CURRICULUM

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

I/II SEMESTER B.E.

POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING
(An Autonomous College Under VTU)
KALABURAGI

Course Title: **BASIC ELECTRICAL ENGINEERING**		
Course Code	**21EE14/24**	CIE: 50
Number of Lecture Hours/Week	2hours (Theory)+ 2 hours (Tutorial)	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03

Prerequisite: Students should have the knowledge of
1. Ohms Law, Kirchhoff's Current and Voltage Law.
2. Fundamentals of AC and DC Circuits.
3. Basics of Magnetism.

Course Objectives:
1. Understanding the concept and analysis of Single phase and Three phase AC circuits.
2. Study of construction and performance analysis of single phase transformer.
3. Study of construction and working principle of DC machines
4. Study of construction and working principle of Three phase AC Machines.
5. Study of Power Generation stations, Tariff, measuring instruments and electric safety measures.

Modules	**Teaching Hours**
Module - I **AC Circuits:** **Single Phase Circuits:** AC terminologies, Analysis of R,L,C,R-LSeries circuits, Disadvantages of low power factor, Measurement of power by VAW method. **ThreePhase Circuits:** Advantages, types of connections, Relation between phase & line values. 3 - phase power measurement by two-wattmeter method for balanced load.	**9hrs**
Module - II **Electromagnetism and Single Phase Transformer:** **Electromagnetism:** Faraday Laws of Electromagnetic Induction, Fleming's rules, Lenz's law, types of EMF and numerical. **Transformer:** Principle, construction and working of single phase transformer, types (based on construction), EMF equation, losses, efficiency and Voltage regulation. (Numerical related to EMF equation and Efficiency)	**9hrs**
Module - III **DC Machines**: **DC generator:** Principle, Construction, working, types and EMF equation. (Numerical on EMF equation) **DC Motor:**Principle, Working, back emf and its significance, torque equation, necessity of starter, 3-point starter. (Numerical on Torque & Voltage Equations)	**8hrs**
Module - IV **Three Phase AC Machines:** **Alternator:** Principle of operation, types and constructional features, EMF equation of alternator.(Excluding the winding factors derivation) Numerical on EMF equation.	

Three phase Induction Motor: Construction, concept of rotating magnetic field, principleof operation, Star – Delta starter.(Numerical on Slip calculations only).	**8hrs**

Module – V	
Generation, Tariff, Measuring Instruments and Electric Safety: **Generation of Power:** Block schematic representation of hydroelectric, thermal, nuclear and solar power generating stations (Self study component). **Tariff:** Objectives of Tariff, Desirable characteristics of Tariff, Three-part tariff. **Measuring Instruments:** Principle, Construction & working of Dynamometer type wattmeter &Single phase energy meter. **Electric Safety:** Necessity of earthing, plate & pipe earthing, Elementary discussion on Fuse & MCB. Electric Shock, Effects, Remedies & Precautions(Self study component).	**7hrs**

Question paper pattern: Total ten questions will be asked,two from each module. The student has to answer five questions, selecting at least one from each module.

Reference books:

1. J P Tiwari," Basic Electrical Engineering", New age Publications, 2nd edition, 2011.
2. Rajendra Prasad “Fundamentals of Electrical Engineering", PHI 3rd edition, 2014.
3. B L Theraja& A K Theraja" Electrical Technology", Vol 1 , 2nd edition.
4. B L Theraja& A K Theraja" ABC of Electrical Engineering", 2nd edition.
5. D.P. Kothari and Nagrath “Theory and Problems in electrical Engineering”, PHI edition 2011.
6. V. N. Mittal and Arvind Mittal;, “ Basic Electrical Engineering” McGraw Hill.
7. R.V. Srinivasa Murthy "Basic Electrical Engineering" Sanguine Technical Publisher2004.

Course outcomes: On completion of the course, the student will have the ability to:

Course Code	CO’s	Course Outcome (CO)
21EE14/24	CO1	State, illustrate electric circuit and solving the networks.
	CO2	State, illustrate magnetic circuit, solving the networks and identify the parts, explain the construction, working and examine the performance of Transformer.
	CO3	Identify the parts, explain the construction, working and examine the performance of DC Machines.
	CO4	Recognize the parts, give the illustration of construction and compute the performance of AC machines.

	CO5	Outline the Power Generating stations, analyze the tariff, synthesize the safety measures and explain the working of measuring instruments.

Course Title: **BASIC ELECTRICAL ENGINEERING LAB**			
Course Code	**21EEL12/22**	Credits:1	CIE: 50
Number of Lecture Hours/Week	3hrs (Practical)		SEE: 50
Total Number of Lecture Hours			SEE Hours: 03

Sl.No.	**List of Experiments**
1	Verification of Kirchoff's Laws.
2	Demonstration of two way control of lamps.
3	Measurement of Power by three voltmeter method.
4	Measurement of power in an inductive circuit using two wattmeter.
5	Calibration of single phase energy meter.
6	Study of MCB.
7	Tube light connection.
8	Measurement of power in a 3 phase circuit using two-wattmeter method.
9	Load test on single phase transformer.
10	Brake load test on 3 phase induction motor.
11	Speed Control of Fan.

Course outcomes: On completion of the course, the student will have the ability to:

Course Code	**CO**	**Course Outcome (CO)**

21EEL12/22	CO1	**Apply Kirchhoff's law for the analysis of DC circuits.**
	CO2	**Illustrate two ways control lamp and tube light connections.**
	CO3	**Measure power in single-phase and three phase circuits and energy using single-phase energy meter.**
	CO4	**Control load test on single-phase transformer to estimate losses and efficiency.**
	CO5	**Conduct brake load test on 3-phase induction motor to estimate slip and efficiency at full load.**

Course Articulation Matrix for the Academic Year 2021-22

S.No.	PO / CO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
1	CO1	3	3				3						1			
2	CO2	3	3													
3	CO3	3	3										1			
4	CO4	3	3				3						1			
5	CO5	3	3				3						1			
CAM	AVERAGE															

Course Title: **ELEMENTS OF ELECTRICAL ENGINEERING**		
Course Code	**22EEE13/23**	**CIE: 50**
Number of Lecture Hours/Week	**2 hours (Theory) + 2hours (practical)**	**SEE: 50**
Total Number of Lecture Hours	**40**	**SEE Hours: 03**
	Credits: 03	

Prerequisite: Students should have the knowledge of
1. Ohms Law, Kirchhoff's Current and Voltage Law.
2. Fundamentals of AC and DC Circuits.
3. Basics of Magnetism.

Course Objectives:
1. Understanding the concept and analysis of Single phase and Three phase AC circuits.
2. Study of construction and performance analysis of single phase transformer.
3. Study of construction and working principle of DC machines
4. Study of construction and working principle of Three phase AC Machines.
5. Study of Power Generation stations, Tariff, measuring instruments and electric safety measures.

Modules	**Teaching Hours**
Module - I **AC Circuits:** **Single Phase Circuits:** AC terminologies, Analysis of R, L, C, R-L Series circuits, Disadvantages of low power factor. **Three Phase Circuits:** Advantages, types of connections, Relation between phase & line values. **Practical Component:** Measurement of power by VAW method.,3-phase power measurement by two-wattmeter method for balanced load.	**8hrs**
Module - II **Electromagnetism and Single Phase Transformer:** **Electromagnetism:** Faraday Laws of Electromagnetic Induction, Fleming's rules, Lenz's law, types of EMF and numerical. **Transformer:** Principle, construction and working of single phase transformer, types (based on construction), EMF equation, losses, (Numerical related to EMF equation and Efficiency) **Practical Component**: efficiency and Voltage regulation.	**8hrs**
Module - III **DC Machines:** **DC generator:** Principle, Construction, working, types and EMF equation. (Numerical on EMF equation) **DC Motor:** Principle, Working, back emf and its significance, torque equation, necessity of starter, 3-point starter. (Numerical on Torque & Voltage Equations) **Practical Component:** DC Shunt Motor and Starter	**8hrs**

Module - IV	
Three Phase AC Machines: **Alternator:** Principle of operation, types and constructional features, EMF equation of alternator.(Excluding the winding factors derivation) Numerical on EMF equation. **Three phase Induction Motor:** Construction, concept of rotating magnetic field, principle of operation, Star – Delta starter.(Numerical on Slip calculations only). **Practical Component:** Auto Transformer, Starter for 3 Phase IM and Effect of phase sequencing.	**8hrs**

Module – V	
Generation, Tariff, Measuring Instruments and Electric Safety: **Generation of Power:** Block schematic representation of hydroelectric, thermal, nuclear and solar power generating stations (Self study component). **Tariff:** Objectives of Tariff, Desirable characteristics of Tariff, Three-part tariff. **Measuring Instruments:** Principle, Construction & working of Dynamometer type wattmeter &Single phase energy meter. **Electric Safety:** Necessity of earthing, plate & pipe earthing, Elementary discussion on Fuse & MCB. Electric Shock, Effects, Remedies & Precautions (Self study component).	**8hrs**

Question paper pattern: Total ten questions will be asked, two from each module. The student has to answer five questions, selecting at least one from each module.

Reference books:

8. J P Tiwari," Basic Electrical Engineering", New age Publications, 2nd edition, 2011.
9. Rajendra Prasad “Fundamentals of Electrical Engineering", PHI 3rd edition, 2014.
10. B L Theraja& A K Theraja" Electrical Technology", Vol 1 , 2nd edition.
11. B L Theraja& A K Theraja" ABC of Electrical Engineering", 2nd edition.
12. D.P. Kothari and Nagrath “Theory and Problems in electrical Engineering”, PHI edition 2011.
13. V. N. Mittal and Arvind Mittal;, “ Basic Electrical Engineering” McGraw Hill.
14. R.V. Srinivasa Murthy "Basic Electrical Engineering" Sanguine Technical Publisher2004.

Course outcomes: On completion of the course, the student will have the ability to:

Course Code	CO’s	Course Outcome (CO)

22EEE13/23	**CO1**	State, illustrate electric circuit and solving the networks.
	CO2	State, illustrate magnetic circuit, solving the networks and identify the parts, explain the construction, working and examine the performance of Transformer.
	CO3	Identify the parts, explain the construction, working and examine the performance of DC Machines.
	CO4	Recognize the parts, give the illustration of construction and compute the performance of AC machines.
	CO5	Outline the Power Generating stations, analyze the tariff, synthesize the safety measures and explain the working of measuring instruments.

Course Articulation Matrix for the Academic Year 2022-23

S.No.	PO / CO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
1	CO1	3	2	1	0	1	1	1	1				1			
2	CO2	3	3	2	1	1	1	0	0				1			
3	CO3	3	2	1	1	1	1	1	1				1			
4	CO4	3	2	2	1	0	1	1	1				1			
5	CO5	3	1	2	0	1	2	1	1			1	1			

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

Two Unit Tests each of30 Marks (duration 01 hour)

- First test after the completion of 30-40 % of the syllabus
- Second test after completion of 80-90% of the syllabus

One Improvement test before the closing of the academic term may be conducted if necessary. However best two tests out of three shall be taken into consideration

Two assignments each of 20 Marks

The teacher has to plan the assignments and get them completed by the students well before the closing of the term so that marks entry in the examination portal shall be done in time. Formative (Successive) Assessments include Assignments/Quizzes/Seminars/ Course projects/Field surveys/ Case studies/ Hands-on practice (experiments)/Group Discussions/ others.. The Teachers shall choose the types of assignments depending on the requirement of the course and plan to attain the Cos and POs. (to have a less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course). CIE methods /test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

The sum of two tests, two assignments, will be out of 100 marks and will be scaled down to 50 marks

Semester End Examination (SEE):

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject **(duration 03 hours)**

- The question paper shall be set for 100 marks. The medium of the question paper shall be English/Kannada). The duration of SEE is 03 hours.
- The question paper will have 10 questions. Two questions per module. Each question is set for 20marks.The students have to answer 5 full questions, selecting one full question from each module. The student has to answer for 100 marks and **marks scored out of 100 shall be proportionally reduced to 50 marks.**
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

Course Title: **INTRODUCTION TO ELECTRICAL ENGINEERING**			
Course Code	**22ESC142/242**		**CIE: 50**
Number of Lecture Hours/Week	**3hours (Theory)**	**Credits: 03**	**SEE: 50**
Total Number of Lecture Hours	**40**		**SEE Hours: 03**

Prerequisite: Students should have the knowledge of
1. Ohms Law, Kirchhoff's Current and Voltage Law.
2. Fundamentals of AC and DC Circuits.
3. Basics of Magnetism.

Course Objectives:
1. Understanding the concept and analysis of Single phase and Three phase AC circuits.
2. Study of construction and performance analysis of single phase transformer.
3. Study of construction and working principle of DC machines
4. Study of construction and working principle of Three phase AC Machines.
5. Study of Power Generation stations, Tariff, measuring instruments and electric safety measures.

Modules	**Teaching Hours**
Module - I **Introduction:** Conventional and non-conventional energy resources; **Power Generation:** Hydel, Nuclear, Solar & wind power generation (Block Diagram approach). **Electromagnetism:** Faraday Laws of Electromagnetic Induction, Fleming's rules, Lenz's law, types of EMF and numerical.	**8hrs**
Module - II **A.C. Fundamentals:** Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor. (only definitions) Voltage and current relationship with phasor diagrams in R, L, and C circuits. Concept of Impedance. Analysis of R-L, Active power, reactive power and apparent power. Concept of power factor. (Simple Numerical). **Three Phase Circuits:** Advantages, three phase connections (Star & Delta) (Excluding Derivations).	**8hrs**
Module - III **DC Machines:** **DC Generator**: Principle of operation, constructional details, induced emf expression, types of generators. Relation between induced emf and terminal voltage. Simple numerical. **DC Motor:** Principle of operation, back emf and its significance. Torque equation, types of motors, Applications of DC motors. Simple numerical. 3-point starter.	**8hrs**
Module - IV **Transformers:** Necessity of transformer, principle of operation, Types and construction of singlephase transformers, EMF equation, losses, variation of losses with respect to load. Efficiency and simple numerical. Three-phase induction	

Motors: Concept of rotating magnetic field, Principle of operation, constructional features of motor, types – squirrel cage and wound rotor. Slip and its significance simple numerical.	**8hrs**
Module – V **Domestic Wiring:** Requirements, Types of wiring: casing, capping. Two way and three way control of load. **Electricity Bill**: Power rating of household appliances including air conditioners, PCs, laptops, printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers. **Equipment Safety measures:** Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. **Personal safety measures:** Electric Shock, Earthing and its types, Safety Precautions to avoid shock.	**8hrs**

Question paper pattern: Total ten questions will be asked,two from each module. The student has to answer five questions, selecting at least one from each module.

Reference books:

1. J P Tiwari," Basic Electrical Engineering", New age Publications, 2nd edition, 2011.
2. Rajendra Prasad "Fundamentals of Electrical Engineering", PHI 3rd edition, 2014.
3. B L Theraja& A K Theraja" Electrical Technology", Vol 1 , 2nd edition.
4. B L Theraja& A K Theraja" ABC of Electrical Engineering", 2nd edition.
5. D.P. Kothari and Nagrath "Theory and Problems in electrical Engineering", PHI edition 2011.
6. V. N. Mittal and Arvind Mittal;, " Basic Electrical Engineering" McGraw Hill.
7. R.V. Srinivasa Murthy "Basic Electrical Engineering" Sanguine Technical Publisher2004.

Course outcomes: On completion of the course, the student will have the ability to:

Course Code	CO's	Course Outcome (CO)
22ESC142/	**CO1**	Understand the concepts of various energy sources and Electric circuits.
	CO2	Apply the basic Electrical laws to solve circuits.
	CO3	Discuss the construction and operation of various Electrical Machines.
	CO4	Identify suitable Electrical machine for practical implementation.

242	**CO5**	Explain the concepts of electric power transmission and distribution, electricity billing, circuit protective devices and personal safety measures.

Course Articulation Matrix for the Academic Year 2022-23

S.No.	PO / CO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
1	CO1	3	2	1	0	1	1	1	1				1			
2	CO2	3	3	2	1	1	1	0	0				1			
3	CO3	3	2	1	1	1	1	1	1				1			
4	CO4	3	2	2	1	0	1	1	1				1			
5	CO5	3	1	2	0	1	2	1	1			1	1			

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

Two Unit Tests each of30 Marks (duration 01 hour)

- First test after the completion of 30-40 % of the syllabus
- Second test after completion of 80-90% of the syllabus

One Improvement test before the closing of the academic term may be conducted if necessary. However best two tests out of three shall be taken into consideration

Two assignments each of 20 Marks

The teacher has to plan the assignments and get them completed by the students well before the closing of the term so that marks entry in the examination portal shall be done in time. Formative (Successive)

Assessments include Assignments/Quizzes/Seminars/ Course projects/Field surveys/ Case studies/ Hands-on practice (experiments)/Group Discussions/ others.. The Teachers shall choose the types of assignments depending on the requirement of the course and plan to attain the Cos and POs. (to have a less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course). CIE methods /test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

The sum of two tests, two assignments, will be out of 100 marks and will be scaled down to 50 marks

Semester End Examination (SEE):

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject **(duration 03 hours)**

- The question paper shall be set for 100 marks. The medium of the question paper shall be English/Kannada). The duration of SEE is 03 hours.
- The question paper will have 10 questions. Two questions per module. Each question is set for 20marks.The students have to answer 5 full questions, selecting one full question from each module. The student has to answer for 100 marks and **marks scored out of 100 shall be proportionally reduced to 50 marks.**
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

Course Title: **Introduction to Solar PV System**		
Course Code	**22ETC15B/22ETC25B**	**CIE: 50**
Number of Lecture Hours/Week	**3hours (Theory)**	**SEE: 50**
Total Number of Lecture Hours	**40**	**SEE Hours: 03**

Prerequisite: Students should have the knowledge of
1. Energy Fundamentals.
2. Renewable energy sources.

Course Objectives:
1. Understanding the need of energy and basics of solar radiations.
2. Study different solar thermal energy applications.
3. Expose to PV Industry and different PV technologies.
4. Study Inverters and different components of PV system.
5. Study the installation of PV systems and O&M.

Modules	**Teaching Hours**
Module – I **Solar Resource and Radiation** **An introduction to Energy Sources:** Energy consumption as a measure of Prosperity, world energy futures and energy sources and their availibity. **Solar Resource and Radiation:** Solar resources, Quantifying solar radiation, The effect of the Earth's atmosphere on solar radiation, Sun geometry, Geometry for installing solar arrays.	**8hrs**
Module – II **Solar thermal energy** **The solar energy option – An overview of thermal applications:** Devices for thermal collection and storage, thermal applications and some observations.	**8hrs**
Module – III **PV Industry and Technology** **PV Industry and Technology:** Semiconductor devices, Mainstream technologies, Mono crystalline silicon, Multi crystalline/polycrystalline silicon, Thin film solar cells, Contacts, Buying solar modules, Standards, Certifications, Warranties, Emerging technologies, Dye-sensitized solar cells, Sliver cells, Hetero junction with intrinsic thin layer (HIT) photovoltaic cells, Solar concentrators. **PV Cells, Modules and Arrays:** Characteristics of PV cells, Graphic representations of PV cell performance, Connecting PV cells to create a module, Specification sheets, Creating a string of modules, Creating an array, Photovoltaic array performance, Irradiance, Temperature, Shading.	**8hrs**
Module-IV **Inverters and Other System Components** **Inverters and Other System Components:** Introduction, Inverters, Battery inverters, Grid-interactive inverters, Transformers, Mainstream inverter technologies, String inverters, Multi-string inverter, Central inverter, Modular inverters, Inverter protection	**8hrs**

systems, Self-protection, Grid protection, Balance of system equipment: System equipment excluding the PV array and inverter, Cabling, PV combiner box, Module junction box, Circuit breakers and fuses, PV main disconnects/isolators, Lightning and surge protection, System monitoring, Metering, Net metering, Gross metering. Mounting Systems: Roof mounting systems, Pitched roof mounts, Pitched roof mounts for tiled roofs, Pitched roof mounts for metal roofs Rack mounts, Direct mounts, Building-integrated systems, Ground mounting systems, Ground rack mounts, Pole mounts, Sun-tracking systems, Wind loading.	
Module-V **Installing Grid-connected PV Systems** **Installing Grid-connected PV Systems:** PV array installation, DC wiring, Cabling routes and required lengths, Cable sizing, PV combiner box, System grounding/earthling, Inverter installation, Installation checklist, Interconnection with the utility grid, Required information for installation, Safety. **System Commissioning:** Introduction, Final inspection of system installation, Testing, Commissioning, System documentation. **System Operation and Maintenance:** System maintenance, PV array maintenance, Inverter maintenance, System integrity, Troubleshooting, Identifying the problem, Troubleshooting PV arrays, Troubleshooting underperforming systems, Troubleshooting inverters, Other common problems.	**8hrs**

Question paper pattern: Total ten questions will be asked, two from each module. The student has to answer five questions, selecting at least one from each module.

Reference books:

1. Chetan Singh Solanki, Solar Photovoltaic Technology And Systems - A Manual For Technicians, Trainers And Engineers, PHI Publication New Delhi- 2013 Edition.

2.Geoff Stapleton Susan Neill, Grid-connected Solar Electric Systems: The Earthscan Expert Handbook for Planning, Design and Installation, Routledge; 1st edition 2021.

3. Chetan Singh Solanki, Solar Photovoltaic's**:** Fundamentals, Technologies And Applications **,** PHI Publication New Delhi, 3rd Edition

4. GD Rai, Non Convention Sources of Energy, Khanna Publishers, New Delhi, 5th Edition

5..SP Sukhatme, JK Nayak, Solar Energy, TMH Publishing Company limited New Delhi, 3rd Edition.

Course outcomes: On completion of the course, the student will have the ability to:

Course Code	CO's	Course Outcome (CO)
22ETC15B/	**CO1**	Understand the needs of energy and discuss the solar radiation.
	CO2	Appreciate the solar thermal energy applications.
	CO3	Discuss the PV technology and Industry.
	CO4	Identify the components of PV system and Inverters.

25B	**CO5**	Understand the installation of PV system and O&M of PV systems

Course Articulation Matrix for the Academic Year 2022-23

S.No.	PO / CO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
1	CO1	3	2	0	0	1	0	0	0				0			
2	CO2	3	0	0	1	1	1	0	0				1			
3	CO3	3	3	1	1	1	1	1	1				1			
4	CO4	3	0	0	1	0	1	1	1				1			
5	CO5	3	3	3	0	1	2	1	1				0			

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

Two Unit Tests each of30 Marks (duration 01 hour)

- First test after the completion of 30-40 % of the syllabus
- Second test after completion of 80-90% of the syllabus

One Improvement test before the closing of the academic term may be conducted if necessary. However best two tests out of three shall be taken into consideration

Two assignments each of 20 Marks

The teacher has to plan the assignments and get them completed by the students well before the closing of the term so that marks entry in the examination portal shall be done in time. Formative (Successive) Assessments include Assignments/Quizzes/Seminars/ Course projects/Field surveys/ Case studies/ Hands-on practice (experiments)/Group Discussions/ others.. The Teachers shall choose the types of assignments depending on the requirement of the course and plan to attain the Cos and POs. (to have a less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course). CIE methods /test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

The sum of two tests, two assignments, will be out of 100 marks and will be scaled down to 50 marks

Semester End Examination (SEE):

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject **(duration 03 hours)**

- The question paper shall be set for 100 marks. The medium of the question paper shall be English/Kannada). The duration of SEE is 03 hours.
- The question paper will have 10 questions. Two questions per module. Each question is set for 20marks.The students have to answer 5 full questions, selecting one full question from each module. The student has to answer for 100 marks and **marks scored out of 100 shall be proportionally reduced to 50 marks.**
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.