ISBN: 81-219-2450-2.
4. Power Electronics – Dr. P. S. Bhimbra, Khanna Publishers, Fifth Edition, 2014 Reprint, New Delhi
5. Electrical circuit and Basic Semiconductor Electronics, Pragati Prakashan Meerut, 2010, ISBN: 978-93-5006-302-6
6. Industrial Electronics, S. N.Biswas, Dhanpatirai and Sons, 1996.

Course Name: Sensor Fundamentals

Course Code: ELET/MJ/509, Course Type: MJ,

Contact Hours: 30, Credits: 02, Hours/Week: 02, Max. Marks: 50

Course Objectives:

1. To facilitate the students to understand
   a) the concepts of sensor
   b) the concept of different principles of sensors
2. To provide an opportunity to the students to enter into sensor research
3. To create enthusiasm among the students to undertake research in sensors

Course Outcome:

Students will be able to -

1. understand and explain Sensors, characteristics of sensors, optical fiber and optical sensors.
2. analyze the system based on sensor and actuators.
3. design and develop sensor devices
4. Students will be capable to undertake research in Sensors.

Course Contents:

Unit - I: Introduction **(10 Hrs.)**

Sensors and Sensor Science, Sensors – Eyes and Ears of Machines, The Term 'Sensor', Optical Sensors, Physical Sensors, Chemical Sensors, elements of chemical sensors, **Sensor Physics**, Solids, Energy Band Model, Lattice Defects, Ionic Conductance, Hopping,Junctions and Potential Barriers, **Primary electronics for sensors :** Amplification by Operational Amplifier, Instruments for electric measurements.

Unit - II: Sensors and Sensor Characteristics **(10 Hrs.)**

Sensors, Signals, and Systems; Ideal sensor curve, ideal sensor requisite, Sensor Classifications; **Sensor Characteristics**: Transfer Function; Span (Full-Scale Input); Full-Scale Output; Accuracy; Calibration; Calibration Error; Hysteresis; Nonlinearity; Saturation ; Repeatability; Dead Band; Resolution; **Parameters of sensors**: Sensitivity, detection limit, response and recovery time, selectivity, dynamic range, linearity, stability

Unit - III: Optical Sensors **(10 Hrs.)**

Introduction of light detectors: Photodiodes, Phototransistor, Photoresistors; photovoltaic cell, Optical waveguides and fibres, types of optical fibers: single mode, multimode and graded index optical fiber, concept of TIR and ATR, Optical fibre sensors: Introduction and classification of sensors with optical

fibres, Optical fibre sensors with amplitude modulation, Sensor with wavelength modulation; Optical chemical sensors: Introduction, Optical sensors: Methods of detection, Evanescent wave sensors.

References:

1. Chemical Sensors: An Introduction for Scientists and Engineers : Grundler, Peter; Springer Berlin Heidelberg New York **(2007),** ISBN 978-3-540-45742-8
2. Modern Sensors Handbook, Editedby Pavel Ripka and AloisTipek; ISTE Ltd, USA **(2007),** ISBN 978-1-905209-66-8.
3. Handbook of Chemical and Biological Sensors; Edited by Richard F Taylor, Arthur D Little Inc., Jerome S Schultz, University of Pittsburgh ; Institute of Physics Publishing Bristol and Philadelphia; **(1996)** ISBN 0 7503 0323 9
4. Hand Book of Modern Sensors : Physics, Designs and Applications By Jacob Fraden Third Edition (Springer-Verlag New York, Inc.) **(2004),** ISBN 0-387-00750-4.
5. Understanding Smart Sensors By Randy Frank; Second Edition; Artech House Boston . London **(2000),**ISBN 1-58053-398-1.
6. Sensors and Transducers, Third Edition By Ian R. Sinclair; Butterworth-Heinemann publication, Woburn **(2001),** ISBN 0 7506 4932 1
7. Principles of Chemical Sensors : Janata, Jiri 2nd Edition ; Springer Dordrecht Heidelberg London, New York **(2009),** ISBN 978-0-387-69930-1 e-ISBN 978-0-387-69931-8
8. Optoelectronics Devices and System SECOND EDITION by S. C. Gupta; Prentice Hall International**(2011)** ISBN: 978-81-203-5065-6
9. Optical Fibers and fiber optic communication Systems by Subir Kumar Sarkar; S Chand & Company Ltd **(2000),** ISBN:9788121914598
10. Lasers and Optical Fiber Communications by P Sarah; I.K. International Publishing House Pvt Ltd, New Delhi **(2008),** ISBN : 9788189866587 / 8189866583
11. Optoelectronics by R. A. Barapate (Tech-Max Publication) **(2003)**

Course Name: Network Analysis and Synthesis

Course Code: ELET/MJ/510, Course Type: MJ,

Contact Hours: 30, Credits: 02, Hours/Week: 02, Max. Marks: 50

Course Objectives:

To equip the students with rigorous theoretical and practical knowledge to analyse and synthesize networks.

Course Outcomes:

- Apply the knowledge of basic circuital law and simplify the network using reduction technique.
- Analyze the circuit using Kirchoff's law and network theorem.
- Infer and evaluate transient response, steady state response, network functions.
- Equip with network synthesis study.

Course Contents:

Unit - I: Network Theorems **(10 Hrs.)**

Applications of Thevenin and Norton's theorem, Reciprocity theorem, Compensation theorem, Superposition theorem &Tellegen's theorem.

Unit - II: Time Domain Analysis of Networks **(10 Hrs.)**

Differential equation approach (first and higher order differential equations), initial conditions in networks, Laplace Transformation: Introduction to the Laplace transform approach, partial fraction expansion, Heaviside's expansion theorem, transform impedance and transform circuits, network functions.

Unit - III: Two Port Network Parameters **(10 Hrs.)**

Transmission and inverse transmission parameters, hybrid and inverse hybrid parameters, relation between parameter sets, and interconnection of two port network, Graph Theory: graph tree, link branches, basic tie and cut set, matrices for planar networks.

References:

1. M. E. Van Valkenburg, "Network Analysis", 3rd ed., Pearson.
2. M. E. Van Valkenburg, "Network Synthesis", PHI.
3. DeCarlo, R. A. and Lin, P. M., "Linear Circuit Analysis: Time Domain, Phasor and Laplace Transform Approaches", Oxford University Press.
4. Hayt, Kemmerley and Durbin, "Engineering Circuit Analysis", 8th Ed. Tata McGraw-Hill.
5. Kuo, F. F., "Network Analysis and Synthesis", 2nd Ed., Wiley India.

Course Name: Principle of Digital electronics and Circuits

Course Code: ELET/DSE/511, Course Type: DSE,

Contact Hours: 30, Credits: 02, Hours/Week: 02, Max. Marks: 50

Course Objectives:

1. To understand principle of digital electronics.
2. To introduces student to logic gates, flip-flops and Registers.
3. To enable student to design circuits using digital components.

Course outcome:

After completion of the course students will be able to –

a. Apply the principal of logic gates to design digital circuits.
b. Able to design memory device using flip-flops.
c. Able to undusted computer systems.

Course Content:

Unit – I: Digital Principles and Digital Logic **(10 Hrs.)**

Introduction, **Definitions for Digital:**Analog versus Digital Signals,Binary System,Ideal Digital Signals, **Digital Waveforms:** Voltage levels, Switching Time,Period and Frequency, Duty Cycle, Problems, **Digital logic:** Generating Logic Levels, The Buffer, The Tri-State Buffer, The Inverter (NOT Gate), The Tri-state Inverter, The AND Gate, The OR Gate.

The Basic Gates-NOT, OR, AND: The Inverter (NOT Gate), AND Gate with Timing Diagram, TTL AND Gate, OR Gate with Timing Diagram, TTL OR Gate, Boolean equation, Problems, **Universal Logic Gates**: NOR Gates, bubbled AND Gate, De Morgan's First Theorem, Universality of NOR Gate, Eye of the Beholder, NAND Gates, Bubbled OR Gate, De Morgan's Second Theorem, Universality of NAND Gate.

Unit – II: Flip-Flops and Registers **(10 Hrs.)**

RSFlip-Flops: NOR-Gate latch, NANO-Gate latch, **Gated Flip-Flops:** Clocked RS Flip-Flops, Clocked D Flip-Flops, **Edge-Triggered RSFlip-Flops:** Positive-Edge-Triggered RS Flip-flops, Negative-Edge-Triggered RS Flip-Flops, **Edge-Triggered DFlip-Flops, Edge-Triggered JKFlip-Flops, JK Master-Slave Flip-Flops.**

Types Of Registers: Serial in-serial out, Serial In - Parallel Out, Parallel In - Serial Out, Parallel In-Parallel Out, **Universal Shift Register and Applications:** Ring Counter, Johnson Counter.

Unit - III: Digital Computers and A Simple Computer Design **(10hr)**

Moving And Storing Digital Information: Memory Elements, Registers, Transferring Digital Data, Magnetic and Optical Memory, Solid state memory, **Arithmetic logic Unit:** Addition and Subtraction, Logic Functions, **Input/Output, Building Blocks of Computer:** Memory, Register Array, Important Hardware, Register Transfer Language, **Execution of Instructions, Macro and Micro Operations:** Instruction Cycles, Fetch Cycle, Decode Cycle, Execute Cycle.

References:

1. Digital Principles and Applications: Malvino Leach, Tata McGraw-Hill.
2. Digital Electronics: Jain R.P., Tata McGraw Hill.
3. Digital Fundamentals: Floyd T.M., Jain R.P., Pearson Education

Course Name: Control System

Course Code: ELET/DSE/512, Course Type: DSE,

Contact Hours: 30, Credits: 02, Hours/Week: 02, Max. Marks: 50

Course Objectives:

1. To introduce students to the classifications of control system, controllers and complex modes of operation
2. To make students understand the advantages and limitations of various types of controlsystems

Course Outcomes:

1. Acquire terminologies in controlsystem.
2. Design Control system by block diagram & Signal flowgraph.
3. Estimate the stability of controlsystem.
4. Apply different tuning method according to controloperation.

Course Contents:

Unit - I: Element of control system (10 Hrs.)

Classification of control System, operational amplifier as error detector, servomechanism, Transfer function and impulse response function, Automatic control system. Block Diagram algebra; block diagram fundamentals, Canonical or simple form of control system, Block Diagram reduction rules. Signal flow graphs; signal flow graphs terms, properties of SFG, Mason's gain equation, use of mason's gain formula for electrical network.

Unit - II: ControlSystem analysis (10Hrs.)

Transient and steady-state response analysis; first order system, second order system & higher order system. Routh's stability criterion, Root locus plots, Lead compensation & lag compensation, lead-lag compensation, Bode diagrams, Nyquist stability criterion.

Unit - III: Mathematical modelling ofcontrol system (10Hrs.)

Mathematical modeling of control system; Mechanical system, Electrical system, liquid level system, pneumatic system, Hydraulic system, Thermal system. Interacting and non interacting system; Step response of single capacity system, Step response of first order systems arranged in non-interacting mode, impulse response of first order systems arranged in non-interacting mode, Step response of first order systems arranged in interacting mode, Impulse response of first order systems arranged in interacting mode.

References:

Text:

1. Katsuhiko Ogata; 2010; Modern Control Engineering (Fifth Edition); PHI Learning PVT LTD; Delhi (India)
2. Bela G. Liptak; Process control (Third Edition), Instrument Engineer'sHandbook.
3. FaridGolnaraghi, Benjamin c. Kuo; 2009; automatic control system; John Wiley & sons, inc.
4. Interacting and non-interacting system;https://www.apexinnovations.co.in.
5. N. Barapate; 2006; Control System; Tech Max publications; Pune(India)

Suggested Reading:

1. I. J. Nagrath, M. Gopal; 2009; Control Systems Engineering (Fifth Edition); New Age International Publishers;India
2. Norman S. Nise; 2004;Control system engineering(Fourth edition);Wileyinternational edition
3. A. Nagoorkani; 2006; Control System; RBA publications; Chennai(India)
4. K. Ogata; 2002; Modern Control Engineering; Prentice Hall; NewDelhi(India)
5. Richard Dorf , Robert Bishop; 2005; Modern Control System; Pearson Education ; New Jersey

Course Name: Research Methodology

(Review of Literature for Research Project and Formulation of Topic)

Course Code: RM (ELET/RM/547), Course Type: RM,

Contact Hours: 60, Credits: 04, Hours/Week: 04, Max. Marks: 100

Course Objectives:

1. To define research and describe the research process and research methods
2. To understand qualitative research and methods used to execute and validate qualitative research
3. To know how to apply the basic aspects of the research process in order to plan and execute a research project.
4. To provide insight into the processes that lead to the publishing of research.
5. To be able to present, review and publish scientific articles

Course Outcomes:

Students will be able to -

1. understand and explain research process
2. do systematic literature survey, formulation of a research topic, study design, analysis and interpretation of data.
3. to design a research approach for a specific research issue of their choice.
4. select a suitable analytical method for a specific research approach.
5. demonstrate a good understanding of how to write a research report.
6. critically assess published quantitative research with regard to the statistical methods and approaches adopted
7. create a research document for implementation research project

Course Contents:

Part – 1 (02 credit : 30 Contact Hours)

Unit - I: Research Fundamentals and Identification of Research Problem: (10 Hrs.)

Research Fundamentals

Introduction: Definition, objectives of the research, characteristics of the research, what makes people to do research, importance of research, Qualitative and Quantitative Research: Qualitative research - Quantitative research - Concept of measurement, causality, generalization, and replication. Merging the two approaches.

Identification of Research Problem

Defining the research problem: Identification of research problems, selection of research problem, facts one should know regarding selection of research problem, the process of research problem definition, some facts involved in defining research problem, Research Design: Concept and Importance in Research - Features of a good research design - Exploratory Research Design - concept, types and uses, Descriptive Research Designs - concept, types and uses. Experimental Design: Concept of Independent & Dependent variables, Case Studies,

Unit- II: Formulation of Research Problem **(10 Hrs.)**

Formulation of the problems: steps involved in defining a problem, formulation of the problems, Formulation of hypothesis: Concept of hypothesis, hypothesis testing, developing the research plan: implementation, interpreting and reporting the findings, Importance of hypothesis in decision making, Case Studies. Interpretation of Data. Measurement: Concept of measurement- what is measured? Problems in measurement in research- Validity and Reliability. Levels of measurementNominal, Ordinal, Interval, Ratio.

Unit – III : Research Report and Proposal Writing **(10 Hrs.)**

Introduction, research proposal writing: costing, the research proposal, rationale for the study, research objectives, research methodology, target respondents, research Centres, sample size and sample composition, sampling procedures, research project execution, research units; An insight into research report and proposal, research project synopsis, research report writing : types of research reports, guidelines for writing reports; Steps in writing report, report presentation, typing the report, documentation and bibliography, formatting guidelines for writing a good research report / research paper, Paper Writing- Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism.Case Studies.

Part – 2 (02 credit : 30 Contact Hours)

Presentations, case studies, Assignments, Tutorials based on Module I to III **(30 Hrs.)**

Students are expected to do the Followings

i) Select Broad topic of Research Project (to be implemented from second semester onwards)
ii) Read the Basic concepts / fundaments of broad topic
iii) Identify 10 SCOPUS / WEB OF SCIENCE Indexed Journals related to broad topic
iv) Search and download 20 research articles from above research Journals
v) Do systematic review of above 20 research articles
vi) While doing review of each of above mentioned 20 research articles, students are expected prepare notes on following points
   a) What are the objectives of the research article?
   b) What methodology has been adopted?

c) What are prominent results?
d) How these results of relevant to the latest development of the subject?
e) What is novelty of research article?
f) What are prominent shortcomings of this research a presented in this research article?
g) What are your plans to address those shortcoming?

vii) Draft the fine-tuned title of research project
viii) Draft hypothesis
ix) Draft Objectives and Methodology
x) Draft expected outcome of the research project

At the end of the assignment, students are expected to prepare a report having following points

i) Fine-tuned title of Research Project
ii) Fundamental aspects of the fine-tuned research topic
iii) Hypothesis
iv) Objectives
v) Methodology
vi) Detailed Experimental plan
vii) Expected outcome
viii) References

References:

1. Research Methodology by Dr. S. L. Gupta, Hitesh Gupta; International Book House Pvt Ltd **(2013),** ISBN-10: 8191064278, ISBN-13: 978-8191064278
2. Basic Research Methods-Gerard Guthrie SAGE Publications, India, Pvt Ltd, New Delhi (**2010),** ISBN-10: 8132104579, ISBN-13: 978-8132104575
3. Research Methodology-methods and techniques By C. R. Kothari, New Age International Publishers **(2011)** ISBN 978-81-224-1522-3
4. Principles of Research Methodology- Phyllis G. Supino, Jeffrey S. Borer; Springer, Verlag New York **(2012),** ISBN-ebook: 1461433592, ISBN (Hardcover): 978-1461433590
5. Research Design Qualitative, Quantitative. and Mixed Methods Approaches- John W. Creswell; SAGE Publications Ltd, UK **(2011),** ISBN-9780857023452
6. Research Methodology -A Step-by-Step Guide for Beginners- Ranjit Kumar; Sage Publications Ltd**(2010)**, ISBN- 1849203016.
7. Scientific Writing and Communication- Angelika Hofmann; Oxford University Press, US **(2010),** ISBN-13-: 978-0 199947560, ISBN-10: 01 99947562
8. Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded-Joshua Schimel, Oxford University Press, **(2011),** ISBN: 9780199760237
9. Handbook of Scientific Proposal Writing- A.YavuzOruc; CRC Press, Taylor & Francis group **(2011),** ISBN: 9781439869185

Course Name: Practical based on ELET/MJ/507

Course Code: ELEP/MJ/531, Course Type: DSE,

Contact Hours: 60, Credits: 02, Hours/Week: 04, Max. Marks: 50

List of Experiments:

1. Study of Instrumentation amplifier
2. Study of window comparator
3. Study of Phase shift/ Wien bridge oscillator
4. Study of voltage controlled oscillator
5. Study of typical monolithic frequency synthesizer
6. Study of PLI
7. Study of digital counters (any two types, pertinent to topic taught in theory)
8. Study of I-V and V-I converter
9. Study of comparator Zero crossing with hysteresis

(Student should complete at least 06 experiments)

Course Name: Practical based on ELET/MJ/508

Course Code: ELEP/MJ/532, Course Type: DSE,

Contact Hours: 60, Credits: 02, Hours/Week: 04, Max. Marks: 50

List of Experiments:

1. Study of DC characteristics of SCR.
2. Study of firing circuits for SCR (any one type)
3. Study of DIAC
4. Study of TRIAC
5. Study of effect of variation of RC in R and RC triggering circuit on firing angle and output voltage of SCR
6. Study of the output waveform of single phase full wave controller rectifier with R and RL load, freewheel diode and measure load voltage
7. Study of effect of firing angle on output voltage in DIAC – TRIAC phase controlled
8. Study of Step UP chopper (with SCR/MOSFET/Transistor)
9. Study of Step down chopper (with SCR/MOSFET/Transistor)

(Student should complete at least 06experiments)

Course Name: Practical based on ELET/MJ/509

Course Code: ELEP/MJ/533, Course Type: DSE,

Contact Hours: 60, Credits: 02, Hours/Week: 04, Max. Marks: 50

List of experiments:

1. Determination of Numerical Aperture of PMMA optical fiber
2. Losses in Optical fiber.
3. Study of Optical to Electrical (O-E) characteristics of fiber optic Phototransistor converter.
4. Study of Electrical to Optical (E-O) characteristics of fiber optic 660nm an 850nm converter.
5. Optical fiber chemical sensor.
6. Study of Potentiometric sensor
7. Study of Displacement sensor
8. Gas sensor based on OCP (organic Conducting Polymers)
9. Gas Sensor based on Single Walled carbon nanotubes (SWNTs)
10. Study of LVDT as displacement Sensor
11. Study of Hall Effect sensor as an event counter

(Student should complete at least 06experiments)

Course Name: Practical based on ELET/DSE/511

Course Code: ELEP/DSE/534, Course Type: DSE,

Contact Hours: 60, Credits: 02, Hours/Week: 04, Max. Marks: 50

1. Introduction to Digital Laboratory Equipment & IC"s
2. Verification of the truth tables of TTL gates.
3. Verify the universal logic gates.
4. Design and test of an S-R flip-flop using NOR/NAND gates.
5. Verify the truth table of a J-K flip-flop (7476).
6. Verify the truth table of a D flip-flop (7474).
7. Design of 4-bit shift register (shift right).
8. Designing and verification of MOD counters

(Student should complete at least 06 experiments)

Course Name: Practical based on ELET/DSE/512

Course Code: ELEP/DSE/535, Course Type: DSE,

Contact Hours: 60, Credits: 02, Hours/Week: 04, Max. Marks: 50

1. Study of open loop system
2. Study of close loop system
3. Design a signal conditioning circuit for analog controller
4. Problem solving using root locus method
5. Study of lead compensator
6. Study of lag compensator
7. Study of lead-lag compensator
8. Study of Bode and Nyquist plot to determine loop system stability
9. Study of close loop control with PID controller
10. Study of PID controller tunning using Ziegler Nichols method

(Student should complete at least 06 experiments)

3/8/2023