RAJEEV GANDHI GOVT. POST GRADUATE COLLEGE, AMBIKAPUR, SURGUJA (CG), INDIA

Learning Outcomes based Curriculum Framework

FOR

FOUR YEAR UNDERGRADUATE PROGRAMME IN ELECTRONICS

UNDER COICE BASED CREDIT SYSTEM (CBCS) PATTERN

SESSION 2022-2023

DEPARTMENT OF ELECTRONICS

VISION

The vision of the Electronics Department is to provide in proficiency both in depth understanding of principles and concept of Electronics, theoretical and experimental Electronics. The Department aims to enhance the students' knowledge in basic and applied electronics. To inculcate aptitude for a research career in academia or industry by introducing advanced ideas and techniques that are applicable while emphasizing the underlying concepts of Electronics.

MISSION

- To impart quality education in Electronics such that they aim to become Scientists in reputed Research Organisations. To make the students effectively disseminate their knowledge in Electronics to coming generations..
- Develop the capacity and know -how to apply principles/laws of Electronics to solve the problems. The ability to do and interpret the data obtained in experiments. To become a center of excellence and extend research facilities.
- Apply the Electronics knowledge for sustainable development useful for society. Assume responsibility and always practice ethical principles. To function effectively as individual as well as in a team.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1	Professional Skill Development To provide professional training and skill development to students in physical sciences,related disciplines and nurture them to become responsible persons in the society.
PEO 2	Core Competency Development To augment their core-competencies and knowledge levels in science, humanities and inter- disciplinary areas by imparting education of high standards and advanced technological tools.
PEO 3	Innovative Curriculum of Global Relevance To upgrade the curriculum periodically based on scientific advancements, innovations andsocietal relevance, so as to cater to the shifting global demands.
PEO 4	Environmental Sensitivity and Sustainability To infuse environmental sensitivity in students through academic activities and hence equip them with technical skills and scientific knowledge required to protect and safeguard the environment for a sustainable future.
PEO 5	Ethical Principles and Holistic Development To promote ethical values and focus on the holistic development of students to becomeproficient, skilled, competent and socially responsible people.
PEO 6	Accessibility and Academic Excellence To provide an accessible learning environment of excellence and equal opportunity to students, enabling them to develop their creativity, critical thinking, and leadership and employability skills.

PROGRAMME OUTCOMES (POs)

PO 1	To understand concept and theory of their respective subject.
PO 2	To express thoughts and ideas effectively in writing and orally.
PO 3	To identify relationship within and across disciplines in thesciences.
PO 4	To cognitive and technical skills in their field and in multidisciplinary context.
PO 5	To select and use relevant methods and tools for problem
PO 6	To make judgment and take decisions based on analysis of data and evidence.
PO 7	To critically evaluate principles and theory of sciences.
PO 8	In digital literacy and data analysis.
PO 9	To find a job in their field, exercise responsibilities to jobassigned and start-
PO 10	To develop a sense of respect and duty towards constitutional,human and
PO 11	To mitigating the effects of environmental degradations, climate change and pollution.

Graduate attributes in Electronics

Some of the characteristic attributes of a graduate in Electronics are

- **Disciplinary knowledge and skills:** Capable of demonstrating

  (i) good knowledge and understanding of major concepts, theoretical principles and experimental findings in Electronics and its different subfields like Astroelectronics and Cosmology, Material science, Nuclear and Particle Electronics, Condensed matter Electronics, Atomic and Molecular Electronics, Mathematical Electronics, Analytical dynamics, Space science and other related fields of study, including broader interdisciplinary subfields like Chemistry, Mathematics, Life sciences, Environmental sciences, Atmospheric Electronics, Computer science, Information Technology etc.

  (ii) ability to use modern instrumentation and laboratory techniques to design and perform experiments is highly desirable in almost all the fields of Electronics listed above in (i).

- **Skilled communicator:** Ability to transmit complex technical information relating all areas in Electronics in a clear and concise manner in writing and oral ability to present complex and technical concepts in a simple language for better understanding.
- **Critical thinker and problem solver:** Ability to employ critical thinking and efficient problem solving skills in all the basic areas of Electronics.
- **Sense of inquiry:** Capability for asking relevant/appropriate questions relating to the issues and problems in the field of Electronics, and planning, executing and reporting the results of a theoretical or experimental investigation.
- **Team player/worker**: Capable of working effectively in diverse teams in both classroom, laboratory, Electronics workshop and in industry and field-based situations.
- **Skilled project manager:** Capable of identifying/mobilizing appropriate resources required for a project, and manage a project through to completion, while observing responsible and ethical scientific conduct; and safety and laboratory hygiene regulations and practices.
- **Digitally Efficient*:*** Capable of using computers for simulation studies in Electronics and computation and appropriate software for numerical and statistical analysis of data, and employing modern e-library search tools like Inflibnet, various websites of the renowned Electronics labs in countries like the USA, Europe, Japan etc. to locate, retrieve, and evaluate Electronics information.
- **Ethical awareness / reasoning*:*** The graduate should be capable of demonstrating ability to think and analyze rationally with modern and scientific outlook and identify ethical issues related to one's work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights, and adopting objectives, unbiased and truthful actions in all aspects of work.

- **National and international perspective*:*** The graduates should be able to develop a national as well as international perspective for their career in the chosen field of the academic activities. They should prepare themselves during their most formative years for their appropriate role in contributing towards the national development and projecting our national priorities at the international level pertaining to their field of interest and future expertise.
- **Lifelong learners:** Capable of self-paced and self-directed learning aimed at personal development and for improving knowledge/skill development and reskilling in all areas of Electronics.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1	Acquire scientific temper leading to critical thinking and research motivation inPhysics and its allied areas.
PSO 2	Gain knowledge and the skills to measure some of the properties of solid materials andunderstand the underlying principles governing the dynamics of rigid bodies.
PSO 3	Appreciate the principles of optics, electricity and magnetism and their applications indaily life.
PSO 4	Design and construct electronic circuits with computer interfacing for sophisticatedanalysis of material behavior and properties.
PSO 5	Comprehend algebraic concepts and advanced mathematical tools involved in theinterpretation of various physical properties of materials.
PSO 6	Attain the required skills to interpret the Physics behind the phenomena occurring innature and surroundings and hence apply them to enhance our life style.
PSO 7	Develop essential logical and analytical skills to approach a problem both quantitatively and qualitatively.

Qualification descriptors for a UG programs in Electronics

The qualification descriptors for a **Four year undergraduate programme in Electronics** may include the following.

The graduates should be able to:

- Demonstrate

  (i) a fundamental/systematic or coherent understanding of the academic field of Electronics, its different learning areas like Astroelectronics, Material science, Nuclear and Particle Electronics, Condensed matter Electronics, Atomic and Molecular Electronics, Mathematical Electronics, Analytical dynamics, Space science and applications, and its linkages with related disciplinary areas/subjects like Chemistry, Mathematics, Life sciences, Environmental sciences, Atmospheric Electronics, Computer science, Information Technology;

  (ii) procedural knowledge that creates different types of professionals related to different areas of study in Electronics outlined above, including research and development, teaching and government and public service;

  (iii) skills in areas related to specialization area relating the subfields and current developments in the academic field of Electronics.

- Use knowledge, understanding and skills required for identifying problems and issues relating to Electronics, collection of relevant quantitative and/or qualitative data drawing on a wide range of sources from various Electronics laboratories of the world, and their application, analysis and evaluation using methodologies as appropriate to Electronics for formulating new theories and concepts.
- Communicate the results of studies undertaken accurately in a range of different contexts using the main concepts, constructs and techniques of Electronics. Develop communication abilities to present these results in technical as well as popular science meetings organized in various universities and other private organizations.
- Ability to meet one's own learning needs, drawing on a range of current research and development work and professional materials, and interaction with other physicists around the world.
- Apply one's knowledge of Electronics and theoretical and laboratory skills to new/unfamiliar contexts to identify and analyse problems and issues and solve complex problems in Electronics and related areas with well-defined solutions.
- Demonstrate Electronics-related technological skills that are relevant to Electronics-related job trades and employment opportunities.

The Programme learning outcomes relating to undergraduate Course in Electronics:

The student graduating with the Degree should be able to

- Acquire

  (i) a fundamental/systematic or coherent understanding of the academic field of Electronics, its different learning areas and applications in basic Electronics like Astroelectronics, Material science, Nuclear and Particle Electronics, Condensed matter Electronics, Atomic and Molecular Electronics, Mathematical Electronics, Analytical dynamics, Space science, and its linkages with related disciplinary areas / subjects like Chemistry, Mathematics, Life sciences, Environmental sciences, Atmospheric Electronics, Computer science, Information Technology;

(ii) procedural knowledge that creates different types of professionals related to the disciplinary/subject area of Electronics, including professionals engaged in research and development, teaching and government/public service;

(iii) skills in areas related to one's specialization area within the disciplinary/subject area of Electronics and current and emerging developments in the field of Electronics.

- Demonstrate the ability to use skills in Electronics and its related areas of technology for formulating and tackling Physics-related problems and identifying and applying appropriate physical principles and methodologies to solve a wide range of problems associated with Electronics.
- Recognize the importance of mathematical modeling simulation and computing, and the role of approximation and mathematical approaches to describing the physical world.
- Plan and execute Physics-related experiments or investigations, analyze and interpret data/information collected using appropriate methods, including the use of appropriate software such as programming languages and purpose-written packages, and report accurately the findings of the experiment/investigations while relating the conclusions/findings to relevant theories of Electronics.
- Demonstrate relevant generic skills and global competencies such as (i) problem-solving skills that are required to solve different types of Electronics-related problems with well-defined solutions, and tackle open-ended problems that belong to the disciplinary-area boundaries; (ii) investigative skills, including skills of independent investigation of Electronics-related issues and problems; (iii) communication skills involving the ability to listen carefully, to read texts and research papers analytically and to present complex information in a concise manner to different groups/audiences of technical or popular nature; (iv) analytical skills involving paying attention to detail and ability to construct logical arguments using correct technical language related to Electronics and ability to translate them with popular language when needed; (v) ICT skills; (vi) personal skills such as the

ability to work both independently and in a group.

- Demonstrate professional behavior such as (i) being objective, unbiased and truthful in all aspects of work and avoiding unethical, irrational behavior such as fabricating, falsifying or misrepresenting data or committing plagiarism; (ii)the ability to identify the potential ethical issues in work-related situations; (iii) appreciation of intellectual property, environmental and sustainability issues; and (iv) promoting safe learning and working environment.

The Four year undergraduate programme in electronics divided into eight semesters. The syllabus and schemes of examination are detailed herewith.

Curricular framework and credit system for the four year undergraduate programme in

semester	Code name	Paper name	Theory Credit	Practical Credit	Total Credit
B.Sc. (Electronics) Sem.-I	VACELE 01	RENEWABLE ENERGY	2	-	2
	SECELE 01	Electronic Instrumentation-I	2	-	2
	DSCELE 01	DSC-ELECTRONICS: **Basic Circuit Theory**	3	-	4
		DSC-LAB-I: **Basic Circuit Theory**	-	1	
	GECELE 01	GEC-ELECTRONICS: **Basic Circuit Element**	3	-	4
		GEC-LAB-I: **Basic Circuit Element**	-	1	

semester	Code name	Paper name	Theory Credit	Practical Credit	Total Credit
B.Sc. (Electronics) Sem.-II	VACELE-02	**Consumer Electronics**	2	-	2
	SECELE-02	**Electronic Instrumentation-II**	2	-	2
	DSCELE-02	DSC-ELECTRONICS:**Electronic Circuit**	3	-	4
		DSC-LAB-II: **Electronic Circuit**	-	1	
	GECELE-02	GEC-ELECTRONICS: **Basic Semiconductor devices**	3	-	4
		GEC-TUTORIAL-I: **Basic Semiconductor devices**	-	1	

semester	Code name	Paper name	Theory Credit	Practical Credit	Total Credit
B.Sc. (Electronics) Sem.-III					
	DSCELE-03	DSC-ELECTRONICS: **Linear and Digital Integrated Circuit**	3	-	4
		DSC-LAB-II: : **Linear and Digital Integrated Circuit**	-	1	
	DSEELE-01	DSEC- **PHOTONICS**	3	-	4
		DSEC-TUTORIAL-: **PHOTONICS**	-	1	

semester	Code name	Paper name	Theory Credit	Practical Credit	Total Credit
B.Sc. (ELECTRONICS) Sem.-IV					
	DSCELE-04	DSC-ELECTRONICS: : **Communication Electronics**	3	-	4
		DSC-LAB-II: **Communication Electronics**	-	1	
	DSEELE-02	DSEC-ELECTRONICS-**Electrical Machine**	3	-	4
		DSEC-TUTORIAL- **Electrical Machine**	-	1	

semester	Code name	Paper name	Theory Credit	Practical Credit	Total Credit
B.Sc. (Electronics) sem.-V					
	DSCELE-05	DSC-ELECTRONICS: **Microprocessor andMicrocontroller**	3	-	4
		DSC-LAB-II: ELECTRONICS: **Microprocessor andMicrocontroller**	-	1	
	GECELE-03	GEC-ELECTRONICS- **Microprocessor and Programe**	3	-	4
		GEC-ELECTRONICS TUTORIAL-I: **Microprocessor and Programe**	-	1	

semester	Code name	Paper name	Theory Credit	Practical Credit	Total Credit
B.Sc. (Electronics) Sem.-VI					
	DSCELE-06	DSC-ELECTRONICS: **Industrial Electronics**	3	-	4
		DSC-LAB-II: **Industrial Electronics**	-	1	
	GECELE-04	GEC-ELECTRONICS-**Power Electronics**	3	-	4
		GEC-ELECTRONICS TUTORIAL-I: **Power Electronics**	-	1	

Discipline Specific Core Course (DSCELE-01)

SemesterI

Paper: Basic Circuit Theory

Course Learning Outcomes

After completing the course the students will able to :

CO-01: The concepts of electromagnetic induction and its applications and eddy currents,
CO-02: Resonant circuits with RC, LR and LCR combinations and the power factor of an AC circuit, basics of circuit theory and network analysis.
CO-03: Resonant circuits with RC, LR and LCR combinations and the power factor of an AC circuit.
CO-04: Apply the knowledge of basic circuital law and simplify the network using reduction technique.

CO-05: Analyze the circuit using Kirchoff's law and network theorem.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10	PO-11
CO-01	✓										
CO-02			✓					✓			
CO-03	✓									✓	
CO-04					✓	✓					
CO-05			✓					✓			

PART-A: Introduction				
Program: *Certificate Course*		Class: **B. Sc.**	**Semester: I**	Session: **2022-2023**
1	Course Code	**DSCELE-01**		
2	Course Title	**Basic Circuit Theory**		
3	Course Type	**Discipline Specific Core Course (DSC)**		
4	Pre-requisite(if,any)	As per Government norms / Institutional scheme		
5	Course Learning. Outcomes **(CLO)**	***After completion of this course, the students will be able to -*** 1. the concepts of electromagnetic induction and its applications and eddy currents, 2. resonant circuits with RC, LR and LCR combinations and the power factor of an AC circuit, 3. basics of circuit theory and network analysis 4. resonant circuits with RC, LR and LCR combinations and the power factor of an AC circuit, 5. Apply the knowledge of basic circuital law and simplify the network using reduction technique. • Analyze the circuit using Kirchoff's law and network theorem.		
6	Credit Value	**04 Credit** (Theory-03 Credit & Practical-01 Credit)		
7	Total Marks	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART –B1: Content of the Course : Theory (03 Credit)		
Total No. of Teaching–learning - Hours– 45		
Unit	**Topics (Course contents)**	**No. of Hours**
I	**Basic Circuit Concepts**: **Resistors**: Fixed and Variable resistors, Construction and Characteristics, Color coding of resistors, resistors in series and parallel. **Inductors**: Fixed and Variable inductors, Self and mutual inductance, Faraday's law and Lenz's law of electromagnetic induction, Energy stored in an inductor, Inductance in series and parallel. **Capacitors**: Principles of capacitance, Parallel plate capacitor, Permittivity, Definition of Dielectric Constant, Dielectric strength, Energy stored in a capacitor, Construction and application, capacitors in series and parallel, factors governing the value of capacitors.	**12Hours**
II	**DC circuit Analysis**: Ohm's Law, Voltage and Current Sources , type of sources, source conversion, voltage and current division rule, Kirchhoff's Current Law (KCL),Dc series circuit, Kirchhoff's Voltage Law (KVL),Dc parallel circuit, Node Analysis, Mesh Analysis.	**11Hours**
III	**AC Circuit Analysis:** Sinusoidal Voltage and Current, Definition of Instantaneous, Peak, Peak to Peak, Root Mean Square and Average Values. Voltage-Current relationship in Resistor, Inductor and Capacitor, Phasor,Complex Impedance,	**11Hours**
IV	**Power in AC Circuits:** Instantaneous Power, Average Power, Reactive Power, Power Factor. Sinusoidal Circuit Analysis for RL, RC and RLC Circuits.Resonance in Series and Parallel RLC Circuits, Frequency Response of Series and Parallel RLC Circuits,Quality (Q) Factor and Bandwidth	**11Hours**

PART –B2: Content of the Course : Practical (01 Credit)	
Course Code	**DSCELE-01-LAB**
Course Title	**DSC-LAB : Basic Circuit Theory**
CourseType	**Laboratory Course**
Pre-requisite (if, any)	As per Govt. norms / Institutional scheme
Course Learning. Outcomes **(CLO)**	At the end of this course, the students will be able to ➢ ***To get the knowledge about use of various measuring instruments.*** ➢ ***To get understand about the simple circuit theory passive elements current and voltage.***

Total No. of Teaching–learning - Hours– 30	
Topics (Course contents) **A tentative list lab work that can be amended by teacher /department concerned.**	**No. of Hours**
At least 06 experiments from the following 1. Familiarization with a) Resistance in series, parallel and series – Parallel. b) Capacitors & Inductors in series & Parallel. c) Multimeter – Checking of components. d) Voltage sources in series, parallel and series – Parallel e) Voltage and Current dividers 2. Measurement of Amplitude, Frequency & Phase difference using CRO. 3. Verification of Kirchoff's Law. 4. RC Circuits: Time Constant, Differentiator, Integrator. 5. Designing of a Low Pass RC Filter and study of its FrequencyResponse. 6. Designing of a High Pass RC Filter and study of its Frequency Response. 7. Study of the Frequency Response of a Series LCR Circuit and determination of its (a) Resonant Frequency (b) Impedance at Resonance (c) Quality Factor Q (d) Band Width.	**30 Hours**

PART–C

Learning Resources: Text Books, Reference Books and Others

Text Books Recommended

1. S. A. Nasar, Electric Circuits, Schaum's outline series, Tata McGraw Hill (2004)

2.Electrical Circuits, M. Nahvi and J. Edminister, Schaum's Outline Series, Tata McGrawHill.(2005)

3. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education (2004)

4. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, Tata McGraw Hill(2005)

5. Alexander and M. Sadiku, Fundamentals of Electric Circuits , McGraw Hill (2008)

Online Resources–

- **e-Resources / e-books and e-learning portals for Physics**

- **Use of following sites**
  - https://www.e-booksdirectory.com/electronics.php
  - https://www.pdfdrive.com/category/66
  - https://www.e-booksdirectory.com/listing.php?category=2
  - https://www.openculture.com/free-physics-textbooks
  - https://bookboon.com/en/physics-ebooks
  - https://www.pdfdrive.com/
  - https://zlibrary.to/

Part - D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Continuous Comprehensive Evaluation (CCE): 15 Marks
Semester End Exam (SEE): 60 Marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test - 02 of 05 Marks each Assignment – 01 of 05 Marks Seminar – 01 of 05 Marks	Average of the obtained marks in both test exam, Seminar and Assignment shall be considered against 15 Marks
Semester End Exam (SEE):	1. Objective type questions: Twelve questions carrying 1 marks each to be asked Nine to be attempted 2. Short answer type questions: Five questions carrying 3 marks each to be asked three to be attempted (Word limit 100 words). 3. Middle answer type questions: Five questions carrying 5 marks each to be set three to be attempted (Word limit 250 words). 4. Long answer type questions: Five questions carrying 9 marks each to be set three to be attempted (Word limit 750 words)	

Generic Elective Course (GECELE-01)

SemesterI

Paper: Basic Circuit Elements

Course Learning Outcomes

After completing the course the students will able to : -

CO-01: basics of circuit theory.Learning about Resistance, Capacitor,Inductor.
CO-02: Learning about Resistance, Capacitor,Inductor.
CO-03: Idea of R,L,C, series parallel connection of R,L,C, types of energy sources.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10	PO-11
CO-01	✓					✓					
CO-02			✓			✓			✓		
CO-03			✓		✓	✓					✓

PART-A: Introduction				
Program: ***Certificate Course***		Class: **B. Sc.**	**Semester: I**	Session: **2022-2023**
1	Course Code	**GECELE– 01**		
2	Course Title	**Basic Circuit Elements**		
3	Course Type	**Generic Elective Course (GEC)**		
4	Pre-requisite(if,any)	As per Government norms / Institutional scheme		
5	Course Learning. Outcomes **(CLO)**	***After completion of this course, the students will be able to -*** basics of circuit theory. Idea of R,L,C, series parallel connection of R,L,C, types of energy sources.		
6	Credit Value	**04 Credit** (Theory-03 Credit & Practical-01 Credit)		
7	Total Marks	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART –B1: Content of the Course : Theory (03 Credit)		
Total No. of Teaching–learning - Hours– 45		
Unit	**Topics (Course contents)**	**No. of Hours**
I	**Energy source**: Current source-: electric current, Type of current source (ideal, practical, fixed, variable, dependent & independent) Voltage source-: electric Voltage, Type of Voltage source (ideal, practical, fixed, variable, dependent & independent),Ohm's law	**12Hours**
II	**Resistors**: Fixed and Variable resistors, Construction and Characteristics, Colour coding of resistors, resistors in series and parallel.	**11Hours**
III	**Capacitors**: Principles of capacitance, Fixed and Variable resistors, Construction and Characteristics, Energy stored in a capacitor, capacitors in series and parallel.	**11Hours**
IV	**Inductors**: Fixed and Variable inductors, Construction and Characteristics Energy stored in an inductor, Inductance in series and parallel.	**11Hours**

PART –B2: Content of the Course : Practical (01 Credit)		
Course Code	**GECELE-01 LAB**	
Course Title	**GEC-LAB : Basic Circuit Elements**	
CourseType	**Laboratory Course**	
Pre-requisite (if, any)	As per Govt. norms / Institutional scheme	
Course Learning. Outcomes **(CLO)**	***After completion of this course, the students will be able to -*** basics of circuit theory. Idea of R,L,C, series parallel connection of R,L,C, types of energy sources.	
Total No. of Teaching–learning - Hours– 30		
Topics (Course contents) **A tentative list lab work that can be amended by teacher /department concerned.**		**No. of Hours**
At least 04 experiments from the following a) Resistance in parallel and series b) Capacitors & Inductors in series & Parallel. c) Multimeter – Checking of components. d) Voltage sources in parallel and series e) Understanding the symbol of all types of above elements.		**30 Hours**

PART–C

Learning Resources: Text Books, Reference Books and Others

Text Books Recommended

. S. A. Nasar, Electric Circuits, Schaum's outline series, Tata McGraw Hill (2004)

2. Electrical Circuits, M. Nahvi and J. Edminister, Schaum's Outline Series, Tata McGrawHill.(2005)

3. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education (2004)

4. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, Tata McGraw Hill(2005)

5. Alexander and M. Sadiku, Fundamentals of Electric Circuits , McGraw Hill (2008)

Online Resources–

- **e-Resources / e-books and e-learning portals for Physics**

- **Use of following sites**
  - https://www.e-booksdirectory.com/electronics.php
  - https://www.pdfdrive.com/category/66
  - https://www.e-booksdirectory.com/listing.php?category=2
  - https://www.openculture.com/free-physics-textbooks
  - https://bookboon.com/en/physics-ebooks
  - https://www.pdfdrive.com/
  - https://zlibrary.to/

Part - D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Continuous Comprehensive Evaluation (CCE): 15
Marks Semester End Exam (SEE): 60 Marks
Lab Work : 25 Marks
Maximum Marks: 100 Marks Minimum Pass Marks: 24 Marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test - 02 of 05 Marks each Assignment – 01 of 05 Marks Seminar – 01 of 05 Marks	Average of the obtained marks in both test exam, Seminar and Assignment shall be considered against 15 Marks
Semester End Exam (SEE):	1. Objective type questions: Twelve questions carrying 1 marks each to be asked Nine to be attempted 2. Short answer type questions: Five questions carrying 3 marks each to be asked three to be attempted (Word limit 100 words). 3. Middle answer type questions: Five questions carrying 5 marks each to be set three to be attempted (Word limit 250 words). 4. Long answer type questions: Five questions carrying 9 marks each to be set three to be attempted (Word limit 750 words)	

Value added Course (VACELE-01)

Semester I

Paper: RENEWABLE ENERGY

Course Learning Outcomes

After completing the course the students will able to :

CO-01: Understand the concept of renewable energy

CO-02: Harvesting of renewable energy

CO-03: Different kind of renewable energy

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10	PO-11
CO-01	✓										
CO-02			✓		✓			✓			
CO-03	✓									✓	

PART-A: Introduction				
Program: ***Certificate Course***		Class: **B. Sc.**	**Semester: I**	Session: **2022-2023**
1	Course Code	**VACELE – 01**		
2	Course Title	**RENEWABLE ENERGY**		
3	Course Type	**Value Added Course (VAC)**		
4	Pre-requisite(if,any)	As per Government norms / Institutional scheme		
5	Course Learning. Outcomes **(CLO)**	***After completion of this course, the students will be able to -*** • Understand the concept of renewable energy • Harvesting of renewable energy • Different kind of renewable energy		
6	Credit Value	**02 Credit** (Theory-02 Credit)		
7	Total Marks	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART –B1: Content of the Course : Theory (02 Credit)		
Total No. of Teaching–learning - Hours– 30		
Unit	**Topics (Course contents)**	**No. of Hours**
I	**Fossil Fuels and Alternate Sources of Energy:** Fossil Fuels and Nuclear Energy, Their Limitation, Need of Renewable Energy, Non-Conventional Energy Sources, An Overview of Developments in Offshore Wind Energy, Tidal Energy, Wave Energy Systems, Ocean Thermal Energy Conversion, Solar Energy, Biomass, Biochemical Conversion, Biogas Generation, Geothermal Energy Tidal Energy, Hydroelectricity	**15Hours**
II	**Solar Energy:** Solar Energy, Its Importance, Storage of Solar Energy, Solar Pond, Non-Convective Solar Pond, Applications of Solar Pond and Solar Energy, Solar Water Heater, Solar Cooker, Solar Green Houses, Solar Cell. **Wind Energy Harvesting:** Fundamentals of Wind Energy, Wind Turbines and Different Electrical Machines in Wind Turbines, Power Electronic Interfaces, and Grid Interconnection Topologies.	**15Hours**

PART–C

Learning Resources: Text Books, Reference Books and Others

Text Books Recommended

- khan, Non-Conventional Energy Sources, Tata McGraw Hill.

• Sukhatme and Nayak, Solar Energy: Principles of Thermal Collection and Storage, Tata McGraw Hill.

• Boyle, Renewable Energy: Power for a Sustainable Future, Oxford.

• Kothari, Singal and Ranjan, Renewable Energy Sources and Emerging Technologies, PHI.

• Jayakumar, Solar Energy Resource Assessment Handbook (2009).

• Balfour, Shaw and Jarosek, Photovoltaics, Lawrence J Goodrich (USA).

Online Resources–

a. e-Resources / e-books and e-learning portals for Physics

- **Use of following sites**
  - https://www.e-booksdirectory.com/electronics.php
  - https://www.pdfdrive.com/category/66
  - https://www.e-booksdirectory.com/listing.php?category=2
  - http://en.wikipedia.org/wiki/Renewable_energy
  - https://www.openculture.com/free-physics-textbooks
  - https://bookboon.com/en/physics-ebooks
  - https://www.pdfdrive.com/
  - https://zlibrary.to/

Part - D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Continuous Comprehensive Evaluation (CCE): 10 Marks
Semester End Exam (SEE): 40 Marks
Maximum Marks: 50 Marks **Minimum Pass Marks: 20 Marks**

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test - 02 of 04 Marks each Assignment – 01 of 03 Marks Seminar – 01 of 04 Marks	Average of the obtained marks in both test exam, Seminar and Assignment shall be considered against 10 Marks
Semester End Exam (SEE):	1. Objective type questions: Twelve questions carrying 1 marks each to be asked Nine to be attempted 2. Short answer type questions: Five questions carrying 3 marks each to be asked three to be attempted (Word limit 100 words). 3. Middle answer type questions: Five questions carrying 5 marks each to be set three to be attempted (Word limit 250 words). 4. Long answer type questions: Five questions carrying 9 marks each to be set three to be attempted (Word limit 750 words)	

Skill Enhancement CourseSkill

(SECELE-01)

Semester-I

Paper: ELECTRONIC INSTRUMENATATION-I

Course Learning Outcomes

After completing the course the students will able to :

CO-01: Understanding the physics of the devices their characteristics and applications, tobe able to use them in electronic circuits.

CO-02: Students would be aware of various signal conditioning, processing and generation techniques thus being better equipped to understand their use in larger and complex systems.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10	PO-11
CO-01	✓	✓				✓		✓	✓		
CO-02		✓	✓			✓			✓		✓

Program: Certificate *Course*		Class: **B. Sc.**	**Semester: I**	
1	Course Code	**SECELE – 01**		
2	Course Title	**ELECTRONIC INSTRUMENATATION-I**		
3	Course Type	**Skill Enhancement Course (SEC)**		
4	Pre-requisite(if,any)	As per Government norms / Institutional scheme		
5	Course Learning. Outcomes **(CLO)**	***After completion of this course, the students will be able to -*** • Understanding the electronics of the devices their characteristics and applications, to be able to use them in electronic circuits. • Students would be aware of various signal conditioning, processing and generation techniques thus being better equipped to understand their use in larger and complex systems.		
6	Credit Value	**02 Credit** (Theory-01 Credit & Practical-01 Credit)		
7	Total Marks	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART –B1: Content of the Course : Theory (01 Credit) Practical (01 credit)		
Total No. of Teaching–learning - Hours– 45		
Unit	**Topics (Course contents)**	**No. of Hours**
I	**Qualities of Measurement:** Specifications of instruments, their static and dynamic characteristics, Error (Gross error, systematic error, absolute error and relative error) and uncertainty analysis. Statistical analysis of data and curve fitting	**8Hours**
II	**Measurement of Resistance and Impedance:** Low Resistance by Kelvin's double bridge method, Medium Resistance by Wheatstone bridge method, High Resistance by Megger. Measurement of Self Inductance by Maxwell's bridge, , Measurement of Capacitance by Schering's bridge, Measurement of frequency byWien's bridge.	**7Hours**
Lab	1. Design of multi range ammeter and voltmeter using galvanometer. 2. Measurement of resistance by Wheatstone bridge and measurement of bridge sensitivity. 3. Measurement of Capacitance by de'Sautys. 4. Measure of low resistance by Kelvin's double bridge. 5. To determine the Characteristics of resistance transducer - Strain Gauge(Measurement of Strain using half and full bridge.)	**30Hours**

PART–C (ESEC – 1TP)

Learning Resources: Text Books, Reference Books and Others

Text Books Recommended

H. S. Kalsi, Electronic Instrumentaion, TMH(2006)
2. W.D. Cooper and A. D. Helfrick, Electronic Instrumentation and Measurement Techniques, PrenticeHall (2005).
3. Instrumentation Measurement and analysis: Nakra B C, Chaudry K, TMH
4. E.O.Doebelin, Measurement Systems: Application and Design, McGraw Hill Book - fifth Edition (2003).
5. Joseph J Carr, Elements of Electronic Instrumentation and Measurement, Pearson Education (2005)
6. David A. Bell, Electronic Instrumentation and Measurements, Prentice Hall (2013). 7. Oliver and Cage, "Electronic Measurements and Instrumentation", TMH (2009).
8. Alan S. Morris, "Measurement and Instrumentation Principles", Elsevier (ButerworthHeinmann2008).
9. A. K Sawhney, Electrical and Electronics Measurements and Instrumentation, DhanpatRai and Sons (2007).
10. C. S. Rangan, G. R. Sarma and V. S. Mani, Instrumentation Devices and Systems, Tata Mcgraw Hill (1998).

Online Resources–

a. e-Resources / e-books and e-learning portals for Physics

- **Use of following sites**
  - https://www.e-booksdirectory.com/electronics.php
  - https://www.pdfdrive.com/category/66
  - https://www.e-booksdirectory.com/listing.php?category=2
  - https://www.openculture.com/free-physics-textbooks
  - https://bookboon.com/en/physics-ebooks
  - https://www.pdfdrive.com/
  - https://zlibrary.to/

Part - D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Continuous Comprehensive Evaluation (CCE): 10 Marks
Semester End Exam (SEE): 40 Marks
Maximum Marks: 50 Marks **Minimum Pass Marks: 20 Marks**

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test - 02 of 04 Marks each Assignment – 01 of 03 Marks Seminar – 01 of 04 Marks	Average of the obtained marks in both test exam, Seminar and Assignment shall be considered against 10 Marks
Semester End Exam (SEE):	1. Objective type questions: Twelve questions carrying 1 marks each to be asked Nine to be attempted 2. Short answer type questions: Five questions carrying 3 marks each to be asked three to be attempted (Word limit 100 words). 3. Middle answer type questions: Five questions carrying 5 marks each to be set three to be attempted (Word limit 250 words). 4. Long answer type questions: Five questions carrying 9 marks each to be set three to be attempted (Word limit 750 words)	

Discipline Specific Core Course (DSCELE-02)

Semester II

Paper: Electronics Circuits

Course Learning Outcomes

After completing the course the students will able to :

CO-01 the design and working of RC coupled amplifiers, transformer coupled amplifiers and power amplifiers, b. the concept of negative and positive feedback,.

CO-02: structure, characteristics, working and applications of variousdiodes, JFET, MOSFET, etc.

CO-03: Principles of charge coupled devices, metal semiconductor junction characteristics.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10	PO-11
CO-01	✓										✓
CO-02	✓		✓							✓	
CO-03						✓			✓		

PART-A: Introduction				
Program: ***Diploma Course***		Class: **B. Sc.**	**Semester: II**	Session: **2022-2023**
1	Course Code	**DSCELE-02**		
2	Course Title	**Electronics Circuits**		
3	Course Type	**Discipline Specific Core Course (DSC)**		
4	Pre-requisite(if,any)	As per Government norms / Institutional scheme		
5	Course Learning. Outcomes **(CLO)**	***After completion of this course, the students will be able to -*** ***1.*** the design and working of RC coupled amplifiers, transformer coupled amplifiers and power amplifiers, b. the concept of negative and positive feedback,. ***2.*** structure, characteristics, working and applications of various diodes, JFET, MOSFET, etc., ***3.*** Principles of charge coupled devices, metal semiconductor junction characteristics.		
6	Credit Value	**04 Credit** (Theory-03 Credit & Practical-01 Credit)		
7	Total Marks	**Max. Marks: 100**		**Min Passing Marks: 40**

PART –B1: Content of the Course : Theory (03 Credit)		
Total No. of Teaching–learning - Hours– 45		
Unit	**Topics (Course contents)**	**No. of Hours**
I	**Diode Circuits**: Ideal diode, piecewise linear equivalent circuit, dc load line analysis, Quiescent (Q) point.Clipping and clamping circuits. Rectifiers: HWR, FWR (center tapped and bridge). Circuit diagrams, working and waveforms, ripple factor & efficiency, comparison. Filters: types, circuit diagram and explanation of shunt capacitor filter with waveforms.Zener diode regulator circuit diagram and explanation for load and line regulation, disadvantages ofZener diode regulator.	**12Hours**
II	**Bipolar Junction Transistor**: PNP and NPN Transistors, Basic Transistor Action, Emitter Efficiency, Base Transport Factor, Current Gain Review of CE, CB Characteristics and regions of operation. Hybrid parameters. Transistor biasing, DC load line, operating point, thermal runaway, stability and stability factor Fixed bias without and with RE, collector to base bias, voltage divider bias and emitter bias (+VCC and –VEE bias), circuit diagrams and their working. Transistor as a switch,circuit and working**,**	**11Hours**
III	**Feedback Amplifiers:** Concept of feedback, negative and positive feedback, advantages and disadvantages of negative feedback, voltage (series and shunt), current (series and shunt) feedback amplifiers, gain, input and output impedances . Barkhausen criteria for oscillations, Study of phase shift oscillator, Colpitts oscillator and Hartley oscillator	**11Hours**
IV	**Field Effect Transistors:** JFET, Construction, Idea of Channel Formation, Pinch-Off and Saturation Voltage ,Current-Voltage Output Characteristics **MOSFET Circuits**: Review of Depletion and Enhancement MOSFET, Biasing of MOSFETs, Small Signal Parameters, Common Source amplifier circuit analysis, CMOS circuits.	**11Hours**

B.Sc-II: Content of the Course : Practical (01 Credit)

Course Code	
Course Title	**DSCELE-02-LAB : Electronics Circuits**
CourseType	**Laboratory Course**
Pre-requisite (if, any)	As per Govt. norms / Institutional scheme
Course Learning. Outcomes **(CLO)**	At the end of this course, the students will be able to ***1.*** the design and working of RC coupled amplifiers, transformer coupledamplifiers and power amplifiers, b. the concept of negative and positive feedback,. ***2.*** structure, characteristics, working and applications of various diodes, JFET, MOSFET, etc., ***3.*** Principles of charge coupled devices, metal semiconductor junction characteristics.

Total No. of Teaching–learning - Hours– 30

Topics (Course contents) **A tentative list lab work that can be amended by teacher /department concerned.**	**No. of Hours**
At least 10 experiments from the following: Study of the I-V Characteristics of Diode – Ordinary and Zener Diode. 1. Study of the I-V Characteristics of the CE configuration of BJT and obtain r_i, r_o, β. 2. Study of the I-V Characteristics of the Common Base Configuration of BJT and obtain r_i, r_o, α. 3. Study of the I-V Characteristics of the Common Collector Configuration of BJT and obtain voltagegain, ri, r_o. 4. Study of the I-V Characteristics of JFET. 5. Study of the I-V Characteristics of MOSFET. 6. Study of Characteristics of Solar Cell 7. Study of the half wave rectifier and Full wave rectifier. 8. Study of power supply using C filter and Zener diode. 9. Designing and testing of 5V/9 V DC regulated power supply and find its load- regulation 10. Study of clipping and clamping circuits . 11. Study of Fixed Bias, Voltage divider and Collector-to-Base bias Feedback configuration fortransistors. 12. Designing of a Single Stage CE amplifier. 13. Study of the frequency response of Common Source FET amplifier determine its (a) Anti-resonant frequency and (b) Quality factor .	**30 Hours**

PART–C

Learning Resources: Text Books, Reference Books and Others

Text Books Recommended

i. S. M. Sze, Semiconductor Devices: Physics and Technology, 2ndEdition, Wiley India edition(2002).

ii. Ben G Streetman and S. Banerjee, Solid State Electronic Devices, Pearson Education (2006)

iii. Dennis Le Croissette, Transistors, Pearson Education (1989)

iv. Jasprit Singh, Semiconductor Devices: Basic Principles, John Wiley and Sons (2001)

v. Kanaan Kano, Semiconductor Devices, Pearson Education (2004)

Robert F. Pierret, Semiconductor Device Fundamentals, Pearson Education (2006)

Online Resources–

a. e-Resources / e-books and e-learning portals for Physics

vi. Use of following sites

a. https://www.e-booksdirectory.com/electronics.php
b. https://www.pdfdrive.com/category/66
c. https://www.e-booksdirectory.com/listing.php?category=2
d. https://www.openculture.com/free-physics-textbooks
e. https://bookboon.com/en/physics-ebooks
f. https://www.pdfdrive.com/
g. https://zlibrary.to/

Part - D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Continuous Comprehensive Evaluation (CCE): 15 Marks

Semester End Exam (SEE): 60 Marks

Lab Work : 25 Marks

Maximum Marks: 100 Marks **Minimum Pass Marks: 24 Marks**

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test - 02 of 05 Marks each Assignment – 01 of 05 Marks Seminar – 01 of 05 Marks	Average of the obtained marks in both test exam, Seminar and Assignment shall be considered against 15 Marks
Semester End Exam (SEE):	1. Objective type questions: Twelve questions carrying 1 marks each to be asked Nine to be attempted 2. Short answer type questions: Five questions carrying 3 marks each to be asked three to be attempted (Word limit 100 words). 3. Middle answer type questions: Five questions carrying 5 marks each to be set three to be attempted (Word limit 250 words). 4. Long answer type questions: Five questions carrying 9 marks each to be set three to be attempted (Word limit 750 words)	

Generic Elective Course

(GECELE-02)

Semester II

Paper: Basic Semiconductor devices

Course Learning Outcomes

After completing the course the students will able to : -

CO-01: structure, characteristics, working and applications of various diodes, JFET, MOSFET,transistor etc.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10	PO-11
CO-01	✓										✓

PART-A: Introduction				
Program: ***Diploma Course***		Class: **B. Sc.**	**Semester: II**	Session: **2022-2023**
1	Course Code	**GECELE-01**		
2	Course Title	**Basic Semiconductor devices**		
3	Course Type	**Generic Elective Course (GEC)**		
4	Pre-requisite(if,any)	As per Government norms / Institutional scheme		
5	Course Learning. Outcomes **(CLO)**	***After completion of this course, the students will be able to -*** • structure, characteristics, working and applications of various diodes, JFET, MOSFET,transistor etc		
6	Credit Value	**04 Credit** (Theory-03 Credit & Tutorial-01 Credit)		
7	Total Marks	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART –B: Content of the Course : Theory (03 Credit)		
Total No. of Teaching–learning - Hours– 45		
Unit	**Topics (Course contents)**	**No. of Hours**
I	**Semiconductor Basics:** Introduction to Semiconductor Materials, Crystal Structure, Planes and Miller Indices, Energy Band in Solids, Concept of Effective Mass, Density of States ,Intrinsic & Extrinsic Semiconductors, Donors, Acceptors	**12Hours**
II	**P-N Junction Diode**: Formation of Depletion Layer, Space Charge at a Junction, Derivation of Diode Equation and I-V Characteristics	**11Hours**
III	**Bipolar Junction Transistors (BJT):** PNP and NPN Transistors, Basic Transistor Action, Emitter Efficiency, Base Transport Factor, Current Gain,Modes of operation,	**11Hours**
IV	**Some special PN Diode**:- Zener and Avalanche Junction Breakdown Mechanism.Tunnel diode, varactor diode, solar cell: circuit symbol, characteristics, applications	**11Hours**

PART–C

Learning Resources: Text Books, Reference Books and Others

Text Books Recommended

1. S. M. Sze, Semiconductor Devices: Physics and Technology, 2ndEdition, Wiley India edition (2002).

2. Ben G Streetman and S. Banerjee, Solid State Electronic Devices, Pearson Education (2006)

3) Dennis Le Croissette, Transistors, Pearson Education (1989)

4) Jasprit Singh, Semiconductor Devices: Basic Principles, John Wiley and Sons (2001)

5) Kanaan Kano, Semiconductor Devices, Pearson Education (2004)

Online Resources–

5. **e-Resources / e-books and e-learning portals for Physics**

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  - https://www.pdfdrive.com/category/66
  - https://www.e-booksdirectory.com/listing.php?category=2
  - https://www.openculture.com/free-physics-textbooks
  - https://bookboon.com/en/physics-ebooks
  - https://www.pdfdrive.com/
  - https://zlibrary.to/

Part - D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Continuous Comprehensive Evaluation (CCE): 15 Marks

Semester End Exam (SEE): 60 Marks

Lab Work : 25 Marks

Maximum Marks: 100 Marks **Minimum Pass Marks: 24 Marks**

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test - 02 of 05 Marks each Assignment – 01 of 05 Marks Seminar – 01 of 05 Marks	Average of the obtained marks in both test exam, Seminar and Assignment shall be considered against 15 Marks
Semester End Exam (SEE):	Objective type questions: Twelve questions carrying 1 marks each to be asked Nine to be attempted Short answer type questions: Five questions carrying 3 marks each to be asked three to be attempted (Word limit 100 words). Middle answer type questions: Five questions carrying 5 marks each to be set three to be attempted (Word limit 250 words). Long answer type questions: Five questions carrying 9 marks each to be set three to be attempted (Word limit 750 words)	

Value added Course (VACELE-02)

SemesterII

Paper: CONSUMER ELECTRONICS

Course Learning Outcomes

After completing the course the students will able to : -

CO 1: Understanding and learn about different

CO:2 Type ofconsumer elctronics devices used in daily life.

Mapping for CO&PO

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10	PO-11
CO-01	✓										✓
CO-02	✓		✓							✓	

PART-A: Introduction				
Program: Diploma *Course*		Class: **B. Sc.**	**Semester: II**	Session: **2022-2023**
1	Course Code	**VACELE – 02**		
2	Course Title	**CONSUMER ELECTRONICS**		
3	Course Type	**Value Added Course (VAC)**		
4	Pre-requisite(if,any)	As per Government norms / Institutional scheme		
5	Course Learning. Outcomes **(CLO)**	***After completion of this course, the students will be able to -*** • Understanding and learn about different type of consumer elctronics devices used in daily life.		
6	Credit Value	**02 Credit** (Theory-02 Credit)		
7	Total Marks	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART –B1: Content of the Course : Theory (02 Credit)		
Total No. of Teaching–learning - Hours– 30		
Unit	**Topics (Course contents)**	**No. of Hours**
I	**Audio systems**: PA system, Microphone, Amplifier, Loudspeakers. Radio receivers, AM/FM. Audio recording and reproduction, Cassettes, CD and MP3.	**15Hours**
II	**TV and Video systems:** Television standards, BW/Colour, CRT/HDTV. Video system, VCR/VCD/DVD players, MP4 players, Set Top box, CATV and Dish TV, LCD, Plasma & LED TV. Projectors: DLP, Home Theatres, Remote Controls	**15Hours**

PART–C

Learning Resources: Text Books, Reference Books and Others

Text Books Recommended

1. R. P. Bali Consumer Electronics Pearson Education (2008)

2. R. G. Gupta Audio and Video systems Tata McGraw Hill (2004)

Online Resources–

6. **e-Resources / e-books and e-learning portals for Physics**

- **Use of following sites**
  - https://www.e-booksdirectory.com/electronics.php
  - https://www.pdfdrive.com/category/66
  - https://www.e-booksdirectory.com/listing.php?category=2
  - https://www.openculture.com/free-physics-textbooks
  - https://bookboon.com/en/physics-ebooks
  - https://www.pdfdrive.com/
  - https://zlibrary.to/

Part - D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Continuous Comprehensive Evaluation (CCE): 10 Marks
Semester End Exam (SEE): 40 Marks
Maximum Marks: 50 Marks **Minimum Pass Marks: 20 Marks**

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test - 02 of 04 Marks each Assignment – 01 of 03 Marks Seminar – 01 of 04 Marks	Average of the obtained marks in both test exam, Seminar and Assignment shall be considered against 10 Marks
Semester End Exam (SEE):	Objective type questions: Twelve questions carrying 1 marks each to be asked Nine to be attempted Short answer type questions: Five questions carrying 3 marks each to be asked three to be attempted (Word limit 100 words). Middle answer type questions: Five questions carrying 5 marks each to be set three to be attempted (Word limit 250 words). Long answer type questions: Five questions carrying 9 marks each to be set three to be attempted (Word limit 750 words)	

Skill Enhancement Course

(SECELE-02)

SemesterII

Paper: ELECTRONIC INSTRUMENATATION-II

Course Learning Outcomes

After completing the course the students will able to :

- **CO-01:** Understanding the electronics of the devices their characteristics and applications, to be able to use them in electronic circuits.

- **CO-02:** Students would be aware of various signal conditioning, processing and generation techniques thus being better equipped to understand their use in larger and complex systems.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10	PO-11
CO-01	✓										✓
CO-02	✓		✓							✓	

PART-A: Introduction				
Program: Diploma *Course*		Class: **B. Sc.**	**Semester: II**	Session: **2022-2023**
1	Course Code	**SECELE – 01**		
2	Course Title	**ELECTRONIC INSTRUMENATATION-II**		
3	Course Type	**Skill Enhancement Course (SEC)**		
4	Pre-requisite(if,any)	As per Government norms / Institutional scheme		
5	Course Learning. Outcomes **(CLO)**	***After completion of this course, the students will be able to -*** • Understanding the electronics of the devices their characteristics and applications, to be able to use them in electronic circuits. • Students would be aware of various signal conditioning, processing and generation techniques thus being better equipped to understand their use in larger and complex systems.		
6	Credit Value	**02 Credit** (Theory-01 Credit & Practical-01 Credit)		
7	Total Marks	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART –B1: Content of the Course : Theory (01 Credit) Practical (01 credit)		
Total No. of Teaching–learning - Hours– 45		
Unit	**Topics (Course contents)**	**No. of Hours**
I	**Oscilloscopes:** CRT, wave form display and electrostatic focusing, time base and sweep synchronization, measurement of voltage, frequency and phase by CRO, **Power scope:** Block diagram, principle and working, Advantages and applications, CRO specifications (bandwidth, sensitivity, rise time). Signal Generators: Audio oscillator, Pulse Generator, Function generators	**8Hours**
II	**Transducers and sensors:** Classification of transducers, Basic requirement/characteristics of transducers, active & passive transducers, Resistive (Potentiometer, Strain gauge – Theory, types, temperature compensation and applications), Capacitive (Variable Area Type – Variable Air Gap type – Variable Permittivity type), Inductive (LVDT) and piezoelectric transducers. Measurement of temperature (RTD, thermistor, thermocouple, semiconductor IC sensors), Light transducers (photoresistors, photovoltaic cells, photodiodes).	**7Hours**
Lab	1. 1. To determine the Characteristics of resistance transducer - Strain Gauge (Measurement of Strain using half and full bridge.) 2. To determine the Characteristics of LVDT. 3. To determine the Characteristics of Thermistors and RTD. 4. Measurement of temperature by Thermocouples and study of transducers like AD590 (two terminal temperature sensor), PT-100, J- type, K-type. 5. To study the Characteristics of LDR, Photodiode, and Phototransistor: (i) Variable Illumination. (ii) Linear Displacement. 6. Characteristics of one Solid State sensor/ Fiber optic sensor	**30Hours**

PART–C

Learning Resources: Text Books, Reference Books and Others

Text Books Recommended

1. R. P. Bali Consumer Electronics Pearson Education (2008)

2. R. G. Gupta Audio and Video systems Tata McGraw Hill (2004)

Online Resources–

7. **e-Resources / e-books and e-learning portals for Physics**

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  - https://www.pdfdrive.com/category/66
  - https://www.e-booksdirectory.com/listing.php?category=2
  - https://www.openculture.com/free-physics-textbooks
  - https://bookboon.com/en/physics-ebooks
  - https://www.pdfdrive.com/
  - https://zlibrary.to/

Part - D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Continuous Comprehensive Evaluation (CCE): 10 Marks
Semester End Exam (SEE): 40 Marks
Maximum Marks: 50 Marks **Minimum Pass Marks: 20 Marks**

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test - 02 of 04 Marks each Assignment – 01 of 03 Marks Seminar – 01 of 04 Marks	Average of the obtained marks in both test exam, Seminar and Assignment shall be considered against 10 Marks
Semester End Exam (SEE):	Objective type questions: Twelve questions carrying 1 marks each to be asked Nine to be attempted Short answer type questions: Five questions carrying 3 marks each to be asked three to be attempted (Word limit 100 words). Middle answer type questions: Five questions carrying 5 marks each to be set three to be attempted (Word limit 250 words). Long answer type questions: Five questions carrying 9 marks each to be set three to be attempted (Word limit 750 words)	

Discipline Specific Core Course (DSCELE-03)

SemesterIII

PaperI: Linear and Digital Integrated Circuits

Course Outcomes

After completing the course the students will able to :

CO01: Study of Operational amplifier
CO02: Apply the knowledge of Inverting and Non inverting Amplifier, Summing Difference ,Differentiator,Integrator,
CO03: Number system and codes.
CO04: Learning about Logic Gates and Boolean Algebra.
CO05: Analyze the Combinational Logic &Design.
CO06: Multiplexers & Demultiplexers,IC555,Asatble and Moostable Multimeter.
CO07: Knowing about Flip Flop and it's types. Learn about Materslaves ,Jk ,Serial in Serial out,counters(4bit).

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10	PO-11
CO-01	✓								✓	✓	
CO-02	✓		✓								✓
CO-03						✓	✓				
CO-04										✓	
CO-05								✓			✓
CO-06		✓			✓						
CO-07						✓		✓			

B.Sc.-III	THIRD SEMESTER	COURSE CODE: DSCELE-03
PAPER CODE: EDSC-3T	Credit: (Theory-03, Practical-1), Theory: 45 Hours, Practical: 30 Hours	
PAPER TITLE: Linear and Digital Integrated Circuits		
THEORY MARKS: 100 (SEE: 80 & CCA : 20) PRACTICAL MARKS: 50		
Question Pattern-i) Objective Type Question-MCQ, Fill up the blanks, True/False, Total- 10 Q. ii) Very Short Answer Type- Word Limit 70-100, Total-5 Q. iii) Short Answer Type- Word Limit 200-250, Total-5 Q. iv) Long Answer Type- Word Limit 500-600, Total-5 Q.		
UNIT-1 **15 Hours**	**Operational Amplifiers (Black box approach):** Characteristics of an Ideal and Practical Operational Amplifier (IC 741), Open and closed loop configuration, Frequency Response. CMRR. Slew Rate and concept of Virtual Ground. **Applications of Op-Amps:** (1) Inverting and non-inverting amplifiers, (2) Summing and Difference Amplifier, (3) Differentiator, (4) Integrator, (S) Wein bridge oscillator, (6) Comparator and Zero-crossing detector, and (7) Active low pass and high pass, Butterworth filter (1st order only).	
UNIT-2 **13 Hours**	**Number System and Codes:** Decimal, Binary, Octal and Hexadecimal number systems base conversions. Representation of signed and unsigned numbers, BCD code. Binary, octal and hexadecimal arithmetic; addition, subtraction by 2's complement method, multiplication. **Logic Gates and Boolean algebra:** Truth Tables of OR, AND, NOT, NOR, NAND, XOR, XNOR, Universal Gates, Basic postulates and fundamental theorems of Booleanalgebra.	
UNIT-3 **07 Hours**	**Combinational Logic Analysis and Design:** Standard representation of logic functions (SOP and POS), Minimization Techniques (Karnaugh map minimization up to 4 variables for SOP).Arithmetic Circuits: Binary Addition. Half and Full Adder.Half and Full Subtractor, 4-bit binary Adder/Subtractor. **Data processing circuits:** Multiplexers, De-multiplexers, Decoders, Encoders. Clock and Timer (IC 555): Introduction, Block diagram of IC 555, Astable and Monostable multivibrator circuits.	

UNIT-4 **10 Hours**	Sequential **Circuits:** SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. PresetandClear operations. Race-aroundconditions inJKFlip-Flop. Master-slave JK Flip-Flop. **Shift registers:** Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel- in-Parallel-out Shift Registers (only up to 4 bits). Counters(4 bits): Ring Counter. Asynchronous counters, Decade Counter Synchronous Counter. and A-D Conversion: 4 bit binaryweighted and R-2R D-A converters, circuit and working, Accuracy and Resolution. A-D conversion characteristics, successive approximation ADC. (Mention of relevant ICs for all).
SUGGESTED READINGS	1. Digital Principles and Applications, A.P.Malvino, D.P.Leach and G. Saha, 8th Ed., 2018, Tata McGraw Hill Education. 2. Fundamentals of Digital Circuits, Anand Kumar, 4th Edn, 2018, PHI Learning Pvt. Ltd. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill 3. Microprocessor Architecture Programming & applications with 8085, 2002, R.S. Goankar, Prentice Hall. Digital Computer Electronics, A.P. Malvino, J.A. Brown, 3rd Edition, 2018, Tata McGraw Hill Education.Digital Design, Morris Mano, 5th Ed. Pearson.
Practicum (02 Credit)	Peer/Micro teaching, Class Seminar, Quiz, Group Discussion

B.Sc.-III	THIRD SEMESTER	COURSE CODE: DSCELE-03-LAB
PAPER CODE: EDSC-3P	Credit: Practical-1, Practical: 30 Hours	
PAPER TITLE: DSCELE-03-LAB: LINEAR AND DIGITAL INTEGRATED CIRCUITS LAB		
PRACTICAL MARKS: 50		
Topics (Course contents) A tentative list lab work that can be amended by teacher /department concerned.		
30 Hours	**Section-A:** 1. To design an inverting amplifier using Op-amp (741,351)for dc voltage of given gain 2. (a) To design inverting amplifier using Op-amp (741,351) & study its frequency response (b) To design non-inverting amplifier using Op-amp (741,351) & studyfrequency response 3. (a) To add two dc voltages using Op-amp in inverting and non-inverting mode (b) To study the zero-crossing detector and comparator. 4. To design a precision Differential amplifier of given I/O specification using Op-amp. 5. To investigate the use of an op-amp as an Integrator. 6. To investigate the use of an op-amp as a Differentiator. 7. To design a Wien bridge oscillator for given frequency using an op-amp. 8. To design a circuit to simulate the solution of simultaneous equation and $1^{st}/2^{nd}$order differential equation. 9. Design a Butterworth Low Passactive Filter (1^{st} order)& studyFrequency Response 10. Design a Butterworth High Passactive Filter (1^{st} order)& studyFrequencyResponse 11. Design a digital to analog converter (DAC) of given specifications. .	

Online resources	➢ **e-Resources / e-books and e-learning portals for Physics** ➢ **Use of following sites** ➢ https://www.e-booksdirectory.com/physics.php ➢ https://www.pdfdrive.com/category/66 ➢ https://www.e-booksdirectory.com/listing.php?category=2 ➢ https://www.openculture.com/free-physics-textbooks ➢ https://bookboon.com/en/physics-ebooks ➢ https://www.pdfdrive.com/ https://zlibrary.to/
SUGGESTED READINGS	1. Modern Digital Electronics, R.P. Jain, 4th Edition, 2010, Tata McGraw Hill 2. Basic Electronics: A text lab manual, P.B.Zbar, A.P.Malvino, M.A.Miller, 1994, Mc- Graw Hill. 3. Microprocessor 8085: Architecture, Programming and interfacing, A.Wadhwa, 2010, PHI Learning

Discipline Specific Elective Course (DSEELE-01)

SEMESTER-III

Paper: PHOTONICS

Course Learning Outcomes

After completing this course, student will be able to

CO-01: Learning about light as an electromagnetic wave,interference

CO-02: Understand the concept of Photodetectors**,** Bolometer, Photomultiplier tube.

CO-03: Learning the concept of spherical waves,reflection and transmission at an interface, total internal reflection.

CO-04: Understanding the principle of Brewster's Law ,Huygen Fresnel Principle and Malus' law

CO-05: Knowing the Polarization: Linear, circular and elliptical polarization, polarizer-analyzer, LED,Laser&LCD

MAPPING MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10	PO-11
CO-01	✓										✓
CO-02	✓		✓							✓	
CO-03						✓			✓		
CO-04			✓			✓					✓
CO-05			✓					✓		✓	

B.Sc.-IV	THIRD SEMESTER	COURSE CODE: DSEELE-01
PAPER CODE:EDSE-1T	Credit: (Theory-03, Practical-1), Theory: 45 Hours, Practical: 30 Hours	
PAPER TITLE: PHOTONICS		
THEORY MARKS: 100 (SEE: 80 & CCA : 20) PRACTICAL MARKS: 50		
Question Pattern-i) Objective Type Question-MCQ, Fill up the blanks, True/False, Total- 10 Q. ii) Very Short Answer Type- Word Limit 70-100, Total-5 Q. iii) Short Answer Type- Word Limit 200-250, Total-5 Q. iv) Long Answer Type- Word Limit 500-600, Total-5 Q.		
UNIT-1 12 Hours	**Light as an Electromagnetic Wave:** Plane waves in homogeneous media, concept of spherical waves. Reflection and transmission at an interface, total internal reflection, Brewster's Law. Interaction of electromagnetic waves with dielectrics: origin of refractive index, dispersion. **Interference :** Superposition of waves of same frequency, Concept of coherence, Interference by division of wavefront, Young's double slit, Division of Amplitude, thin filminterference, anti-reflecting films, Newton's rings	
UNIT-2 10 Hours	**Diffraction:** Huygen Fresnel Principle, Diffraction Integral, Fresnel and Fraunhoffer approximations .Fraunhoffer Diffraction by a single slit, rectangular aperture, double slit, Resolving power of microscopes and telescopes	
UNIT-3 15 Hrs	**Polarization:** Linear, circular and elliptical polarization, polarizer-analyzer and Malus' law; Double refraction by crystals, Interference of polarized light, Wave propagation in uniaxial media. Half wave and quarter wave plates. Faraday rotation and electro-optic effect. **Photodetectors:** Bolometer, Photomultiplier tube, Charge Coupled Device. Photo transistors and Photodiodes (p-i-n, avalanche), quantum efficiency and responsivity.	

UNIT- 4 **12 Hrs**	**Light Emitting Diodes**: Construction, materials and operation. **Lasers:** Interaction of radiation and matter, Einstein coefficients, Condition for amplification, laser cavity, threshold for laser oscillation, line shape function. Examples of common lasers.The semiconductor injection laser diode. **LCD Displays:** Types of liquid crystals, Principle of Liquid Crystal Displays, applications,advantages over LED displays.
SUGGESTEDREADINGS	1. Ajoy Ghatak, Optics, Tata McGraw Hill, New Delhi (2005) 2. E. Hecht, Optics, Pearson Education Ltd. (2002) 3. J. Wilson and J. F. B. Hawkes, Optoelectronics: An Introduction, Prentice Hall India (1996) 4. S. O. Kasap, Optoelectronics and Photonics: Principles and Practices, Pearson Education (2009) 5. Ghatak A.K. and Thyagarajan K., "Introduction to fiber optics," Cambridge Univ. Press. (1998) Other References ➢ **e-Resources / e-books and e-learning portals for Physics** ➢ **Use of following sites** ➢ https://www.e-booksdirectory.com/physics.php ➢ https://www.pdfdrive.com/category/66 ➢ https://www.e-booksdirectory.com/listing.php?category=2 ➢ https://www.openculture.com/free-physics-textbooks ➢ https://bookboon.com/en/physics-ebooks ➢ https://www.pdfdrive.com/ https://zlibrary.to/

B.Sc.-IV	FOURTH SEMESTER	COURSE CODE: DSEELE-01 LAB
PAPER CODE: EDSE-1P	**Credit: Practical-1, Practical: 30 Hours**	
PAPER TITLE: DSCELE-LAB: PHOTONICS		
PRACTICAL MARKS: 50		
Topics (Course contents) **A tentative list lab work that can be amended by teacher /department concerned.**		
30 Hours	1. To verify the law of Malus for plane polarized light. 2. To determine wavelength of sodium light using Michelson's Interferometer. 3. To determine wavelength of sodium light using Newton's Rings. 4. To determine the resolving power and Dispersive power of Diffraction Grating. 5. Diffraction experiments using a laser. 6. Study of Faraday rotation. 7. Study of Electro-optic Effect. 8. To determine the specific rotation of scan sugar using polarimeter. 9. To determine characteristics of LEDs and Photo- detector. 10. To measure the numerical aperture of an optical fiber.	

Discipline Specific Core Course (DSCELE-04)

Semester IV

Paper Name: Communication Electronics

Course Outcomes

After completing the course the students will able to :

CO01: Introduction to communication its means and modes,TRAI,Electromagnetic communication spectrum,Concept pof Noise.
CO02: Learn about Analog modulation and Analog pulse modulation.
CO03: Learn the concept of Amplitude Shift Key(ASK),Frequency Shift Key(FSK), Phase Shift Key(PSK)&BSK.
CO04: Learn about the Sattelite communication.
CO05: Knowing about the concept and applications of Mobile Telephony System.
CO06: In the laboratory course, the students are expected to do some basic experiments in Design of Amplitude Modulation using transistor, envelope detector, study of FM,AM transmitter and receiver,TDM.PWMPPM,and the types of modulation I.e-(ASK,PSK,BSK).

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10	PO-11
CO-01	✓										✓
CO-02	✓		✓			✓					
CO-03	✓									✓	
CO-04	✓										✓
CO-05						✓	✓		✓		
CO-06		✓			✓	✓			✓		

B.Sc.-IV	FOURTH SEMESTER	COURSE CODE: DSCELE-04
PAPER CODE:EDSC-4T	Credit: (Theory-03, Practical-1), Theory: 45 Hours, Practical: 30 Hours	
PAPER TITLE: C o m m u n i c a t i o n E l e c t r o n i c s		
THEORY MARKS: 100 (SEE: 80 & CCA : 20) PRACTICAL MARKS: 50		
Question Pattern-i) Objective Type Question-MCQ, Fill up the blanks, True/False, Total- 10 Q. v) Very Short Answer Type- Word Limit 70-100, Total-5 Q. vi) Short Answer Type- Word Limit 200-250, Total-5 Q. vii) Long Answer Type- Word Limit 500-600, Total-5 Q.		
UNIT-1 12 Hours	**Electronic communication:** Introduction to communication — means and modes. Need for modulation. Block diagram of an electronic communication system. Brief idea of frequency allocation for radio communication system in India (TRAI). Electromagnetic communication spectrum, band designations and usage. Channels and base-band signals. Concept of Noise, signal-to-noise (S/N) ratio.	
UNIT-2 10 Hours	**Analog Modulation:** Amplitude Modulation, modulation index and frequency spectrum. GenerationofAM (Emitter Modulation), Amplitude Demodulation (diode detector), Concept of Single side band generation and detection. Frequency Modulation (FM) and Phase Modulation(PM), modulation index and frequency spectrum, equivalence between FMand PM,Generation of FM using VCO, FM detector (slope detector), Qualitative idea of Super heterodyne receiver Analog Pulse **Modulation:** Channel capacity, Sampling theorem, Basic Principles-PAM, PWM, PPM, modulation and detection technique for PAM only, Multiplexing.	
UNIT-3 15 Hrs	**Digital Pulse Modulation:** Need for digital transmission, Pulse Code Modu1ation,Digita1 Carrier Modulation Techniques, Sampling, Quantization and Encoding. Concept of Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), PhaseShift Keying (PSK), and Binary Phase Shift Keying (BPSK). Optical **Communication:** Introduction of Optical Fiber, Block Diagram of optical communication system.	

UNIT- 4 **12 Hrs**	Introduction to Communication and Navigation systems: Satellite Communication— Introduction, need, Geosynchronous satellite orbits,geostationary satellite advantages of geostationary satellites. Satellite visibility, transponders (C - Band), path loss, ground station, simplified block diagram of earth station. Uplink and downlink.
SUGGESTEDREADINGS	1. Electronic Communications, D. Roddy and J. Coolen, Pearson Education India. 2. Advanced Electronics Communication Systems- Tomasi, 6th edition, Prentice Hall. 3. Modern Digital and Analog Communication Systems, B.P.Lathi, 4th Edition, 2011,Oxford University Press. 4. Electronic Communication systems, G. Kennedy, 3rd Edn., 1999, Tata McGrawHill. 5. Principles of Electronic communication systems — Frenzel, 3rd edition, McGraw Hill 6. Communication Systems, S. Haykin, 2006, Wiley India 7. Electronic Communication system, Blake, Cengage, 5th edition. 8. Wireless communications, Andrea Goldsmith, 2015, Cambridge University Press

B.Sc.-IV	FOURTH SEMESTER	COURSE CODE: DSCELE-04 LAB
PAPER CODE: EDSC-4P	**Credit: Practical-1, Practical: 30 Hours**	
PAPER TITLE: DSCELE-LAB: Communication Electronics		
PRACTICAL MARKS: 50		
Topics (Course contents) **A tentative list lab work that can be amended by teacher /department concerned.**		
30 Hours	1. To design an Amplitude Modulator using Transistor 2. To study envelope detector for demodulation of AM signal 3. To study FM-Generator and Detector circuit 4. To study AM Transmitter and Receiver 5. To study FM Transmitter and Receiver 6. To study Time Division Multiplexing (TDM) 7. To study Pulse Amplitude Modulation (PAM) 8. To study Pulse Width Modulation (PWM) 9. To study Pulse Position Modulation (PPM) 10. To study ASK, PSK and FSK modulators	
Online resources	➢ **e-Resources / e-books and e-learning portals for Physics** ➢ **Use of following sites** ➢ https://www.e-booksdirectory.com/physics.php ➢ https://www.pdfdrive.com/category/66 ➢ https://www.e-booksdirectory.com/listing.php?category=2 ➢ https://www.openculture.com/free-physics-textbooks ➢ https://bookboon.com/en/physics-ebooks ➢ https://www.pdfdrive.com/ https://zlibrary.to/	

Discipline Specific Elective Course (DSEELE-02)

SEMESTER-IV

Paper: Electrical Machines

Course Learning Outcomes

After completing this course, student will be able to

CO-01: Learning about DC machine,DC generator,DC motor.

CO-02: Understand the Types of transformers, Transformer Construction, EMF equation.

CO-03: Learning the concept of Poly Phase Induction Motors.

CO-04: Understanding the principle of Ferrari's (Rotating magnetic field)

CO-05: Knowing the single phase motors, single phase induction motors, construction & priciple

MAPPING MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10	PO-11
CO-01	✓										✓
CO-02	✓		✓							✓	
CO-03						✓			✓		
CO-04			✓			✓					✓
CO-05			✓					✓		✓	

B.Sc.-IV	**FOURTH SEMESTER** **COURSE CODE: DSEELE-02**
PAPER CODE: EDSE-2T	**Credit: (Theory-03,Practical-1), Theory: 45 Hours, Practical: 30 Hours**
PAPER TITLE:	**Electrical Machines**
THEORY MARKS: 100 (SEE: 80 & CCA : 20) **PRACTICAL MARKS: 50**	
Question Pattern-i) Objective Type Question-MCQ, Fill up the blanks, True/False, Total- 10 Q. ii) Very Short Answer Type- Word Limit 70-100, Total-5 Q. iii) Short Answer Type- Word Limit 200-250, Total-5 Q. iv) Long Answer Type- Word Limit 500-600, Total-5 Q.	
UNIT-1 **15 Hours**	**DC Machines:** Basic constructional features and physical principles involved in electrical machines, armature winding (ac and dc), lap and wave connections, different types of pitches **D.C. Generators:** Construction and principles of operation, brief idea about armaturereaction and commutation, E.M.F. Equation. **D.C. Motors:** Comparison of generator and motor action & interchangeability, principle of operation, significance of back EMF
UNIT-2 **13 Hours**	**Transformers:** Types of transformers, Transformer Construction, EMF equation, No load operation, operation under load, Phasor diagram, equivalent circuit of transformer, Transformer Losses, Voltage regulation, condition for maximum efficiency, All day efficiency, Short circuit and open circuit tests.
UNIT-3 **07 Hours**	**Poly Phase Induction Motors:** General constructional features, Types of rotors, Rotating magnetic field (Ferrari's Principle), Induction motor as a generalized transformer, equivalent circuit, Production of torque, Slip, Torque equation, Torque-slip characteristics, Speed control of Induction motor. Comparison with DC motor
UNIT-4 **10 Hours**	**Single Phase Motors:** Single phase induction motors, Construction, principle of operation based on starting methods, Split phase motors, capacitor start motors, capacitor start & run motors, Reluctance Motor, Stepper Motor, Single phase a.c. series motors, Universal motor.
SUGGESTED READINGS	1. B.L. Thareja, A.K. Thareja, A Textbook of Electrical Technology-Vol-II, S.Chand 2. J.B. Gupta, Electrical Technology (Electrical Machines), Katsons 3. I. J. Nagrath and D. P. Kothari, Electrical Machines, Tata McGraw Hill 4. G. Mc. Pherson, An introduction to Electrical Machines & Transformers, John Wiley &Sons 5. H. Cotton, Advanced Electrical Technology, CBS Publishers and Distributors, New Delhi
	Peer/Micro teaching, Class Seminar, Quiz, Group Discussion

B.Sc.-IV	FOURTH SEMESTER	COURSE CODE: DSEELE-02LAB
PAPER CODE: EDSE-2P	Credit: Practical-1, Practical: 30 Hours	
PAPER TITLE: DSEC-LAB: Electrical Machines		
PRACTICAL MARKS: 50		
	Topics (Course contents) A tentative list lab work that can be amended by teacher /department concerned.	
30 Hours	1. Study of characteristics of DC Series motor. 2. Study of characteristics of DC Shunt motor. 3. Study of characteristics of single phase induction motor. 4. Study of characteristics of three phase induction motor. 5. Study of control of DC motor using SCR. 6. Study of Open Circuit Test on single phase transformer. 7. Study of Short Circuit Test on single phase transformer.	

Online resources	➢ **e-Resources / e-books and e-learning portals for Physics** ➢ **Use of following sites** ➢ https://www.e-booksdirectory.com/physics.php ➢ https://www.pdfdrive.com/category/66 ➢ https://www.e-booksdirectory.com/listing.php?category=2 ➢ https://www.openculture.com/free-physics-textbooks ➢ https://bookboon.com/en/physics-ebooks ➢ https://www.pdfdrive.com/ https://zlibrary.to/

. **Discipline Specific Core Course (DSCELE-05)**

P a p

Paper: Microprocessor and Microcontroller

Course Outcomes

Semester-V

After completing the course the students will able to :

CO01: Learning the concepts of **,** Microcomputer Organization: Input/Output Devices. Data storage (idea of RAM and ROM). Computer memory. Memory organization & addressing, Memory Interfacing , Memory Map. 8085 Microprocessor Architecture: Main features of 8085, Block diagram, Pin-outdiagram of 8085,Registers, ALU, Stack memory. Program counter.

CO02: Apply basic knowledge of Instructions set (Data transfer includingstacks).
CO03: Understand the concept of 8051 microcontroller,and its block diagram.
CO04: Explain several phenomena we can observe in everyday life that can be explained
CO05: Understand the working of 8051 I/O port programming: Introduction of I/O port programming, pin out diagram of8051 microcontroller, I/O port pins description & their functions, I/O port programming in 8051 (using assembly language), I/O programming: Bit manipulation.
CO07: In the laboratory course, student will gain hands-on experience of using various Addition and subtraction of numbers using direct addressing mode, Use of CALL and RETURN Instruction, Use one of the four ports of 8051 for O/P interfaced to eight LED's. Simulate binary counter (8 bit) on LED's.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10	PO-11
CO-01	✓								✓	✓	
CO-02	✓		✓								✓
CO-03						✓	✓				
CO-04							✓			✓	
CO-05								✓			✓
CO-06		✓			✓						
CO-07						✓		✓	✓		

B.Sc.-V	FIFTH SEMESTER	COURSE CODE: DSCELE-05
PAPER CODE: EDSC-5T	Credit: (Theory-03, Practical-1),	Theory: 45 Hours, Practical: 30Hours
PAPER TITLE: Microprocessor and Microcontroller		
THEORY MARKS: 100 (SEE: 80 & CCA : 20) PRACTICAL MARKS: 50		
Question Pattern-i) Objective Type Question-MCQ, Fill up the blanks, True/False, Total- 10 Q. ii) Very Short Answer Type- Word Limit 70-100, Total-5 Q. iii) Short Answer Type- Word Limit 200-250, Total-5 Q. iv) Long Answer Type- Word Limit 500-600, Total-5 Q.		

UNIT-1 12 Hours	**Microcomputer Organization:** Input/Output Devices. Datastorage(idea ofRAM andROM). Computer memory. Memory organization & addressing. Memory Interfacing. Memory Map. **8085 Microprocessor Architecture:** Main features of 8085. Block diagram. Pin-outdiagram of 8085. Data and address buses. Registers. ALU. Stack memory. Program counter.
UNIT-2 12Hours	**8085 Programming** :Instruction classification, Instructions set (Data transfer includingstacks. Arithmetic, logical, branch, and control instructions). Subroutines, delay loops. Timing & Control circuitry. Timing states. Instruction cycle, Timing diagram of MOV and MVI. Hardware and software interrupts.
UNIT-3 11 Hours	**8051 microcontroller:** Introduction and block diagram of 8051 microcontroller,architecture of 8051, overview of 8051 family, 8051 assembly language programming, Program Counter and ROM memory map, Data types and directives, Flag bits and Program Status Word (PSW) register, Jump, loop and call instructions.
UNIT-4 10 Hours	**8051 I/O port programming:** Introduction of FO port programming, pin out diagram of805l microcontroller, I/O port pins description & their functions, I/O port programming in 8051 (using assembly language), FO programming: Bit manipulation. **8051 Programming:** 8051 addressing modes and accessing memory locations usingvarious addressing modes, assembly language instructions using each addressing mode, arithmetic and logic instructions, 8051 programming in C: for time delay & FO operations and manipulation, for arithmetic and logic operations, for ASCII and BCD conversions. **Introduction to embedded system:** Embedded systems and general purpose computersystems. Architecture of embedded system. Classifications, applications andpurpose of embedded systems.

SUGGESTED READINGS	1. Microprocessor Architecture Programming & applications with 8085, 2002, R.S. Goankar, Prentice Hall. 2. Embedded Systems: Architecture, Programming & Design, Raj Kamal, 2008,Tata McGraw Hill 3. The 8051 Microcontroller and Embedded Systems Using Assembly and C, M.A. Mazidi,
Practicum(02 Credit)	Peer/Micro teaching, Class Seminar, Quiz, Group Discussion

B.Sc.-V	FIFTH SEMESTER	COURSE CODE: DSCELE-05 LAB
PAPER CODE: EDSC-5P	Credit: Practical-1,	Practical: 30 Hours
PAPER TITLE: DSCC-LAB: Microprocessor and Microcontroller		
PRACTICAL MARKS: 50		

Topics (Course contents)

A tentative list lab work that can be amended by teacher /department concerned.

30 Hours	1. Addition and subtraction of numbers using direct addressing mode 2. Addition and subtraction of numbers using indirect addressing mode 3. Multiplication by repeated addition. 4. Division by repeated subtraction. 5. Handling of 16-bit Numbers. 6. Use of CALL and RETURN Instruction. 7. Block data handling. 8. Other programs (e.g. Parity Check, using interrupts, etc.).
Online resources	➢ **e-Resources / e-books and e-learning portals for Physics** ➢ **Use of following sites** ➢ https://www.e-booksdirectory.com/physics.php ➢ https://www.pdfdrive.com/category/66 ➢ https://www.e-booksdirectory.com/listing.php?category=2 ➢ https://www.openculture.com/free-physics-textbooks ➢ https://bookboon.com/en/physics-ebooks ➢ https://www.pdfdrive.com/ https://zlibrary.to/
SUGGESTED BOOKS	1. Microprocessor Architecture Programming & applications with 8085, 2002, R.S. Goankar, Prentice Hall. 2. Embedded Systems: Architecture, Programming & Design, Raj Kamal, 2008, TataMcGraw Hill 3. The 8051 Microcontroller and Embedded Systems Using Assembly and C, M.A. Mazidi, J.G. Mazidi, and R.D. McKinlay, 2nd Ed., 2007, Pearson Education India.

Generic Elective Course (GECELE-03)

Semester-V

Paper: Microprocessor and Programming

Course Learning Outcomes

At the end of this course, the following concepts will be learnt

CO01: Learning the concepts of **,**Number systems**:** Binary, hexadecimal – conversion from binary to decimal and vice-versa, binary to hexadecimal and vice-versa.

CO02: Learning about the microprocessor Introduction to Microprocessor**,**applications, basic block diagram, speed, word size, memory capacity, classification of microprocessors.

Apply basic knowledge of Instructions set (Data transfer includingstacks).

CO03: Understand the concept of 8051 microcontroller,and its block diagram.

Architecture:Main features of 8085, Block diagram, Pin-outdiagram of 8085,Registers,

CO04: Knowing about the Microcomputer Organization,Input/Output Devices.

Datastorage computer memory. Memory ,memory map.

Explain several phenomena we can observe in everyday life that can be explained

CO05: Knowing about embedded system,architecture and phenomenon.

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10	PO-11
CO-01	✓								✓	✓	
CO-02	✓		✓								✓
CO-03						✓	✓				
CO-04							✓			✓	
CO-05								✓			✓

B.Sc.-V	FIFTH SEMESTER	COURSE CODE: GECELE-03
PAPER CODE: EGEC-3T	Credit: (Theory-03, Practical-1),	Theory: 45 Hours, Practical: 30 Hours
PAPER TITLE: **Microprocessor and Programming**		
THEORY MARKS: 100 (SEE: 80 & CCA : 20) PRACTICAL MARKS: 50		
Question Pattern-i) Objective Type Question-MCQ, Fill up the blanks, True/False, Total- 10 Q. ii) Very Short Answer Type- Word Limit 70-100, Total-5 Q. iii) Short Answer Type- Word Limit 200-250, Total-5 Q. iv) Long Answer Type- Word Limit 500-600, Total-5 Q.		

UNIT-1 10 Hours	**Number systems:** Binary, hexadecimal – conversion from binary to decimal and vice-versa, binary to hexadecimal and vice-versa, decimal to hexadecimal and vice versa, addition and subtraction of binary numbers and hexadecimal numbers. Subtraction using 2's complement, signed number arithmetic.
UNIT-2 10 Hours	**Introduction to Microprocessor:** Introduction, applications, basic block diagram, speed, word size, memory capacity, classification of microprocessors (mention different microprocessors being used)
UNIT-3 10 Hours	**Microcomputer Organization:** Input/Output Devices. Datastorage(idea ofRAM andROM). Computer memory. Memory organization & addressing. Memory Interfacing. Memory Map.
UNIT-4 10 Hours	**8085 Instructions:** Operation code, Operand & Mnemonics. Instruction set of 8085, instruction classification, addressing modes, instruction format. Data transfer instructions, arithmetic instructions, increment & decrement instructions, logical instructions, branch instructions and machine control instructions. **Introduction to embedded system**: Architecture of embedded system,classifications,applications and purpose of embedded systems.

SUGGESTED READINGS	1. The 8051 Microcontroller and Embedded Systems Using Assembly and C, 2. M.A. Mazidi, J.G. Mazidi, and R.D. McKinlay, 2nd Ed., 2007, Pearson Education India. 3. Microprocessor Architecture Programming & applications with 2002, R.S. Goankar, Prentice Hall. 4. Embedded Systems: Architecture, Programming & Design, Raj Kamal, 2008,TataMcGraw Hill

Practicum (02 Credit)	Peer/Micro teaching, Class Seminar, Quiz, Group Discussion

B.Sc.-V	FIFTH SEMESTER	COURSE CODE: GECELE-03LAB
PAPER CODE: EGEC-3T	Credit: Practical-1, Practical: 30 Hours	
PAPER TITLE: DSEC-LAB: Microprocessor and Programming		
PRACTICAL MARKS: 50		

Topics (Course contents)

A tentative list lab work that can be amended by teacher /department concerned.

30 Hours

At least 08 experiments from the following:

1. Addition and subtraction of numbers using direct addressing mode
2. Addition and subtraction of numbers using indirect addressing mode
3. Multiplication by repeated addition.
4. Division by repeated subtraction.
5. Handling of 16-bit Numbers.
6. Use of CALL and RETURN Instruction.
7. Program to generate terms of Fibonacci Series.
8. Program to seach a given number in agiven list.

Online resources

- **e-Resources / e-books and e-learning portals for Physics**

- **Use of following sites**
  - https://www.e-booksdirectory.com/physics.php
  - https://www.pdfdrive.com/category/66
  - https://www.e-booksdirectory.com/listing.php?category=2
  - https://www.openculture.com/free-physics-textbooks
  - https://bookboon.com/en/physics-ebooks
  - https://www.pdfdrive.com/
    https://zlibrary.to/

SUGGESTED BOOKS	1.Basic Electronics: A text lab manual, P.B.Zbar, A.P.Malvino, M.A.Miller, 1994, Mc-Graw Hill. OP-Amps.

Discipline Specific Core Course(DSCELE-06)

Semester VI

Paper Name: Industrial Electronics

Course Outcomes

After completing the course the students will able to :

CO01: Learning about the Thyristor, it's Principle and using SCR.
CO02: Understand the Applications of SCR: Multiple connections of SCR, Series operation, Triggering of series connected SCR, Parallel operation, Triggering of parallel connected SCR, SCR di/dt calculation, Snubber circuit, dv/dt calculation across SCR.
CO03: Understand the Full wave controlled rectifier with resistive load, FWCR with inductive load, FWCR with freewheeling diode
CO04: Understanding the Induction heating, Resistance welding, Over voltage protection, Zero voltage switch, SMPS,UPS, DC circuit breaker, Battery charger, AC static switch, DC static switch. Time delay, Fan regulator using TRIAC.
CO05: Learning about PCB, PCB Advantages, components of PCB. Electronic components, ICs, Surface Mount Devices (SMD). Classification of PCB single, double, multilayer and flexible boards, Manufacturing of PCB, PCB standard

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10	PO-11
CO-01	✓								✓	✓	
CO-02	✓		✓								✓
CO-03						✓	✓				
CO-04							✓			✓	
CO-05								✓			✓

B.Sc.-VI	SIXTH SEMESTER	COURSE CODE: DSCELE-06
PAPER CODE: EDSC-6T Credit: (Theory-03, Practical-1), Theory: 45 Hours, Practical: 30 Hours		
PAPER TITLE: **Industrial Electronics**		
THEORY MARKS: 100 (SEE: 80 & CCA : 20) PRACTICAL MARKS: 50		
Question Pattern-i) Objective Type Question-MCQ, Fill up the blanks, True/False, Total- 10 Q. ii) Very Short Answer Type- Word Limit 70-100, Total-5 Q. iii) Short Answer Type- Word Limit 200-250, Total-5 Q. iv) Long Answer Type- Word Limit 500-600, Total-5 Q.		
UNIT-1 10 Hours	**Thyristors:** Principles and operations of SCR, voltage amplifier gate characteristics of SCR, characteristics of two transistor models, Thyristor construction, rectifier circuit using SCR, GTO, Operation and characteristics of DIAC, TRIAC, Silicon Controlled Switch, Silicon Unilateral Switch, Silicon Bilateral Switch and Light activated SCR. Turn ON/OFF Mechanism: Basics of turn on and turn off methods.	
UNIT-2 10 Hours	**Applications of SCR**: Multiple connections of SCR, Series operation, Triggering of series connected SCR, Parallel operation, Triggering of parallel connected SCR, SCR di/dt calculation, Snubber circuit, dv/dt calculation across SCR, Types of converters, Full wave controlled rectifier with resistive load, FWCR with inductive load, FWCR with freewheeling diode .	
UNIT-3 10 Hours	**Inverters:** Types of inverters, Single phase bridge inverter, Mc Murray impulse communication inverter, Single phase half bridge voltage source inverter, Single phase full bridge voltage inverter, Step down choppers, Step up choppers, Chopper classification. **Other Applications:** Induction heating, Resistance welding, Over voltage protection, Zero voltage switch, SMPS,UPS, DC circuit breaker, Battery charger, AC static switch, DC static switch, Time delay, Fan regulator using TRIAC .	
UNIT-4 10 Hours	PCB Fundamentals: PCB Advantages, components of PCB. Electronic components. IC's, Surface Mount Devices (SMD). Classification of PCB single, double, multilayer and flexible boards, Manufacturing of PCB, PCB standards, Schematic & Layout Design: Schematic diagram, Gener Mechanical and Electrical design considerations. Placing and Mounting of components, Conductor spacing, routing guidelines, heat sinks and package density. Net list, creating components for library. Tracks, Pads, Vias, power plane, grounding, Lead cutting and Soldering Techniques. Testing and quality controls. PCB Technology Trends, Environmental concern in PCB industry.	

SUGGESTED READINGS	Power Electronics: Devices, Circuits and Industrial Applications V.R. MoorthyOxford University Press; First Edition edition Printed circuit BoardDesign & Technology by Walter C. Bosshart, Tata McGraw Hill. Printed Circuit Board Design, Fabrication, Assembly & Testing by R.S.Khandpur, TATA McGraw Hill Publisher
Practicum (02 Credit)	Peer/Micro teaching, Class Seminar, Quiz, Group Discussion

B.Sc.-VI	SIXTH SEMESTER	COURSE CODE: DSCELE-06 LAB
PAPER CODE: EDSC-6P	Credit: Practical-1,	Practical: 30 Hours
PAPER TITLE: DSEC-LAB: Industrial Electronics		
PRACTICAL MARKS: 50		

Topics (Course contents)

A tentative list lab work that can be amended by teacher /department concerned.

30 Hours

At least 06 experiments from the following:

1. Study of I-V characteristics of DIAC
2. Study of I-V characteristics of a TRIAC
3. Study of I-V characteristics of a SCR
4. SCR as a half wave and full wave rectifiers with R and RL loads
5. DC motor control using SCR.
6. DC motor control using TRIAC.
7. AC voltage controller using TRIAC with UJT triggering.
8. Study of parallel and bridge inverter.
9. Design of snubber circuit
10. Study of chopper circuits

Online resources

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- **Use of following sites**
  - https://www.e-booksdirectory.com/physics.php
  - https://www.pdfdrive.com/category/66
  - https://www.e-booksdirectory.com/listing.php?category=2
  - https://www.openculture.com/free-physics-textbooks
  - https://bookboon.com/en/physics-ebooks
  - https://www.pdfdrive.com/
    https://zlibrary.to/

SUGGESTED BOOKS

1. Printed circuit Board Design & Technology by Walter C. Bosshart, Tata McGraw Hill.

2. Printed Circuit Board Design, Fabrication, Assembly & Testing by R.S.Khandpur, TATA McGraw Hill Publisher

Generic Elective Course (GECELE-04)

Semester-VI

Paper: Power Electronics

Course Learning Outcomes

At the end of this course, the following concepts will be learnt

CO-01: The concept of Thyristor it's method and it's application

CO-02: SCR –construction ,working and knowing about it's uses.

CO-03: The introduction to DIAC,characteristics and applications.

CO-04: The concept of TRIAC application and operation

MAPPING OF CO (COURSE OUTCOME) AND PO (PROGRAMME OUTCOME):

POs / COs	PO-01	PO-02	PO-03	PO-04	PO-05	PO-06	PO-07	PO-08	PO-09	PO-10	PO-11
CO-01	✓										
CO-02			✓								✓
CO-03					✓				✓		
CO-04	✓		✓								✓

B.Sc.-VI	SIXTH SEMESTER	COURSE CODE: GECELE-04
PAPER CODE: EGEC-4T	Credit: (Theory-03, Practical-1),	Theory: 45 Hours, Practical: 30 Hours
PAPER TITLE: **Power Electronics**		
THEORY MARKS: 100 (SEE: 80 & CCA : 20) PRACTICAL MARKS: 50		
Question Pattern-i) Objective Type Question-MCQ, Fill up the blanks, True/False, Total- 10 Q. v) Very Short Answer Type- Word Limit 70-100, Total-5 Q. vi) Short Answer Type- Word Limit 200-250, Total-5 Q. vii) Long Answer Type- Word Limit 500-600, Total-5 Q.		

UNIT-1 10 Hours	**Thyristors :** Introduction to Thyristor, four layer diode-Application, Static I-V characteristics,Thyristor , ,turn on method, turn Off characteristic[RRC], turn ON characteristic, Gate characteristics, protection of thyristor.
UNIT-2 10 Hours	**SCR:** Silicon Controlled Rectifier,SCR specifications & applications, construction and symbols of SCR- Reverse blocking mode,Forward blocking mode,Forward conducting mode. Working of SCR, advantage,disadvantage,uses.
UNIT-3 10 Hours	**DIAC:** Introduction,construction of DIAC,operation , V-I characteristic of DIAC,applicationand uses.
UNIT-4 10 Hours	**TRIAC:** Structure & symbol,operation of TRIAC,characteristic,advantage ,disadvantage,uses.
SUGGESTED READINGS	1. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc- Graw Hill. Electronics: Fundamentals and Applications, J.D. Ryder, 200. 2. J Printed circuit Board Design & Technology by Walter C. Bosshart,Tata McGraw Hill. 3. Printed Circuit Board Design, Fabrication, Assembly & Testing by R.S.Khandpur, TATA McGraw Hill Publisher.

B.Sc.-VI	SIXTH SEMESTER	COURSE CODE: GECELE-04LAB
PAPER CODE: EGEC-4P	Credit: Practical-1,	Practical: 30 Hours
PAPER TITLE: DSEC-LAB: Power Electronics		
PRACTICAL MARKS: 50		

Topics (Course contents)

A tentative list lab work that can be amended by teacher /department concerned.

30 Hours

At least 08 experiments from the following:

1. Study of I-V characteristics of DIAC
2. Study of I-V characteristics of a TRIAC
3. Study of I-V characteristics of a SCR
4. SCR as a half wave and full wave rectifiers with R and RL loads
5. DC motor control using SCR.
6. DC motor control using TRIAC.
7. AC voltage controller using TRIAC
8. Study of the working of SCR
9. Study of the operating of RIAC

Online resources

- **e-Resources / e-books and e-learning portals for Physics**

- **Use of following sites**
  - https://www.e-booksdirectory.com/physics.php
  - https://www.pdfdrive.com/category/66
  - https://www.e-booksdirectory.com/listing.php?category=2
  - https://www.openculture.com/free-physics-textbooks
  - https://bookboon.com/en/physics-ebooks
  - https://www.pdfdrive.com/
    https://zlibrary.to/

SUGGESTED BOOKS	1.Basic Electronics: A text lab manual, P.B.Zbar, A.P.Malvino, M.A.Miller, 1994, Mc-Graw Hill. OP-Amps.