

DAYANANDA SAGAR ACADEMY OF TECHNOLOGY & MANAGEMENT



CURRICULUM

Scheme and Syllabus V to VI Semester

Outcome Based Education

(Academic Year 2025-2026)

Department of Electrical & Electronics Engineering

5th & 6th Semester B.E

ABOUT THE INSTITUTE

Dayananda Sagar Academy of Technology and Management- DSATM was established in 2011 with 5 UG Programmes and 1 PG Program, the programmes are approved by All India Council for Technical Education (AICTE) New Delhi, Affiliated to Visvesvaraya Technological University (VTU), Belagavi and DSATM is an autonomous institute from 2023-2024.

The Dayananda Sagar Institutions is one of pioneer institutions in India and abroad with six decades of excellence in Academic and Research. The newer campuses were necessary to accommodate the growing need of the technology and innovation.

DSATM nurtures the students in academic, research, sports, cultural and extracurricular activities.

- Creating an academic environment to nurture and develop competent entrepreneurs, leaders and professionals who are socially sensitive and environmentally conscious.
- Integration of Outcome Based Education and cognitive teaching and learning strategies to enhance learning effectiveness.
- Developing necessary infrastructure to cater to the changing needs of Business and Society.
- Optimum utilization of the infrastructure and resources to achieve excellence in all areas of relevance.
- Adopting learning beyond curriculum through outbound activities and creative assignments.
- Imparting contemporary and emerging techno-managerial skills to keep pace with the changing global trends.
- Facilitating greater Industry-Institute Interaction for skill development and employability enhancement.
- Establishing systems and processes to facilitate research, innovation and entrepreneurship for holistic development of students.
- Implementation of Quality Assurance System in all Institutional processes.

VISION OF THE INSTITUTE

To strive at creating the institution a centre of highest calibre of learning, so as to create an overall intellectual atmosphere with each deriving strength from the other to be the best of engineers, scientists with management & design skills.

MISSION OF THE INSTITUTE

- To serve its region, state, the nation and globally by preparing students to make meaningful contributions in an increasing complex global society challenges.
- To encourage, reflection on and evaluation of emerging needs and priorities with state-of-the-art infrastructure at institution.
- To support research and services establishing enhancements in technical, economic, human and cultural development.
- To establish interdisciplinary centre of excellence, supporting/ promoting student's implementation.
- To increase the number of Doctorate holders to promote research culture on campus.
- To establish IIPC, IPR, EDC, innovation cells with functional MOU's supporting student's quality growth.

QUALITY POLICY

Dayananda Sagar Academy of Technology and Management aims at achieving academic excellence through continuous improvement in all spheres of Technical and Management education. In pursuit of excellence cutting – edge and contemporary skills are imparted to the utmost satisfaction of the students and the concerned stakeholders.

ABOUT THE DEPARTMENT

The department established during the 2011-2012 academic session with an initial intake of 60 students, the EEE Department aims to provide quality professional education to students nationwide, with a special focus on the Karnataka region. We offer a four-year (8-semesters) B.E. Programme under Visvesvaraya Technological University (VTU).

The department boasts excellent infrastructure, a highly talented teaching faculty, and a dedicated Training and Placement Cell, ensuring a bright future for our students. We are confident that our students will emerge as assets not only to this institution and the organizations they join but also to the country at large.

Credentials of the Department:

- Accredited by NBA-AICTE, New Delhi
- Approved by AICTE, New Delhi
- Permanently affiliated with Visvesvaraya Technological University (VTU)

The EEE department at DSATM encompasses a wide range of traditional and disruptive technologies in core and IT fields, including Smart Grid, Advanced Meter Infrastructure (AMI), EV-Battery Management Systems, Microgrids, Distributed Energy Resources (DERs), Better Battery Technologies, Cybersecurity in the Power Industry, Blockchain Technology in the Energy Market, IoT/IIoT, and Automation. The flexibility and heterogeneity of the EEE program at DSATM equip students with special personal skills, making them successful engineers and entrepreneurs.

VISION OF THE DEPARTMENT

To impart quality education and to develop a supportive and collaborative learning environment to meet the challenges by innovation and integration, consequently reflecting effective progress of our students in making a real difference in their profession and society.

MISSION OF THE DEPARTMENT

- M1: To provide a student-centric learning environment that facilitates the students to pursue their higher education.
- M2: To motivate the students to work professionally in several fields through pedagogy teaching and learning process.
- M3: To help students in developing their overall professional competence and social awareness by providing value-based and behavioral training programs.
- M4: To impart a supportive ecosystem to cultivate the innovation, research, and entrepreneurial culture in the faculty and students.

PROGRAM EDUCATION OBJECTIVES (PEO'S):

- PEO-1: Graduates will excel in their profession and career by applying the concepts of Electrical and Electronics Engineering.
- PEO 2: Graduates will have the potential to work in diverse sub domains of professional field.
- PEO 3: Graduates will have the desire for higher education and lifelong learning.
- PEO 4: Graduates will have fidelity regarding ethical and social responsibilities.

PROGRAM OUTCOMES (PO's)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO's)

PSO-1: Able to formulate, investigate the various problems in Power Systems, Power Electronics, Control Systems, Electrical Machines and Drives for different application.

PSO-2: Able to inculcate the knowledge of sustainable technologies with modern tools.



Dayananda Sagar Academy of Technology & Management
(Autonomous Institute under VTU)

Affiliated to **VTU**
Approved by **AICTE**
Accredited by **NAAC** with **A+** Grade
6 Programs Accredited by **NBA**
(CSE, ISE, ECE, EEE, MECH, CV)

PROPOSED UG CREDIT STRUCTURE IN ALIGNMENT WITH VTU

Sl.No	Semester	No. of Credits
1	1 st Semester	20
2	2 nd Semester	20
3	3 rd Semester	21
4	4 th Semester	21
5	5 th Semester	22
6	6 th Semester	22
7	7 th Semester	20
8	8 th Semester	14
Total		160

PROPOSED UG SCHEME

Sl. No	Course Category	BOS	TD	Teaching Hours/Week					Credits
				Lecture	Tutorial	Practical	Project	Total	
				L	T	P	S	(Hrs/week)	
1	IPCC-1	EEE	EEE	2	2	2	0	6	4
2	IPCC-2	EEE	EEE	2	2	2	0	6	4
3	PCC-1	EEE	EEE	3	0	0	0	3	3
4	PCC-2	EEE	EEE	2	2	0	0	4	3
5	ETC	EEE	EEE	3	0	0	0	3	3
6	PCCL	EEE	EEE	0	0	2	0	2	2
7	AEC	EEE	EEE	0	0	0	2	2	1
8	SCR	EEE	EEE	0	0	2	0	2	1
9	NCMC	NSS / YOGA / PED							
10	AICTE Activity Points								
Total									21

Percentage of Mapping– Theory & Practical - Scheme & Syllabus- 3rd & 4th Sem

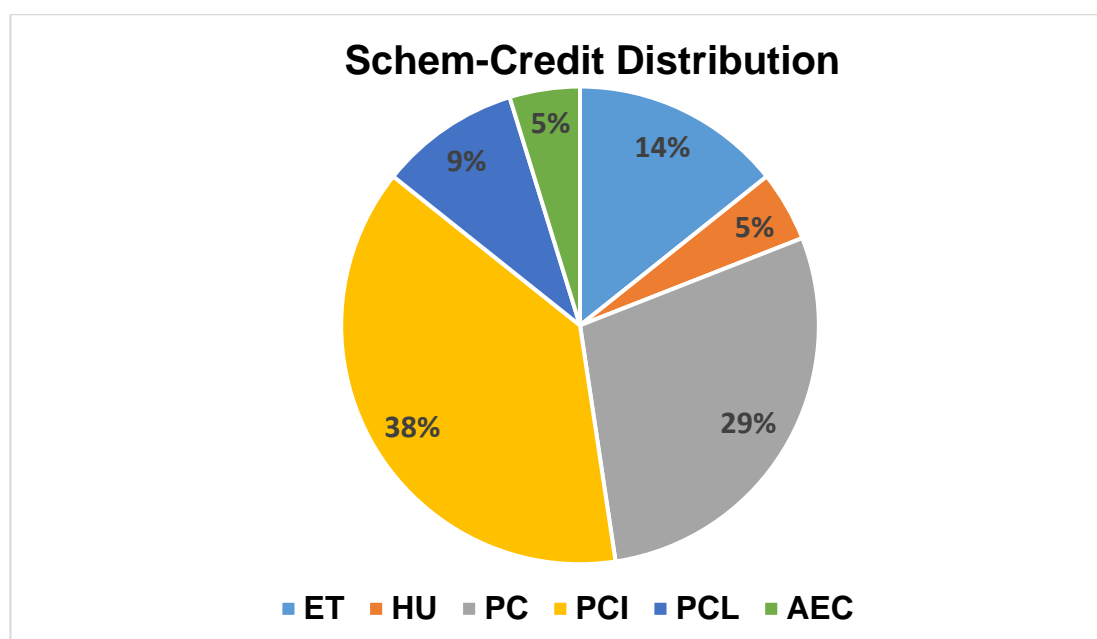
3rd Sem & 4th Sem

Sl. No	Course Category	Component			
		Theory	Practical	Outreach	YOGA/SPORTS
1	IPCC-1	60%	40%	--	--
2	IPCC-2	60%	40%	--	--
3	PCC-1	100%	--	--	--
4	PCC-2	100%	--	--	--
5	ETC	100%			
6	PCCL	--	100%	--	--
7	AEC	--	100%	--	--
8	SCR	--	--	100%	--
9	NCMC	--	--	--	100%
Total Percentage		53%	47%	13%	13%

Scheme Distribution (5th & 6th SEM)

Department of Electrical & Electronics Engineering

Course Component	Credits	% of Credits
Basic Science (BS)	0	
Engineering Technology (ET)	3+3=6	14.3
Humanities (HU)	1+1=2	4.76
Program core (PC)	6+6=12	28.57
Program core Integrated (PCI)	8+8=16	38.09
Program core exclusive Lab(PCL)	2+2=4	9.52
Program elective (PE)	0	0
Open Elective (OE)	0	0
Internship (INT)	0	0
Ability Enhancement course (AEC)	1+1=2	4.76
Project (PR)	0	
Total	42	100



SEMESTER WISE CREDIT BREAKDOWN FOR B.E. DEGREE CURRICULUM

BATCH 2023-2027

Course Category	Semester								Total Credits
	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	
Basic Sciences (BSC)	8	8							16
Engineering Sciences (ESC) / Emerging Technology Course(ETC)	9	9	3	3					24
Humanities, Social Sciences and Management (HSMC)	2	2	1		5				10
Ability Enhancement Course (AEC)	1	1	1	1		1			5
Universal Human Values (UHV)				1					1
Professional Core Courses (PCC)			6	6	6	7	4		29
Integrated Professional core Course (IPCC)			8	8	4	4	4		28
Professional Core Laboratory (PCL)			2	2	2	2			8
Professional Elective Course (PEC)					3	3	3		9
Institutional Open Elective Courses (IOE)						3	3		6
Internship (INT)								12	12
Mini Project / Project Work (PW)					2	2	6		10
Technical Seminar								2	2
Non-credit Mandatory Courses (NCMC)			(1)	(1)					
Total Credits	20	20	21	21	22	22	20	14	160



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Scheme of Teaching and Examinations – 2025
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from 2025-26)

5th Semester: Electrical & Electronics Engineering (EEE)

Sl. No	Course Code	Course Title	Course Category	BOS	TD	Teaching Hours/Week					Credits	Examination			
						Lecture	Tutorial	Practical	Project	Total		SEE Duration (Hrs)	CIE Marks	SEE Marks	Total Marks
						L	T	P	S	I					
1	BEE501	Signals & DSP	IPCC	EEE	EEE	2	2	2	0	6	4	3	50	50	100
2	BEE502	Power Electronics	PCC	EEE	EEE	2	2	0	0	4	3	3	50	50	100
3	BEE503	Modern Control Theory	PCC	EEE	EEE	2	2	0	0	4	3	3	50	50	100
4	BEE504	Engineering M & E	HSMS	EEE	EEE	3	0	0	0	3	3	3	50	50	100
5	BEE515X	Professional Elective-I	PEC-1	EEE	EEE	3	0	0	0	3	3	3	50	50	100
6	BEE506	Mini Project	Min-Proj	EEE	EEE	0	0	0	6	6	2	3	50	50	100
7	BEEL507	Power Electronics Lab	PCCL	EEE	EEE	0	0	2	0	2	2	3	50	50	100
8	BESK508	Environmental Studies	MC	EEE	CV	2	0	0	0	2	2	3	50	50	100
9	BNSK509	National Service Scheme (NSS)	NCCM	NSS coordinator		0	0	2	0	2	0	--	100	--	100
	BPEK509	Physical Education (PE) (Sports and Athletics)		PED											
	BYOK509	Yoga		Yoga Teacher											
Total						14	6	6	6	32	22	24	500	400	900

Professional Elective-I

BEE515A	Fundamentals of VLSI
BEE515B	Quantum Technologies and Applications
BEE515C	EV Technology- Fundamentals of Electric Vehicles & Powertrain Systems
BEE515D	Electrical Machine Design

Mini Project: As part of the undergraduate curriculum, a **Mini Project** is introduced to enhance students' practical and problem-solving skills. This component is directly linked with the **Skill Enhancement Courses (SECs)** offered in emerging technology areas such as:

- Renewable Energy Systems
 - Electric Vehicle (EV) Technologies
 - Industrial Automation
 - Internet of Things (IoT), Machine Learning, and other interdisciplinary/emerging domains
-

Purpose and Integration:

- The mini project is designed to **complement the concepts** taught in the corresponding skill enhancement course.
- It will encourage **innovation, application of theoretical knowledge**, and exposure to real-world technical challenges.
- Each student/group will **select a topic/project idea aligned with the SEC theme** and work under faculty supervision.

6th Semester: Electrical & Electronics Engineering (EEE)

Sl. No	Course Code	Course Title	Course Category	BOS	TD	Teaching Hours/Week					Credits	Examination			
						Lecture	Tutorial	Practical	Project	Total		SEE Duration (Hrs)	CIE Marks	SEE Marks	Total Marks
						L	T	P	S	I					
1	BEE601	High Voltage and Power System Protection	IPCC	EEE	EEE	2	2	2	0	6	4	3	50	50	100
2	BEE602	Power System Analysis	PCC	EEE	EEE	3	2	0	0	5	4	3	50	50	100
3	BEE603	Solar & Wind Energy Systems	PCC	EEE	EEE	3	0	0	0	3	3	3	50	50	100
4	BEE604X	Professional Elective-II	PEC-2	EEE	EEE	3	0	0	0	3	3	3	50	50	100
5	BEE605X	Open Elective course-1	OEC-1	EEE	EEE	3	0	0	0	3	3	3	50	50	100
6	BEEL606	Power System Analysis Laboratory	PCCL	EEE	EEE	1	0	2	0	2	2	3	50	50	100
7	BEE607	Project Phase-1	Proj	EEE	EEE	1	0	0	2	4	2	3	100	--	100
8	BEE608X	Ability Enhancement course	AEC	EEE	EEE	0	0	2	0	2	1	3	50	50	100
9	BNSK658	National Service Scheme (NSS)	NCCMC	NSS coordinator		0	0	2	0	2	0	--	100	--	100
	BPEK658	Physical Education (PE) (Sports and Athletics)		PED											
	BYOK658	Yoga		Yoga Teacher											
Total						14	4	8	4	30	22	24	550	350	900

Professional Elective-II

BEE604A	Electric Motor and Drive Systems for Electric Vehicles
BEE604B	Power Electronics for RES
BEE604C	EVT- Battery Energy Storage & Charging Infrastructure for Electric Vehicles
BEE604D	Embedded System Design

Ability Enhancement Course :

BEE608A	Energy Management in Electric Vehicles
BEE608B	Energy Audit Project
BEE608C	Solar Rooftop PV Systems: Design, Integration, and Policy
BEE608D	Simulation of Control of Power Electronics Circuits

Open Elective-I

BEE605A	Utilization of Electrical Power
BEE605B	Industrial Servo Control Systems
BEE605C	Renewable Energy Sources

Project Phase-1: As part of the UG curriculum, **Project Phase-1** includes **1 hour of theory and 2 hours of project work** per week.

- (a) During the **theory hour**, students will be introduced to essential concepts of **research methodology**, including:
- Selection of research/project topics
 - Conducting a literature survey
 - Problem formulation techniques
 - Research ethics and methodology
 - Introduction to **Intellectual Property Rights (IPR) etc.**
- (b) **A workshop will be conducted based on Research Methodology and IPR.**
- (c) **Orientation on Research Paper writing**

Guidelines (Literature Survey Based)**Objective:**

Project Phase-1 aims to build students' capability in conducting a structured literature survey to lay the foundation for their final year project (Phase-2). This phase focuses on exploring current research, identifying gaps, and formulating a problem statement.

(i) Research Methodology Sessions (Theory):

- Introduction to academic research
- Sources of credible research: IEEE, Springer, Elsevier, Science Direct, etc.
- Search techniques and keyword strategy
- Referencing styles (APA/IEEE) and avoiding plagiarism
- Basics of IPR and ethical practices in research

(ii) Literature Review Process (Project Work):

- Identify at least 35–45 relevant research papers/journals
- Organize literature chronologically or thematically
- Prepare a comparison matrix (key contributions, methods, gaps)
- Summarize key findings and critical observations

(iii) Documentation:

- Submit a structured **Literature Survey Report** that includes:
 - Introduction & topic justification
 - Review of existing work
 - Comparison table/chart
 - Identified gap
 - Tentative problem statement & objectives
 - References

(iv) Evaluation Criteria:

Component	Weightage (%)
Topic relevance & justification	10%
Depth of literature review	25%
Analysis & Identification of Research Gaps	20%
Problem statement clarity and Methodology	15%
Report writing & presentation	20%
Paper Presentation	10%

IPCC: Integrated Professional Core Course,

PCC: Professional Core Course

PBL: Project Based Learning

AEC: Ability Enhancement Course,

NCMC: Non-Credit Mandatory Course

L: Lecture,

T: Tutorial,

P: Practical

S= SDA: Skill Development Activity,

CIE: Continuous Internal Evaluation,

SEE: Semester End Evaluation.

Integrated Professional Core Course (IPCC): Refers to Integrated Professional Core Course Theory Integrated with practical's of the same course. Credit for IPCC can be 04 and its Teaching Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

Non Credit Mandatory Course (NCMC) - National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Newly introduced subjects in the syllabus

		5 th Semester	6 th Semester
1.	List of Existing Elective Courses	Nil	Nil
2.	List of New Existing Elective Courses	1. EV Technology- Fundamentals of Electric Vehicles & Powertrain Systems. 2. Quantum Technologies and Applications	1. Solar Rooftop PV Systems: Design, Integration, and Policy
3.	List of New Industry Aligned Courses	1.Modern Control Theory 2.Solar & Wind Energy Systems	1. EVT- Battery Energy Storage & Charging Infrastructure for Electric Vehicles

Percentage of Change in the Syllabus

5 th Semester						
Sl.No	Course Code	Course Name	Topics Added	Topics removed	Revised in %	Justification
1	BEE501	Signals and DSP	<ul style="list-style-type: none"> Digital Signal Processor Multirate Digital Signal Processing 		40%	<ul style="list-style-type: none"> Students need to know the application of basic digital signal processor used for processing the signals.
2	BEE515C	EV Technology- Fundamentals of Electric Vehicles & Powertrain Systems.	<ul style="list-style-type: none"> PMSM, BLDC, SRM special Machines BMS, SOC,SOH V2X infrastructure 	battery charging control	20%	<ul style="list-style-type: none"> Students need to know the resent machines used for EV with BMS and trending infrastructure
	BEE515A	Fundamentals of VLSI	<ul style="list-style-type: none"> Testing of VLSI Circuits 		10%	<ul style="list-style-type: none"> Students need to know about the various methodology used to test VLSI Circuits

6th Semester						
Sl.No	Course Code	Course Name	Topics Added	Topics removed	Revised in %	Justification
1	BEE613A	Electric Motor and Drive Systems for Electric Vehicles.	<ul style="list-style-type: none"> • Brushless DC Motor Drives and PMSM Drive control techniques. • Space vector analysis 	<ul style="list-style-type: none"> • Induction motor and Dc motor Basics 	30%	<ul style="list-style-type: none"> • Students need to know new motor control techniques.
2	BEE613D	Embedded Systems Design	<ul style="list-style-type: none"> • Hardware Software Co Design and Program Modeling • Embedded System Firmware Design • ARM Cortex M3 Micro Controller 	<ul style="list-style-type: none"> • Basics of Embedded System 	60%	<ul style="list-style-type: none"> • Students have prior knowledge about the basics of Embedded System and its operation. • Students learn about the Differences between ARM 7 and ARM Cortex M3 Micro Controller and Design and Development of Hardware Software Co Design and Program Modeling and Firmware

5th SEMESTER

**INTEGRATED
PROFESSIONAL CORE
COURSE (IPCC)**

IPCC Course – Integrated Professional Core Course

Teaching Hours/Week (L: T:P: S)	2:2:2:0
Total Hours of Pedagogy	40 hours Theory + 20 Hours of Practical Classes
Credits:	04
Theory - Each Module	8 Hrs
Practical's	8-10 Programs / Experiments
CIE Marks	50
SEE Marks	50
Total Marks	100
Exam Hours	3
Examination nature (SEE)	Theory

- The theory part of the IPCC shall be evaluated both by CIE and SEE.
- The practical part shall be evaluated by only CIE (no SEE).
- However, questions from the practical part of IPCC shall be included in the SEE question paper.

Integrated Professional Core Course (IPCC) - 4 Credit Course

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) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).
- A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures 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) for the Theory component of the IPCC (Maximum marks 50)

Internal Assessment Test (IAT):

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are 25 marks and that for the practical component is 25 marks.
- 25 marks for the theory component are split into 15 marks for two Internal Assessment Tests (Two Tests, each of 50 Marks with 01-hour 30 minutes' duration, are to be conducted and average of two tests to be reduced to 15 marks) and 10 marks for Two Continuous Comprehensive Assessment(CCA) methods.

- The first Internal test at the end of 40-50% coverage of the syllabus
- The second Internal test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for 25 marks).
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

The IA test questions are to be framed to map the Course Outcomes (COs), Program Outcomes (POs) and the Revised Blooms Taxonomy (RBT) Levels. Emphasis to be given for Higher order Thinking Skills(HOTS).

Continuous Internal Evaluation (CIE) for the practical component of the IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and Marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report, **05 Marks** are for conducting the experiment, **05 Marks** for preparation of the laboratory record, **5 Marks** for conducting Open Ended Experiments Each experiment. Marks of all experiments' write-ups are added to 15 marks.
- The Practical laboratory test (**duration 03 hours**) at the end of the 15th week of the semester/after completion of all the experiments (whichever is early) shall be conducted for **50 Marks** and scaled down to **5 Marks**.
- The open-ended experiment after completion of all the experiments shall be conducted for 20 marks with a split-up for 5 Marks for writeup, 10 Marks for Execution, and 5 Marks for Viva-Voce. Marks for writeup, Execution and Viva-Voce is added and scaled down to 05 marks.
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 25 marks.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

Semester End Examination (SEE) for IPCC Theory

SEE will be conducted as per the scheduled timetable, with common question papers for the course (duration 03 hours)

- The question paper will have ten questions. Each question is set for 20 marks.

- The question paper shall be set for 100 Marks. The medium of the question paper shall be English. **The duration of SEE is 03 hours.**
- 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. The two questions shall be of same course outcome, program outcome and Blooms RBT level. Emphasis to be given for higher order RBT levels.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored by the student shall be proportionally scaled down to 50 Marks.
- The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only.
- Questions mentioned in the SEE paper may include questions from the practical component.

Continuous and Comprehensive Assessment (CCA):

Two of continuous and comprehensive assessment (CCA) to be conducted to attain COs and POs, evaluated each for **50 Marks**. Total Marks scored will be $(CCA1+CCA2)/2$ and scaled down to **10 Marks**.

- CCA1 after 4th week and CCA2 after 9th week. The Assessment will be through rubrics.
- CCA as project-based learning,
 - CCA is evaluated for **50 Marks** with review 1 of **20 Marks** after and review 2 of **30 Marks** includes project demonstration/competition and report submission.
 - The evaluation of review 1 after 6th weeks of semester and review 2 after 12th week of semester with project demonstration and submission of the report

Total score for CCA is **10 Marks**

Total Marks scored for theory component of CIE (IAT+ CCA) is **25 Marks**

Possible Continuous and Comprehensive Assessment (CCA):

- Project based, Problem Based, Building Models, Lab-to-Land, Mobile Studio, Design and Programming Contest, Certification, Concept Map (Collage presentation/poster presentation), Case studies, Think-Pair-Share, Flipped classroom,
- The assessment of these techniques shall be in rubrics.
- The faculty can adopt any other CCA method of implementation and its assessment with prior approval of Program Assessment Committee (PAC).

4 Credits Courses – Integrated Professional Core Course (IPCC)

Assessment Method	Component	Type of Assessments	Syllabus Coverage	Maximum Marks	Average	Reduced Marks	Minimum Passing Marks	Evaluation Details
Total CIE Theory + Practical				50	----	----	20	
CIE	Theory	Internal Assessment Test (IAT) – I	Module – 1 to 2.5	50	(50+50) / 2	15	6	Average of Two Internal test each of 50 Marks scale down the marks to 15 Marks
		Internal Assessment Test (IAT) – II	Module – 2.5 to 5	50				
	Continuous Comprehensive Assessment (CCA)	CCA-1- Pedagogical Initiatives / Activity based learning	Considering all the Modules	50	(50+50) / 2	10	4	Two CCA methods as per VTU Clause 22OB4.2 of regulations to be adopted. If CCA chosen is Project Based Learning, then one assessment method may be adopted
		CCA-2- Pedagogical Initiatives/ Activity based learning		50				
	Total CIE Theory						25	10

CIE	Practical	Conduction of Experiments	Performance- Continuous Evaluation of each experiment	05	15	Average of all Experiments	15	4	Performance of the Experiment (On completion of every experiment/progr am in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. 20 marks are for conducting the experiment and calculations/obse rvations/output)
			Record	05					
			Observation book	05					
		Practical Test	Write up	15	50	----	05	4	One Internal Practical Test after conduction of all Experiments for 50 Marks
			Execution	25					
			Viva-voce	10					
		Open Ended Experiment	Write up	05	20	----	05	2	One experiment for 20 marks. 20 marks reduced to 05 marks
			Execution	10					
			Viva-voce	05					
			Total CIE Practical						25

								Open-Ended Experiment
SEE		Theory exam	Entire theory syllabus including questions from lab Component in respective Modules	100	----	50	20	SEE Exam is theory Exam conducted for 100 Marks, scored Marks are scaled down to 50 Marks
CIE + SEE				100	----	----	40	

- The Minimum Marks to be secured in CIE to appear for SEE shall be 10 (40% of Maximum Marks – 25) in the Theory Component and 10 (40% of Maximum Marks – 25) in the Practical component.
- The Laboratory Component for the IPCC shall be for CIE only.
- However, in SEE, the Questions from the Laboratory Component shall be included in the respective Modules only.

Note: If few of the 3 Credit Courses are Integrated course type, for such courses the method suggested for 4 Credit IPCC Course shall be followed



Dayananda Sagar Academy of Technology & Management
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Semester	:	5		
Course Title	:	Signals and DSP		
Course Code	:	BEE501		
Course Type (Theory/ Practical/ Integrated)	:	Integrated		
Category	:	IPCC		
Stream	:	EEE	CIE	: 50
Teaching hours/ week (L:T:P:S)	:	2:2:2:0	SEE	: 50
Total Hours	:	40+20	SEE	: 3 hours
Credits	:	4	Duration	

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Understand the elementary signals, convolution applied to LTI systems, effectiveness of FFT over conventional computation, nature of IIR filters and FIR filters.
2	Apply the knowledge of elementary signals to solve the convolution of signals, Continuous time and Discrete time systems by various methods and fast and effective techniques to find DFT and its inverse, DFT techniques to linear filters, different forms to realize FIR and IIR filters.
3	Analyze the DFT using properties, appropriate filter designs for finite response and infinite impulse response filters
4	Determine DFT of various signals by formula and fast Fourier transform method, filter design and their realization for FIR and IIR filters
	Simulate and test the LTI systems, filter designs and DFT operations using modern tool.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to of basic MATLAB programming
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL)**, which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.

- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.



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Scheme of Teaching and Examinations for BE Programme -2025-26
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COURSE CURRICULUM

Module No.	Topics	Hours
1	Signals and Systems: Introduction to Signals and systems, classification of signals, Basic Operations on Signals, Basic Elementary Signals, properties of systems. Time-domain representations for LTI systems: Convolution, impulse response representation, Convolution Sum and Convolution Integral, properties of impulse response representation, properties of LTI system .	8
Pedagogy	Chalk and Talk, Experiential Learning.	
2	Analog IIR Filters: Characteristics of commonly used Analog Filters–Butterworth and Chebyshev Type-1 filters, Design of analog filters, Frequency transformation in the Analog Domain. Digital IIR Filters: Analog to Digital Transformations- Impulse Invariance Technique, Bilinear Transformation. Design of Digital IIR Filters using Impulse Invariance and Bilinear Transformation.	8
Pedagogy	Chalk and Talk, Experiential Learning.	
3	FIR Filters: Characteristics of practical Frequency Selective Filters, Symmetric and anti-symmetric FIR Filters, Window functions: Rectangular, Hanning, Hamming, Blackmann and Kaiser. Design of FIR Filters using Windows, Design of Linear phase FIR filters by frequency sampling method. Realization of FIR filters: Direct form, Linear Phase form, Cascade form and lattice form structures.	8
Pedagogy	Chalk and Talk, Experiential Learning.	

4	Digital Signal Processor: Features of fixed point and floating point processors. TMS320C67x Processor: Introduction, Features, Internal architecture, CPU, General purpose Register files, Functional units and operations, Data paths, control Register file	8
Pedagogy	Chalk and Talk, Experiential Learning.	
5	Multirate Digital Signal Processing: Introduction, Up sampling, Down sampling, Interpolation and Decimation. Sampling rate conversion (Reduction, Increase), Sampling rate change by non-integer factor, Multistage Decimation, Poly phase structures and implementation.	8
Pedagogy	Chalk and Talk, Experiential Learning.	
	Pedagogical Initiatives (Not limited to): <ul style="list-style-type: none"> • Think Pair and Share (Blended Learning): provides an opportunity for students to learn from one another • Problem Solving: encourages cognitive thinking and enables creative problem solving • Demonstration: exhibits the implementation process • Experiential Learning: conducts experiments substantiating the concept more effectively 	

List of Programs:

Sl. No.	Experiments/Programs
1	Generation of continuous and discrete signals.
2	Verification of sampling Theorem in Time Domain and Frequency Domain
3	Cross Correlation of Given Two Sequence
4	Circular Convolution by matrix method
5	Linear Convolution: Implementation of Formula
6	Design and Implementation of IIR Filter – Butterworth
7	Design and Implementation of IIR Filter - Chebyshev (Type-1)
8	Design And Implementation of FIR Filter
9	Solution of Difference Equation
10	Impulse Response of a given First/Second order system
Open ended Programs	
1	Generation of Sinusoidal signal using DSP Processor
2	Noise Cancellation using DSP Processor

Text Books

Sl. No.	Title of the Book/Name of the author/Name of the publisher/Edition and Year
1	Digital Signal Processing : Principle, Algorithms and Applications, Proakis, 3rd Edition, 2004, Pearson Education / PHI, ISBN-81-203-1129-9
2	Digital Signal Processing – Fundamentals and Applications, Li Tan, 2008, Elsevier, ISBN: 978-0-12-374090- 8

3	Digital Signal Processors: Architecture, Programming and Applications; B. Venkataramani and M. Bhaskar, 2 nd Edition, 2012, McGraw Hill, ISBN:978-0-07-070256- 1.
Reference Books	
1	Modern Digital Signal Processing, V.Udayashankara, 2nd Edition, 2012, PHI, ISBN: 978- 81-203-4567-6
2	Signals and Systems, Simon Haykin and Barry Van Veen, 2nd Edition, 2008. John Wiley & Sons, ISBN: 13: 978-0471164746.
3	Signals and Systems, V Oppenheim, Alan Willsky and A Hamid Nawab, Alan, 2nd Edition, 2006,Pearson Education Asia/ PHI, ISBN 10: 0138147574

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Understand the fundamental concepts of digital signals, signal processing, DSP processors and filters	L2	U
CO2	Apply the knowledge of elementary signals, its properties to solve complex signals	L3	A
CO3	Analyze different types of digital signals and filters.	L4	An
CO4	Design, simulation and implementation of digital filters	L5	E
CO5	Implementation of techniques for signal analysis , signal processing and filter algorithms using modern tools.	L6	C

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	3	3	-	-	-	-	2	-	-	-	3

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Continuous Comprehensive Assessment (CCA)			
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks
Remember	15	10	5	5
Understand	15	5	5	5
Apply	10	10	5	5
Analyse	5	10	5	5
Evaluate	5	5	5	5
Create		10	25	25

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage(%)
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	15	5	5	5	5	5	40	40
CO2	5	5	0	0	5	5	20	20
CO3	0	5	5	0	5	5	20	20
CO4	0	5	0	0	5	0	10	10
CO5	0	0	0	0	0	10	10	10
Total	20	20	10	5	20	25	100	100

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks
Remember	8
Understand	7
Apply	10
Analyse	10
Evaluate	5
Create	10

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage (%)
	Module-1	Module-2	Module-3	Module-4	Module-5		
CO1	5	5	0	0	5	15	15
CO2		3	3	4		10	10
CO3			6	4		10	10
CO4				5		05	5
CO5					10	10	10
Total	5	8	9	13	15	50	50

**PROFESSIONAL CORE
COURSE (PCC)**

PCC Course - Professional Core Course

Teaching Hours/Week (L: T:P: S)	3:0:0:0 /2:2:0:0
Total Hours of Pedagogy	40 hours
Credits:	03
Each Module	8 Hrs
CIE Marks	50
SEE Marks	50
Total Marks	100
Exam Hours	3
Examination nature (SEE)	Theory

3 Credit Course – Professional Core Course (PCC)

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) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).
- A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures 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:

Internal Assessment Test (IAT):

- For the Internal Assessment Test component of CIE, there are 25 marks and for Assignment component of the CIE, there are 25 marks. Two Tests, each of 50 Marks with 01-hour 30 minutes' duration, are to be conducted and average of two tests to be reduced to 25 marks
 - The first test will be administered after 40-50% of the syllabus has been covered, and
 - The second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.
- Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as
- per the outcome defined for the course.

The IA test questions are to be framed to map the Course Outcomes (COs), Program Outcomes (POs) and the Blooms RBT Levels. Emphasis to be given for higher order RBT levels

Semester-End Examination:

Theory SEE will be conducted as per the scheduled timetable (duration 03 hours).

- The question paper will have ten questions. Each question is set for 20 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.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks.

Continuous and Comprehensive Assessment (CCA):

Two of continuous and comprehensive assessment (CCA) to be conducted to attain COs and POs, evaluated each for **50 Marks**. Total Marks scored will be CCA1+CCA2 and scaled down to **10 Marks**.

- CCA1 after 4th week and CCA2 after 9th week. The evaluation includes either through quiz or rubrics
- CCA as project-based learning,
 - CCA is evaluated for **50 Marks** with review 1 of **20 Marks** after and review 2 of **30 Marks** includes project demonstration/competition and report submission.
 - The evaluation of review 1 after 6th weeks of semester and review 2 after 12th week of semester with project demonstration and submission of the report

Total score for CCA is **10 Marks**

Total Marks scored for theory component of CIE (IAT+ CCA) is **25 Marks**

Possible Continuous and Comprehensive Assessment (CCA):

- Project based, Problem Based, Building Models, Lab-to-Land, Mobile Studio, Design and Programming Contest, Certification, Concept Map (Collage presentation/poster presentation), Case studies, Think-Pair-Share, Flipped classroom,
- The assessment of these techniques shall be in rubrics.
- The faculty can adopt any other CCA method of implementation and its assessment with prior approval of Program Assessment Committee (PAC).

Professional Core Course (PCC) – 3 Credit course – Theory

Assessment Method	Component	Type of Assessments	Syllabus Coverage	Maximum Marks	Average	Reduced Marks	Minimum Passing Marks	Evaluation Details
Total CIE Theory + Practical				50	----	----	20	
	Theory	Internal Assessment Test (IAT) - II	Module – 1 to 2.5	50	$(50+50) / 2$	25	10	Average of Two Internal test each of 50 Marks scale down the marks to 25 Marks
		Internal Assessment Test (IAT) - II	Module – 2.5 to 5	50				
	Continuous Comprehensive Assessment (CCA)	CCA-1- Pedagogical Initiatives / Activity Based learning	Considering all the Modules	50	$(50+50) / 2$	25	10	Two CCA methods as per VTU Clause 22OB4.2 of regulations to be adopted. If CCA chosen is Project Based Learning, then one assessment method may be adopted
		CCA-2- Pedagogical Initiatives / Activity Based learning		50				
	Total CIE Theory						50	20

SEE		Theory exam	Entire theory syllabus including questions from lab Component in respective Modules	100	----	50	20	SEE Exam is theory Exam conducted for 100 Marks, scored Marks are scaled down to 50 Marks
CIE + SEE				100	----	----	40	



Dayananda Sagar Academy of Technology & Management

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Semester	:	5 th Sem			
Course Title	:	Power Electronics			
Course Code	:	BEE502			
Course Type (Theory/ Practical/ Integrated)	:	Theory			
Category	:	PCC			
Stream	:	EEE	CIE	:	50
Teaching hours/ week (L:T:P:S)	:	2:2:0:0	SEE	:	50
Total Hours	:	40	SEE	:	3
Credits	:	3	Duration		

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Identify and understand the fundamental concepts of power semiconductor devices (diodes, transistors, thyristors) and analyze their roles and characteristics in various power electronic circuits, including rectifiers, AC voltage controllers, and converters
2	Apply fundamental electrical engineering concepts to solve complex power electronics circuit problems, including the design and evaluation of power conversion circuits

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Include videos to demonstrate various concepts.
- Encourage collaborative (Group) Learning to encourage team building.
- Adopt **Problem-Based Learning (PBL)**, which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.



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COURSE CURRICULUM

Module No.	Topics	Hours
1	Prerequisite: Familiarity with circuit analysis, analog electronics, and basic mathematics like differential equations is also required, Basic knowledge on Power diode. Introduction to semiconductor devices, Ideal and real switches, Types of Power Electronic Circuits, Peripheral Effects, Power Transistors: Introduction, Bipolar Junction Transistors – Steady State Characteristics, Switching Characteristics, BJT Base Drive, Power MOSFETs – Steady State Characteristics, Switching Characteristics, MOSFET Gate Drive, Applications of BJT and MOSFET	8
Pedagogy		
2	Prerequisite : understanding of semiconductor device physics (especially PN junctions and switching behavior) Power IGBTs: Steady State Characteristics, Switching Characteristics, IGBTs for high voltage applications, Comparison of IGBT, MOSFET & Thyristors. Thyristors: Introduction, Thyristor Characteristics, Thyristor Firing Circuits, Series and Parallel Operation of Thyristors	8
Pedagogy		
3	Prerequisite : AC/DC analysis and RL/RLE load behavior. Controlled Rectifiers: Introduction, Single phase half wave controlled rectifier with resistive load, RL Load , Single phase half wave circuit with RLE Load and Freewheeling Diode, single phase full converter with R load, RLE load, single phase Dual converter with RLE load, , Applications of controlled rectifiers AC voltage controllers : Principal of ON – OFF and Phase control, Single- Phase bi-directional controllers with R and RL load. Applications	8
Pedagogy		
4	Prerequisite: DC-DC converters, load types (R, L, RL), and basic control methods like phase and duty cycle control is also required. Choppers : Introduction, Principle of step down and step up chopper with R L load, Types of choppers, Analysis of Buck, Boost and Buck-boost converter in(Continuous conduction mode (CCM) and Discontinuous conduction mode (DCM) – output voltage equations using volt-sec balance in CCM and DCM. Applications of choppers	8

	DC-DC converter applications: Types of converter Circuits used in - Solar Power, Wind Power, EV and Digital gadgets	
Pedagogy		
5	<p>Prerequisite: Understanding of switching techniques, PWM methods, and inverter load behavior (R, RL).</p> <p>Inverters: Single phase full bridge inverters with R and RL load, Single phase current source inverter, Three phase VSI with 180 and 120 conduction.</p> <p>Types of Multilevel Inverters.</p> <p>Voltage control in single phase inverters, PWM control of inverters – Sinusoidal PWM, Multicarrier PWM, Vector Based PWM techniques, Applications.</p>	8
	<p>Pedagogical Initiatives (Not limited to):</p> <ul style="list-style-type: none"> • Think Pair and Share (Blended Learning): provides an opportunity for students to learn from one another • Problem Solving: encourages cognitive thinking and enables creative problem solving • Poster Presentation: allows students to represent the concepts visually in order to understand the topics easily. • Case studies: maps different domains in real time applications • Demonstration: exhibits the implementation process 	

Text Books	
Sl. No.	Title of the Book/Name of the author/Name of the publisher/Edition and Year
1	Power Electronics: Circuits Devices and Applications, Mohammad H Rashid, Pearson 4th Edition, 2014.
Reference Books	
1	Power Electronics, P.S. Bimbhra, Khanna Publishers, 5th Edition, 2012.
2	Power Electronics: Converters, Applications and Design, Ned Mohan et al, Wiley 3rd Edition, 2014.
3	Power Electronics, Daniel W Hart, McGraw Hill, 1st Edition, 2011.
4	Elements of Power Electronics, Philip T Krein, Oxford, Indian Edition, 2008.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Identify and Understand the basic concept of Power Semiconductor devices like transistors, thyristors.	Understand	L2
CO2	Apply the fundamental and electrical engineering concepts to solve the different Power Electronics circuit problems.	Apply	L3
CO3	Analyze various power electronic circuits such as rectifiers, AC voltage controllers, converters etc	Analyze	L4
CO4	Design and Evaluate various Power Conversion Circuits using modern tool	Create	L6

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2	3													
CO3		3												
CO4			3		3			2	3	2	1	1		

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Continuous Comprehensive Assessment (CCA)			
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks
Remember	15	10	5	5
Understand	15	10	10	10
Apply	10	10	5	5
Analyse	10	10	5	5
Create		10	25	25

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage(%)
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	15	10	5	5	10	5	50	50
CO2	5	5	0	0	10	5	25	25
CO3	0	5	5	0	0	5	15	15
CO4	0	0	0	0	0	10	10	10
Total	20	20	10	5	20	25	100	100

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks
Understand	50
Apply	25
Analyse	15
Create	10

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage (%)
	Module-1	Module-2	Module-3	Module-4	Module-5		
CO1	15	10	10	10	5	50	50
CO2	5	5	0	10	5	25	25
CO3	0	5	5	0	5	15	15
CO4	0	0	0	0	10	10	10
Total	20	20	10	20	25	100	100



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Semester	:	5			
Course Title	:	Modern Control Theory			
Course Code	:	BEE503			
Course Type (Theory/ Practical/ Integrated)	:	Theory			
Category	:	PCC			
Stream	:	EEE	CIE	:	50
Teaching hours/ week (L:T:P:S)	:	2:2:0:0	SEE	:	50
Total Hours	:	45	SEE	:	3 hours
Credits	:	03	Duration		

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To introduce the fundamental concepts of state variables and state-space modeling of dynamic systems.
2	To develop the ability to derive and analyze system representations using physical, phase and canonical variables, eigenvalues, and eigenvectors
3	To equip students with methods for solving state equations and understanding system properties like controllability and observability.
4	To enable students to design control systems using pole placement and observer techniques for improved stability and performance.
5	To familiarize students with stability analysis using different methods

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL)**, which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.



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COURSE CURRICULUM

Module No.	Topics	Hours
1	State Space Models: State Variable Analysis and Design: Introduction, concept of state, state variables and state model, state modeling of linear systems, State space representation using physical variables, phase variables.	10
Pedagogy	Chalk and Talk, NPTEL/Technical Videos and Group Discussion, Animated PPT, Think pair and share	
2	State Space Models: State space representation using canonical variables. Derivation of transfer function from state model, diagonalization- Eigen values, Eigen vectors, generalized Eigen vectors.	10
Pedagogy	Chalk and Talk, NPTEL/Technical Videos and Group Discussion, Animated PPT, Think pair and share	
3	Solution of State Space Models: Solution of homogeneous and non-homogenous state equation, state transition matrix and its properties, computation using Laplace transformation, Cayley-Hamilton method, Controllability & Observability: Concept of controllability & observability, methods of determining the same.	9
Pedagogy	Chalk and Talk, NPTEL/Technical Videos and Group Discussion, Animated PPT, Problem solving method.	
4	Pole Placement Design and State Observers: Pole placement techniques: stability improvements by state feedback, necessary & sufficient conditions for arbitrary pole placement, state regulator design, and design of state observer (full order).	8
Pedagogy	Chalk and Talk, NPTEL/Technical Videos and Group Discussion, Animated PPT, Modern tool usage	
5	Stability Analysis: Introduction, Basic concept, Stability definition and theorems, Lyapunov functions for linear systems, Lyapunov's stability- Hurwitz criterion & Liapunov's direct method. Lyapunov function for nonlinear systems. Krasovskii's method of testing stability.	8

Text Books

Sl. No.	Title of the Book/Name of the author/Name of the publisher/Edition and Year
1	Modern Control Engineering- Katsuhiko Ogata- PHI 2003
2	Control system Engineering- I. J. Nagarath & M. Gopal, - 3 rd edition, New Age International (P) Ltd.
3	M Gopal " Modern Control System Theory "; Wiley Eastern Ltd.
4	Advanced Control Theory , Nagoor A. Kani, 3 rd edition CBS Publishers & Distributors

Reference Books	
1	State Space Analysis of Control Systems- Katsuhiko Ogata -Prentice Hall Inc
2	Modern control systems- Dorf & Bishop- Pearson education, 1998
3	Digital control & state variable methods- M. Gopal - 2 nd edition, THM Hill 2003

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Recall and model physical systems using state-space representation in various canonical forms, and explain key concepts like state transition matrix,	Remember &	L ₁ ,L ₂
CO2	Apply state space methods and Laplace transform and Cayley-Hamilton theorem to solve state-space equations.	Apply	L ₃
CO3	Analyze and derive system transfer functions, eigenvalues, and eigenvectors from state-space models.	Analyze	L ₄
CO4	Evaluate the stability of different systems using Lyapunov's direct method and other criteria.	Evaluate	L ₅
CO5	Design state feedback controllers and state observers for desired pole placement and improved system performance.	Create	L ₆
CO6	Solve the state space equations and stability analysis using modern tools.		L ₁ to L ₆

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													2	2
CO2	3												3	1
CO3		3											2	2
CO4			3										2	2
CO5				3									3	2
CO5	3	3	3	3	3				2	2	1	2	3	3

Weblinks and Video Lectures (e-Resources)

1	https://www.youtube.com/watch?v=xajgSUci9zs(NPTEL)
2	https://www.youtube.com/watch?v=CrXOMBIYFp0&t=300s(NPTEL)

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Continuous Comprehensive Assessment (CCA)			
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks
Remember	15	10	5	5
Understand	15	5	5	5
Apply	10	10	5	5
Analyse	5	10	5	5
Evaluate	5	5	5	5
Create		10	25	25

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage(%)
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	15	5	5	5	5	5	40	40
CO2	5	5	0	0	5	5	20	20
CO3	0	5	5	0	5	5	20	20
CO4	0	5	0	0	5	0	10	10
CO5	0	0	0	0	0	10	10	10
Total	20	20	10	5	20	25	100	100

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks
Remember	8
Understand	7
Apply	10
Analyse	10
Evaluate	5
Create	10

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage (%)
	Module-1	Module-2	Module-3	Module-4	Module-5		
CO1	5	5	0	0	5	15	15
CO2		3	3	4		10	10
CO3			6	4		10	10
CO4				5		05	5
CO5					10	10	10
Total	5	8	9	13	15	50	50

PROFESSIONAL ELECTIVE-1



Dayananda Sagar Academy of Technology & Management (Autonomous Institute under VTU)

Semester	:	5 th		
Course Title	:	Fundamentals to VLSI		
Course Code	:	BEE515A		
Course Type (Theory/ Practical/ Integrated)	:	Theory		
Category	:	Professional Elective-1		
Stream	:	Electrical & Electronics Branch	CIE	: 50 Marks
Teaching hours/ week (L:T:P:S)	:	2:2:0:0	SEE	: 50 Marks
Total Hours	:	40 Hrs Theory	SEE	: 3 Hours
Credits	:	03	Duration	

Course Learning Objectives: Students will be taught

Sl. No.	Course Objectives
1	Understand the operation, fabrication process and basic electrical properties of MOS Transistor
2	Study MOS Transistor fabrication metrics and semiconductor integrated circuit architectures and CMOS testing.
3	Apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect and to verify the functionality, timing, power and parasitic effects.

Teaching-Learning Process

Pedagogy (General Instructions):

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the infrastructures and the mechanism involved in the principle.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOT (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
6. Topics will be introduced in multiple representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
9. Individual teachers can device innovative pedagogy to improve teaching-learning.



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COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	<p>Module-1:- Moore's law, speed power performance, nMOS fabrication, CMOS fabrication: n-well, p-well processes, BiCMOS, Comparison of bipolar and CMOS.</p> <p>Basic Electrical Properties of MOS And BiCMOS Circuits: Drain to source current versus voltage characteristics, threshold voltage, transconductance.</p>	8
Pedagogy	1. Chalk and talk 2. Animated/NPTEL videos 3. Problem Based Learning	
2	<p>Module -2:- Basic Electrical Properties of MOS And BiCMOS Circuits: nMOS inverter, Determination of pull up to pull down ratio, nMOS inverter driven through one or more pass transistors, alternative forms of pull up, CMOS inverter, BiCMOS inverters, latch up.</p> <p>Basic Circuit Concepts: Sheet resistance, area capacitance calculation, Delay unit, inverter delay, estimation of CMOS inverter delay, driving of large capacitance loads, super buffers, BiCMOS drivers</p>	8
Pedagogy	1. Chalk and talk 2. Animated/NPTEL videos 3. Problem Based Learning	
3	<p>Module- 3:- MOS and BiCMOS Circuit Design Processes: MOS layers, stick diagrams, nMOS design style, CMOS design style, design rules and layout, λ - based design.</p> <p>Scaling of MOS Circuits: scaling factors for device parameters, limitations of scaling</p>	8
Pedagogy	1. Chalk and talk 2. Animated/NPTEL videos 3. Problem Based Learning 4. Experiential Learning	
4	<p>Module- 4:- Subsystem Design and Layout-1 : Switch logic pass transistor, Gate logic inverter, NAND gates, NOR gates, pseudo nMOS, Dynamic CMOS, Shifters, Adders, Multipliers ,Parity Generators, Comparators</p>	8
Pedagogy	1. Chalk and talk 2. Animated/NPTEL videos 3. Experiential Learning 4. Demonstration	
5	<p>Module- 5:- CMOS Testing : CMOS Testing, Need for Testing, Testing Principles, Design Strategies for Test, Chip level, Board level and Board Level Test Techniques</p>	8
Pedagogy	1. Chalk and talk 2. Animated/NPTEL videos	

Text Books

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1	“Basic VLSI Design”, Douglas A Pucknell, Kamran Eshraghian, 3 rd Edition, Prentice Hall of India publication, 2005.
2	“CMOS Digital Integrated Circuits, Analysis And Design”, Sung – Mo (Steve) Kang, Yusuf Leblebici, Tata McGraw Hill, 3 rd Edition, 2003
3	VLSI Technology”, S.M. Sze, 2nd edition, Tata McGraw Hill, 2003

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	Level Indicator
CO1	Understand the operation, fabrication process and basic electrical properties of MOS Transistor, need for testability and testing methods in VLSI	Remember and Understand	L1 & L2
CO2	Apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect and to verify the functionality, timing, power and parasitic effects	Apply	L3
CO3	Demonstrate different logic styles such as complementary CMOS logic, pass-transistor Logic, dynamic logic, etc.	Evaluate	L5
CO4	Design static CMOS combinational and sequential logic at the transistor level using Simulation tools	Design	L6

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CO2	3	--	--	--	--	--	--	--	--	--	--	--	--	--
CO3	--	3	--	--	--	--	--	--	--	--	--	--	--	--
CO4	--	--	3	3	3	--	--	--	2	2	--	--	2	2



Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	5		
Course Title	:	Quantum Technologies and Applications		
Course Code	:	BEE515B		
Course Type (Theory/ Practical/ Integrated)	:	Theory		
Category	:	PEC		
Stream	:	EEE	CIE	: 50
Teaching hours/ week (L:T:P:S)	:	2:2:0:0	SEE	: 50
Total Hours	:	40 to 45 hrs of theory	SEE	: 3 hrs
Credits	:	3	Duration	

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To introduce students to the foundational principles of quantum mechanics and their relevance to computing.
2	To develop an understanding of quantum bits, quantum gates, and quantum circuits.
3	To enable students to implement and analyze basic quantum algorithms.
4	To explore the impact of quantum computing on cryptography and information theory.
5	To provide hands-on experience with quantum programming frameworks such as Qiskit/Qsim.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL)**, which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.



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COURSE CURRICULUM

Module No.	Topics	Hours
1	Fundamentals of Quantum Theory: Classical vs. Quantum Systems, Qubits and Quantum Superposition, Quantum Measurement and Wavefunction Collapse, Basic Quantum Gates: X, Y, Z, H, S, T, Dirac Notation (Bra-Ket), Bloch Sphere Representation	8
Pedagogy	Blended Mode, Experiential Learning.	
2	Quantum Gates and Circuits: Multi-Qubit Systems and Entanglement, Tensor Product of States, Multi-Qubit Gates: CNOT, SWAP, Toffoli, Circuit Model of Quantum Computation, Reversible Computation. Introduction to Qiskit: Quantum Circuit Simulation	8
Pedagogy	Blended Mode, Experiential Learning, NPTEL/ IBM Technical Videos and Group Discussion	
3	Quantum Algorithms : Quantum Parallelism, Deutsch Algorithm and Deutsch-Jozsa Algorithm, Grover's Search Algorithm, Oracle Concept, Circuit Design and Hands-on Simulations Using Qiskit	8
Pedagogy	Blended Mode, Experiential Learning, NPTEL/ IBM Technical Videos and Thin-Pair & Share	
4	Quantum Algorithms (Contd.) : Quantum Fourier Transform (QFT), Period Finding Problem, Shor's Algorithm for Integer Factorization, Cryptographic Implications, Simulating QFT and Simplified Shor's Algorithm	8
Pedagogy	Blended Mode, Experiential Learning, NPTEL/ IBM Technical Videos and Thin-Pair & Share	
5	Quantum Programming & Applications: Quantum Programming Platforms: Qiskit, Cirq, Quantum Teleportation and Superdense Coding, No-Cloning Theorem, Basics of Quantum Error Correction, Overview of Current Quantum Hardware, Applications: Cryptography, Machine Learning, Optimization	8

Text Books	
Sl. No.	Title of the Book/Name of the author/Name of the publisher/Edition and Year
1	"Quantum Computing for Everyone" by Chris Bernhardt,2019, MIT Press
2	"Quantum Computation and Quantum Information" by Michael A. Nielsen & Isaac L. Chuang, 10 th Edition,2010, Cambridge Press
3	Quantum Computing: An Applied Approach" by Jack D. Hidary, 2 nd edition, Springer publishers
Reference Books	
1	"Quantum Machine Learning with Python " by Santanu Pattanayak ,Apress Standard, 1 st edition

Module	Books That Cover It
Module 1: Quantum Theory	Nielsen & Chuang, Bernhardt
Module 2: Gates & Circuits	Nielsen & Chuang, Qiskit Textbook, Bernhardt
Module 3: Algorithms I	Nielsen & Chuang, Qiskit Textbook, Hidary, Bernhardt
Module 4: Algorithms II	Nielsen & Chuang, Hidary, Qiskit Textbook
Module 5: Programming & Apps	Qiskit Textbook, Hidary, IBM documentation

Course Outcomes: At the end of the course, the student will be able to:

CO's	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Understand the fundamental principles of quantum mechanics relevant to computation.	Remember & Understand	L ₁ ,L ₂
CO2	Apply quantum logic gates and circuits to represent and process quantum information.	Apply	L ₃
CO3	Analyze and implement basic quantum algorithms such as Grover's and Deutsch-Jozsa.	Analyze	L ₄
CO4	Evaluate the implications of quantum algorithms on cryptography and classical computing limitations.	Evaluate	L ₅
CO5	Develop practical skills in quantum programming using platforms like Qiskit/Qsim.		L1 to L6

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													3	1
CO2	3												2	1
CO3		3											2	1
CO4			3										3	1
CO5	3	3	3	3	3			2	1	3	2	3	3	3

Weblinks and Video Lectures (e-Resources)

1	https://qiskit.org/textbook
2	https://learning.quantum.ibm.com/

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Continuous Comprehensive Assessment (CCA)			
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks
Remember	15	10	5	5
Understand	15	5	5	5
Apply	10	10	5	5
Analyse	5	10	5	5
Evaluate	5	5	5	5
Create		10	25	25

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	15	5	5	5	5	5	40	40
CO2	5	5	0	0	5	5	20	20
CO3	0	5	5	0	5	5	20	20
CO4	0	5	0	0	5	10	20	20
Total	20	20	10	5	20	25	100	100

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (90% Theory+10% Practical Questions)
Remember	10
Understand	10
Apply	15
Analyze	10
Evaluate	5
Create	--

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage (%)
	Module-1	Module-2	Module- 3	Module-4	Module-5		
CO1	5	5	0	0	5	15	15
CO2		3	3	4	10	20	20
CO3			6	4		10	10
CO4				5		05	5
CO5							
Total	5	8	9	13	15	50	50



Dayananda Sagar Academy of Technology & Management (Autonomous Institute under VTU)

Semester	:	V		
Course Title	:	EV Technology- Fundamentals of Electric Vehicles & Powertrain Systems.		
Course Code	:	BEE515C		
Course Type (Theory/ Practical/ Integrated)	:	Theory		
Category	:	PEC-1		
Stream	:	EEE	CIE	: 50
Teaching hours/ week (L:T:P:S)	:	4	SEE	: 50
Total Hours	:	40	SEE	: 3 Hr's
Credits	:	03	Duration	

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To introduce the fundamental concepts and architecture of hybrid and electric vehicles, highlighting their types, components, and operations.
2	To equip students with the knowledge required to select appropriate electrical machines for various hybrid and electric vehicle applications.
3	To provide a comprehensive understanding of different energy storage technologies and their selection criteria for automotive systems.
4	To introduce the fundamental concepts and architecture of hybrid and electric vehicles, highlighting their types, components, and operations and supply selection.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Include videos to demonstrate to understand transmission and distribution
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.



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COURSE CURRICULUM

Module No.	Topics	Hours
1	Introduction to hybrid and electric vehicles History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, types of electric vehicles, basic architecture ,vehicle performance.	08
Pedagogy	Chalk and Talk, NPTEL Videos and Group Discussion, Pictorial Demo	
2	Electric Vehicles: Power train Configurations- on Propulsion and source, Performance of Electric Vehicles, Traction Motor Characteristics, Tractive Effort and Transmission Requirement, Vehicle Performance, Energy Consumption.	08
Pedagogy	Chalk and Talk, NPTEL Videos and Group Discussion, Pictorial Demo	
3	Electrical Machines for Electric Vehicles Introduction to electric components used in hybrid and electric vehicles- Configuration and control of DC Motor drives, Induction Motor drives. Permanent Magnet Motor drives, BLDC and Switched Reluctance Motor drives- construction and working.	08
Pedagogy	Chalk and Talk, NPTEL Videos and Group Discussion, Pictorial Demo	
4	Energy storage technologies Energy storage technologies in hybrid vehicles-flywheel, hydraulic, fuel cell and hybrid fuel cell energy storage system-ultra capacitors. Battery Management System- SOH and SOC	08
Pedagogy	Chalk and Talk, NPTEL Videos and Group Discussion, Pictorial Demo	
5	Electricity 112 Supply : Normal Existing Domestic and Industrial Electricity Supply. Infrastructure Needed for Charging Electric Vehicles Electricity Supply Rails. Inductive Power Transfer for Moving Vehicles. Battery Swapping. An electronic control unit (ECU) and its technologies. v2x technology	08
Pedagogy	Chalk and Talk, NPTEL Videos and Group Discussion, Pictorial Demo	

Text Books

Sl. No.	Title of the Book/Name of the author/Name of the publisher/Edition and Year
1	Chris Mi, M. Abul Masrur, David Wenzhong Gao, 'Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives', Wiley, 2011.
2	Ali Emadi, Mehrdad Ehsani, John M. Miller, 'Vehicular Electric Power Systems: Land, Sea, Air, and Space Vehicles', CRC Press, 2010.

Reference Books

1	Sandeep Dhameja, 'Electric Vehicle Battery Systems', Newnes, 2002.
2	Iqbal Husain, 'Electric and Hybrid Vehicles: Design Fundamentals', CRC Press, 2nd Edition, 2010.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Understand the various aspects of electric vehicles and energy storage technologies for EV's	U	L1,L2
CO2	Apply the knowledge for selection of electrical machines for hybrid and electric vehicles.	A	L3
CO3	List the various energy storage technologies and Electricity supply required for hybrid and electric vehicles.	An	L4
CO4	Select the storage technologies used for EV's as per the supply requirement.	E	L5

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2	3													
CO3		3												
CO4				2		2			2	2				

Weblinks and Video Lectures (e-Resources)

1	NPTEL Course Prof.Amit Jain 'Electric Vehicles part-1', IIT Delhi.
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CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Continuous Comprehensive Assessment (CCA)			
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks
Remember	25	15	20	-
Understand	15	25	10	-
Apply	10	05	20	30
Analyze		05	-	20

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	20	15	05	15	10	15	80	80%
CO2	-	05	05	-	5	-	15	15%
CO3	-	-	-			5	05	5%
CO4								
Total	20	20	10	15	15	20	100	100

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (90% Theory+10% Practical Questions)
Remember	40
Understand	40
Apply	15
Analyse	5
Evaluate	-
Create	-

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage
	Module-1	Module-2	Module-3	Module-4	Module-5		
CO1	20	20	10	20	10	80	80
CO2		5	5	5		15	15
CO3					5	5	5
CO4	-	-	-	-	-	-	-
Total	20	25	15	25	15	100	100



Dayananda Sagar Academy of Technology & Management
(Autonomous Institute under VTU)

Semester	:	5		
Course Title	:	Electrical Machine Design		
Course Code	:	BEE515D		
Course Type (Theory/ Practical/ Integrated)	:	Theory		
Category	:	Professional elective II		
Stream	:	EEE	CIE	: 50
Teaching hours/ week (L:T:P:S)	:	3:0:0:0	SEE	: 50
Total Hours	:	40	SEE	: 3 hours
Credits	:	3	Duration	

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To develop knowledge on principles of design of static and rotating machines.
2	Understand the design fundamental concepts, design main dimensions
3	Understand the cooling systems of transformers and main dimensions of rotating machine.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to of basic MATLAB programming
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL)**, which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.



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COURSE CURRICULUM

Module No.	Topics	Hours
1	Fundamental Aspects of Electrical Machine Design: Design of Machines, Design Factors, Limitations in design, Modern Trends in design, manufacturing Techniques. Electrical Engineering Materials: Desirabilities of Conducting Materials, Comparison of Aluminium and Copper wires. Ferromagnetic Materials: Soft Magnetic materials – Solid Core Materials, Electrical Sheet and Strip, Cold Rolled Grain Oriented Steel. Insulating Materials: Desirable Properties, Temperature Rise and Insulating Materials, Classification of Insulating materials based on Thermal Consideration.	8
Pedagogy	Chalk and Talk, Experiential Learning.	
2	Design of DC Machines: Output Equation, Choice of Specific Loadings and Choice of Number of Poles, Main Dimensions of armature, Design of Armature Slot Dimensions, Commutator and Brushes. Estimation of Ampere Turns for the Magnetic Circuit. Dimensions of Yoke, Main Pole and Air Gap. Design of Shunt and Series Field Windings..	8
Pedagogy	Chalk and Talk, Experiential Learning.	
3	Design of Transformers: Output Equations of Single Phase and Three Phase Transformers, Choice of Specific Loadings, Expression for Volts/Turn, Determination of Main Dimensions of the Core, Estimation of Number of Turns and Conductor Cross Sectional area of Primary and Secondary Windings, No Load Current. Expression for the Leakage Reactance of core type transformer with concentric coils, and calculation of Voltage Regulation. Design of Tank and Cooling (Round and Rectangular) Tubes.	8
Pedagogy	Chalk and Talk, Experiential Learning.	
4	Design of Three Phase Induction Motors: Output Equation, Choice of Specific Loadings, Main Dimensions of Stator. Design of stator slots and Winding, Choice of Length Air Gap, Estimation of Number of Slots for Squirrel Cage Rotor. Design of Rotor Bars and End Ring. Design of Slip Ring rotor. Estimation of No Load Current and Leakage Reactance.	8
Pedagogy	Chalk and Talk, Experiential Learning.	
5	Design of Three Phase Synchronous Machines: Output Equation, Choice of Specific Loadings, Short Circuit Ratio, Main Dimensions of Stator. Design of stator slots and Winding. Design of Salient and non- salient Pole Rotors. Magnetic Circuit and Field Winding.	8
Pedagogy	Chalk and Talk, Experiential Learning.	
	Pedagogical Initiatives (Not limited to): <ul style="list-style-type: none">• Think Pair and Share (Blended Learning): provides an opportunity for students to learn from one another	

CO3		3										2	2
CO4			2	3					2			3	2

Weblinks and Video Lectures (e-Resources)

1	https://www.youtube.com/watch?v=B4Ej3E3Rgpw&list=PLiE0cr_0lcyT6bkGhLDNWC6CVzH0J2N4Q
2	https://www.youtube.com/watch?v=VLTWgKANhuY&list=PLp6ek2hDcoNCOQduaaLYTBE9GqTdBmNUC (NPTEL)

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Continuous Assessment Tests (IAT)		Continuous Comprehensive Assessment (CCA)	
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks
Remember	15	10	5	5
Understand	15	5	5	5
Apply	15	10	5	5
Analyse	5	15	10	10
Create		10	25	25

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage(%)
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	15	5	5	5	5	5	40	40
CO2	5	5	0	0	5	5	20	20
CO3	0	5	5	0	5	5	20	20
CO4	0	5	0	0	5	10	20	20
Total	20	20	10	5	20	25	100	100

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks
Remember	10
Understand	10

Apply	10
Analyse	10
Create	10

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage (%)
	Module-1	Module-2	Module-3	Module-4	Module-5		
CO1	5	5	0	0	5	15	15
CO2		3	3	4		10	10
CO3			6	4		10	10
CO4		3	2	5	5	15	15
Total	5	11	11	13	10	50	50

Humanities, Social Sciences and Management (HSMC)

HSMS Course -

Teaching Hours/Week (L: T:P: S)	3:0:0:0 /2:2:0:0
Total Hours of Pedagogy	40 hours

Credits:	03
Each Module	8 Hrs
CIE Marks	50
SEE Marks	50
Total Marks	100
Exam Hours	3
Examination nature (SEE)	Theory

3 Credit Course – Course (HSMS)

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) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).
- A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures 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:

Internal Assessment Test (IAT):

- For the Internal Assessment Test component of CIE, there are 25 marks and for Assignment component of the CIE, there are 25 marks. Two Tests, each of 50 Marks with 01-hour 30 minutes' duration, are to be conducted and average of two tests to be reduced to 25 marks
 - The first test will be administered after 40-50% of the syllabus has been covered, and
 - The second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.
- Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

The IA test questions are to be framed to map the Course Outcomes (COs), Program Outcomes (POs) and the Blooms RBT Levels. Emphasis to be given for higher order RBT levels

Semester-End Examination:

Theory SEE will be conducted as per the scheduled timetable (duration 03 hours).

- The question paper will have ten questions. Each question is set for 20 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.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks.

Continuous and Comprehensive Assessment (CCA):

Two of continuous and comprehensive assessment (CCA) to be conducted to attain COs and POs, evaluated each for **50 Marks**. Total Marks scored will be CCA1 + CCA2 and scaled down to **25 Marks**.

- CCA1 after 4th week and CCA2 after 9th week. The evaluation will be carried out with rubrics
- CCA as learning based on case studies and nearby visits to industry,
 - CCA is evaluated for case studies and nearby visit for **50 Marks** with evaluation of **20 Marks** for analysis and report on case study and evaluation of **30 Marks** includes nearby visit and report submission.
 - The evaluation of CCA1 after 6th weeks of semester CCA2 after 12th week of semester with seminar and submission of the report

Total passing score for CCA is **10 Marks**

Total passing marks scored for theory component of CIE IAT is **10 Marks**

Possible Continuous and Comprehensive Assessment (CCA):

- Case studies, MOOC Certification, Seminar Presentation, Think-Pair-Share, Identify a local business opportunity and design a business model, SWOT Analysis of a start-up company.
- The assessment of these techniques shall be in rubrics.
- The faculty can adopt any other CCA method of implementation and its assessment with prior approval of Program Assessment Committee (PAC).

Course (HSMS) – 3 Credit course – Theory

Assessment Method	Component	Type of Assessments	Syllabus Coverage	Maximum Marks	Average	Reduced Marks	Minimum Passing Marks	Evaluation Details
Total CIE Theory + CCAs				50	----	----	20	
	Theory	Internal Assessment Test (IAT) - I	Module – 1 to 2.5	50	$(50+50) / 2$	25	10	Average of Two Internal test each of 50 Marks and scale down the marks to 25 Marks. Two CCA methods may be adopted
		Internal Assessment Test (IAT) - II	Module – 2.5 to 5	50				
	Continuous Comprehensive Assessment (CCA)	CCA-1- Pedagogical Initiatives / Activity Based learning	Considering all the Modules	50	$(50+50) / 2$	25	10	
		CCA-2- Pedagogical Initiatives / Activity Based learning		50				
	Total CIE Theory						50	

SEE		Theory exam	Entire theory syllabus comprising of all 5 Modules	100	----	50	20	SEE Exam is theory Exam conducted for 100 Marks, scored Marks are scaled down to 50 Marks
CIE + SEE				100	----	----	40	



Dayananda Sagar Academy of Technology & Management (Autonomous Institute under VTU)

Semester	:	V		
Course Title	:	Engineering M and E		
Course Code	:	BEE504		
Course Type (Theory/ Practical/ Integrated)	:	Theory		
Category	:	HSMS		
Stream	:	Electrical and Electronics Engineering	CIE	: 50
Teaching hours/ week (L:T:P:S)	:	2:2:0:0	SEE	: 50
Total Hours	:	40	SEE	: 3 hours
Credits	:	3	Duration	

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To familiarise the students with management functions
2	To introduce to the students leadership styles, motivation theories and organizational principles
3	To introduce to the students qualities of an entrepreneur, identifying business opportunities, functions of state / centre level supporting institutions for Micro, Small and Medium scale businesses
4	To explain the students about business plan, business model, business opportunity and procedure to set up an enterprise

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate to understand engineering management and entrepreneurship
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least two **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.



DSATM

Scheme of Teaching and Examinations for BE Programme -2025-26
Outcome Based Education and Choice Based Credit System (Autonomous Version)
(Effective from the Academic Year 2025-26)

COURSE CURRICULUM

Module No.	Topics	Hours
1	<p>Management: Nature and Functions of Management – Importance, Definition, Management Functions, Roles of a Manager, Levels of Management, Managerial Skills, Management & Administration.</p> <p>Planning: Importance, Types, Steps and limitations of Planning, Decision Making – Steps in Decision Making, Common Difficulties in Decision Making</p>	8
Pedagogy	Chalk and Talk, You tube Videos and Quiz	
2	<p>Organizing and Staffing: Organisation - Meaning, Characteristics, Principles of Organising, Span of Management (meaning and importance only) Departmentalization – Process of departmentalization, Purpose of Departmentalization, Committees – meaning, Types of Committees, Staffing –Importance and need for proper staffing, Steps in Selection Procedure.</p> <p>Directing and Controlling: Meaning and Requirements of effective Direction, Motivation – Importance of Motivation, Motivation Theories (Maslow’s Need Hierarchy Theory),</p>	8
Pedagogy	Chalk and Talk, Think Pair and Share – Real life Example : Organisational Structure of Wipro	
3	<p>Leadership – Meaning, Characteristics, Behavioural approach of Leadership; Coordination- Techniques of Coordination; Controlling – Meaning, Need for Control System, Benefits of Control, Essentials of effective Control System, Steps in Control Process.</p> <p>Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, CSR, Social Audit – Benefits and Limitations, Business Ethics.</p>	8
Pedagogy	Chalk and Talk, Case Study on Leadership styles	
4	<p>Entrepreneurship: Introduction, Evolution of concept of Entrepreneurship, Entrepreneurship today, Types of Entrepreneurs, Entrepreneurial competencies, Capacity Building for Entrepreneurs.</p> <p>Identification of Business Opportunities – Introduction, Mobility of Entrepreneurs, Business opportunities in India, Models for Opportunity Evaluation.</p>	8
Pedagogy	Chalk and Talk, Group Discussion	

5	<p>Business Plans: Introduction, Purpose of a Business Plan, Contents of a Business Plan, How to present a Business Plan, why do some business plans fail? Procedure for setting up an Enterprise.</p> <p>Institutional Supporting Business Opportunities: Central–Level Institutions – Export Promotion Council, PMEGP. State level Institutions – Karnataka Udyog Mitra, State Directorate Industries and Commerce.</p>	8
Pedagogy	Chalk and Talk, Seminar presentation	

Text Books	
Sl. No.	Title of the Book/Name of the author/Name of the publisher/Edition and Year
1	Principles of Management – PC Tripathi, P N Reddy, Tata McGraw Hill, 6 th Edition, 2017
2	Entrepreneurship Development and Small Business Enterprises – Poornima M Charantimath Pearson, 2 nd Edition, 2014
Reference Books	
1	Management and Entrepreneurship – NVR Naidu and T Krishna Rao, I K International Publishing House Pvt Ltd, Reprint 2015

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Understand skills and functions of management, entrepreneurship, social responsibilities of business and institutional support towards business.	Understand	L2
CO2	Apply different theories / control techniques to understand concept of motivation and leadership in business enterprises, CSR, concept of centre / state level institutions supporting MSMEs/Start-ups, Business Opportunity and Business	Apply	L3
CO3	Analyse business opportunity, business plans and procedures to set up a business	Analyse	L4
CO4	Evaluate business models of opportunity including the market conditions, customer demands and financial aspects of business and supporting initiatives from centre and state Governments.	Evaluate	L5

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2								3			3			
CO3								3		3				
CO4								3		3	3			

Weblinks and Video Lectures (e-Resources)	
1	https://nptel.ac.in/courses/110107094
2	https://nptel.ac.in/courses/110106141
3	https://nptel.ac.in/courses/122106031

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Continuous Comprehensive Assessment (CCA)			
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks
Remember				
Understand	20	20		
Apply	30	20		
Analyse		10	30	20
Evaluate			20	30
Create				

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	8	8	4	4	8	8	40	40%
CO2	12	12	6	4	8	8	50	50%
CO3				4	6		10	10%
CO4								
Total	20	20	10	12	22	16	100	100%

SEE- Semester End Examination (50 Marks)

LABORATORY



Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	5 th Sem		
Course Title	:	Power Electronics Lab		
Course Code	:	BEEL505		
Course Type (Theory/ Practical/ Integrated)	:	Practical		
Category	:	PCCL		
Stream	:	EEE	CIE	: 50
Teaching hours/ week (L:T:P:S)	:	2	SEE	: 50
Total Hours	:	24	SEE Duration	: 3
Credits	:	1		

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To analyze and experiment with semiconductor devices by obtaining their static characteristics, studying SCR triggering and commutation methods, and evaluating the performance of single-phase controlled rectifiers, inverters, and AC voltage controllers with various loads.
2	To control and evaluate electric motor performance , including speed control of DC motors, universal motors, and stepper motors using appropriate power electronic circuits.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Include videos to demonstrate various concepts.
- Encourage collaborative (Group) Learning to encourage team building.
- Adopt **Problem-Based Learning (PBL)**, which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.

Sl. No.	Experiments/Programs
1	Static Characteristics of SCR
2	Static Characteristics of MOSFET and IGBT
3	SCR turn on circuit using synchronized UJT relaxation oscillator
4	SCR digital triggering circuit for a single phase controlled rectifier and ac voltage regulator
5	Single phase controlled full wave rectifier with R and R –L loads (Using Simulink also)
6	AC voltage controller using TRIAC and DIAC combination connected to R and RL loads (Using simulink also)
7	Speed control of dc motor using single semi converter
8	Speed control of universal motor using ac voltage regulator
9	Speed control of a separately excited D.C. Motor using an IGBT or MOSFET chopper.
10	Commutation circuit (Using Simulink also)
Open ended experiment	
1	Design of Snubber circuit

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	To determine characteristics of power electronic circuits and switches.	2	U
CO2	To verify the performance of Rectifier, Chopper, Inverter and AC Voltage	3	A
CO3	To analyze the triggering circuits of SCR, commutation circuits for SCR Controller.	4	An
CO4	To Control the speed of a dc motor, universal motor and stepper motors with the applications of power electronic circuits	5	E
CO5	To design snubber circuit	6	C

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2		3												
CO3			3											
CO4				3										
CO5				3	2			2	3	2	1	1		



DSATM

Scheme of Teaching and Examinations for BE Programme -2025-26

Outcome Based Education and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2025-26)

Yoga (V Sem)

Course Code		CIE Marks	100
Teaching Hours/Week (L:T:P:S)	0:0:2:0	SEE Marks	000
Total Hours of Pedagogy per semester	24 – 28 hours (Theory + Practical)	Total Marks	100
Examination nature		Objective type Theory/Practical/Viva voce	

Course Objectives:

1. To enable the student to have good health
2. To practise mental hygiene
3. To possess emotional stability
4. To integrate moral values
5. To attain higher level of consciousness

Syllabus

Patanjali's Ashtanga Yoga, its need and importance

Ashtanga Yoga

1. Asana
2. Pranayama
3. Pratyahara

Asana its meaning by name, technique, precautionary measures and benefits of each asana

Different types of Asanas

- a. Sitting
 1. Ardha Ushtrasana
 2. Vakrasana
 3. Yogamudra in Padmasana
- b. Standing
 1. UrdhvaHastothanasana
 2. Parivritta Trikonasana
 3. Hastapadasana
 4. Utkatasana

- c. Prone line 1. Padangushtha Dhanurasana
 2. Poorna Bhujangasana / Rajakapotasana
- d. Supine line 1. Sarvangasana
 2. Chakrasana
 3. Navasana / Noukasana
 4. Pavanamuktasana

Revision of practice 60 strokes/min 3 rounds

Meaning by name, technique, precautionary measures and benefits of each Pranayama

1. Ujjayi 2. Sheetali 3. Shektari

Course Outcomes:

At the end of the course, the student will be able to

CO1 : Understand and teach different Asanas by name, its importance, methods and benefits

CO2: Instruct Kapalabhati and its need and importance

CO3: Teach different types of Pranayama by its name, precautions, procedure and uses

Assessment Details:

- Students will be assessed with internal test (Two internal assessment tests with 25 marks/test)
- Final test shall be conducted for the whole syllabus for 50 marks
- Continuous Internal Evaluation shall be for 100 marks (including IA test)

Suggested Learning Resources:

Books:

1. Yogapravesha in Kannada by Ajitkumar
2. Light on Yoga by BKS Iyenger
3. Teaching methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly
4. Yoga Instructor Course hand book published by SVYASA University, Bengaluru

Web links and Video lectures(e-resources):

1. <https://youtu.be/KB-TYIgd1wE>
2. <https://youtu.be/aa-TG0Wg1Ls>

6th SEMESTER

**INTEGRATED
PROFESSIONAL CORE
COURSE (IPCC)**

IPCC Course – Integrated Professional Core Course

Teaching Hours/Week (L: T:P: S)	2:2:2:0
Total Hours of Pedagogy	40 hours Theory + 20 Hours of Practical Classes
Credits:	04
Theory - Each Module	8 Hrs
Practical's	8-10 Programs / Experiments
CIE Marks	50
SEE Marks	50
Total Marks	100
Exam Hours	3
Examination nature (SEE)	Theory

- The theory part of the IPCC shall be evaluated both by CIE and SEE.
- The practical part shall be evaluated by only CIE (no SEE).
- However, questions from the practical part of IPCC shall be included in the SEE question paper.

Integrated Professional Core Course (IPCC) - 4 Credit Course

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) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).
- A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures 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) for the Theory component of the IPCC (Maximum marks 50)

Internal Assessment Test (IAT):

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are 25 marks and that for the practical component is 25 marks.

- 25 marks for the theory component are split into 15 marks for two Internal Assessment Tests (Two Tests, each of 50 Marks with 01-hour 30 minutes' duration, are to be conducted and average of two tests to be reduced to 15 marks) and 10 marks for Two Continuous Comprehensive Assessment(CCA) methods.
- The first Internal test at the end of 40-50% coverage of the syllabus
- The second Internal test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for 25 marks).
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

The IA test questions are to be framed to map the Course Outcomes (COs), Program Outcomes (POs) and the Revised Blooms Taxonomy (RBT) Levels. Emphasis to be given for Higher order Thinking Skills(HOTS).

Continuous Internal Evaluation (CIE) for the practical component of the IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and Marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report, **05 Marks** are for conducting the experiment, **05 Marks for** preparation of the laboratory record, **5 Marks** for conducting Open Ended Experiments Each experiment. Marks of all experiments' write-ups are added to 15 marks.
- The Practical laboratory test (**duration 03 hours**) at the end of the 15th week of the semester/after completion of all the experiments (whichever is early) shall be conducted for **50 Marks** and scaled down to **5 Marks**.
- The open-ended experiment after completion of all the experiments shall be conducted for 20 marks with a split-up for 5 Marks for writeup, 10 Marks for Execution, and 5 Marks for Viva-Voce. Marks for writeup, Execution and Viva-Voce is added and scaled down to 05 marks.
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 25 marks.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

Semester End Examination (SEE) for IPCC Theory

SEE will be conducted as per the scheduled timetable, with common question papers for the course (duration 03 hours)

- The question paper will have ten questions. Each question is set for 20 marks.
- The question paper shall be set for 100 Marks. The medium of the question paper shall be English. **The duration of SEE is 03 hours.**
- 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. The two questions shall be of same course outcome, program outcome and Blooms RBT level. Emphasis to be given for higher order RBT levels.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored by the student shall be proportionally scaled down to 50 Marks.
- The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only.
- Questions mentioned in the SEE paper may include questions from the practical component.

Continuous and Comprehensive Assessment (CCA):

Two of continuous and comprehensive assessment (CCA) to be conducted to attain COs and POs, evaluated each for **50 Marks**. Total Marks scored will be $(CCA1+CCA2)/2$ and scaled down to **10 Marks**.

- CCA1 after 4th week and CCA2 after 9th week. The Assessment will be through rubrics.
- CCA as project-based learning,
 - CCA is evaluated for **50 Marks** with review 1 of **20 Marks** after and review 2 of **30 Marks** includes project demonstration/competition and report submission.
 - The evaluation of review 1 after 6th weeks of semester and review 2 after 12th week of semester with project demonstration and submission of the report

Total score for CCA is **10 Marks**

Total Marks scored for theory component of CIE (IAT+ CCA) is **25 Marks**

Possible Continuous and Comprehensive Assessment (CCA):

- Project based, Problem Based, Building Models, Lab-to-Land, Mobile Studio, Design and Programming Contest, Certification, Concept Map (Collage presentation/poster presentation), Case studies, Think-Pair-Share, Flipped classroom,

- | | |
|--|--|
| | <ul style="list-style-type: none">• The assessment of these techniques shall be in rubrics.• The faculty can adopt any other CCA method of implementation and its assessment with prior approval of Program Assessment Committee (PAC). |
|--|--|

4 Credits Courses – Integrated Professional Core Course (IPCC)

Assessment Method	Component	Type of Assessments	Syllabus Coverage	Maximum Marks	Average	Reduced Marks	Minimum Passing Marks	Evaluation Details
Total CIE Theory + Practical				50	----	----	20	
CIE	Theory	Internal Assessment Test (IAT) – I	Module – 1 to 2.5	50	(50+50) / 2	15	6	Average of Two Internal test each of 50 Marks scale down the marks to 15 Marks
		Internal Assessment Test (IAT) - II	Module – 2.5 to 5	50				
	Continuous Comprehensive Assessment (CCA)	CCA-1- Pedagogical Initiatives / Activity based learning	Considering all the Modules	50	(50+50) / 2	10	4	Two CCA methods as per VTU Clause 22OB4.2 of regulations to be adopted. If CCA chosen is Project Based Learning, then one assessment method may be adopted
		CCA-2- Pedagogical Initiatives/ Activity based learning		50				
	Total CIE Theory						25	10

CIE	Practical	Conduction of Experiments	Performance-Continuous Evaluation of each experiment	05	15	Average of all Experiments	15	4	Performance of the Experiment (On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. 20 marks are for conducting the experiment and calculations/observations/output)
			Record	05					
			Observation book	05					
		Practical Test	Write up	15	50	----	05	4	One Internal Practical Test after conduction of all Experiments for 50 Marks
			Execution	25					
			Viva-voce	10					
		Open Ended Experiment	Write up	05	20	----	05	2	One experiment for 20 marks. 20 marks reduced to 05 marks
			Execution	10					
			Viva-voce	05					
			Total CIE Practical						25

SEE		Theory exam	Entire theory syllabus including questions from lab Component in respective Modules	100	----	50	20	SEE Exam is theory Exam conducted for 100 Marks, scored Marks are scaled down to 50 Marks
CIE + SEE				100	----	----	40	
<ul style="list-style-type: none"> • The Minimum Marks to be secured in CIE to appear for SEE shall be 10 (40% of Maximum Marks – 25) in the Theory Component and 10 (40% of Maximum Marks – 25) in the Practical component. • The Laboratory Component for the IPCC shall be for CIE only. • However, in SEE, the Questions from the Laboratory Component shall be included in the respective Modules only. 								
<p>Note: If few of the 3 Credit Courses are Integrated course type, for such courses the method suggested for 4 Credit IPCC Course shall be followed</p>								



Dayananda Sagar Academy of Technology & Management (Autonomous Institute under VTU)

Semester	:	6 th Sem		
Course Title	:	High Voltage and Power System Protection		
Course Code	:	BEE601		
Course Type (Theory/ Practical/ Integrated)	:	Integrated		
Category	:	IPCC		
Stream	:	EEE	CIE	: 50
Teaching hours/ week (L:T:P:S)	:	2:2:2:0	SEE	: 50
Total Hours	:	40 + 20	SEE	: 3 hours
Credits	:	4	Duration	

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To understand the behavior of power systems under fault conditions.
2	To learn the principles and technologies used in protection of electrical systems.
3	To analyze the design and testing of high voltage systems and insulation techniques..
4	To explore different types of switchgear and their applications..
5	To develop skills for industrial protection system design and fault analysis.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL)**, which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**



DSATM

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COURSE CURRICULUM

Module No.	Topics	Hours
1	Introduction to high voltage engineering: Advantages, Limitations and applications. Conduction and Breakdown in Gases: Introduction, Ionization Processes, Townsend's Current Growth Equation and it's Criterion for Breakdown, Streamer Theory of Breakdown in Gases, Paschen's Law, Breakdown in Non Uniform Fields and Corona Discharges. Conduction and Breakdown in Liquid Dielectrics: Introduction, Conduction and Breakdown in Liquid Dielectrics Breakdown in Solid Dielectrics: Introduction, Different types of break studies in Solid Dielectrics..	8
Pedagogy	Chalk and Talk, , Animated/NPTEL videos	
2	Generation of High Voltages and Currents: Generation of High Direct Current Voltages, High Alternating Voltages, Impulse Voltages and Impulse Currents. Measurement of High Voltages and Currents: Measurement of High Direct Current Voltages, High AC and Impulse Voltages, High Currents of Direct, Alternating and Impulse. Non-Destructive Testing of Materials and Electrical Apparatus: Introduction, Measurement of Dielectric Constant and Loss Factor, Partial Discharge Measurements.	8
Pedagogy	Chalk and Talk, , Animated/NPTEL videos	
3	Introduction to Power System Protection: Need for protective schemes, Types of Fault and it's Effects, Essential Qualities of Protection, Primary and Backup Protection. Relay Construction and Operating Principles: Introduction, Numerical Relays. – Merits and Demerits of Numerical Relays. Overcurrent Protection: Introduction, Time–current Characteristics, Current Setting, Time Setting, Directional Relay, Protection of Parallel Feeders and Ring Mains, Earth Fault, Phase Fault Protection and Combined Earth and Phase Fault Protective Scheme, Numerical Overcurrent Relays	8
Pedagogy	Chalk and Talk, , Animated/NPTEL videos	

4	<p>Circuit Breakers: Introduction, Arc Voltage, Arc Interruption, Restriking Voltage and Recovery Voltage, Current Chopping., SF6 Circuit Breakers, Vacuum Circuit Breakers, Rating of Circuit Breakers, Testing of Circuit Breakers.</p> <p>Insulator: Types of insulators and standards</p> <p>Isolators and Fuses: Ratings, selection, and operation of fuse. HRC fuses and expulsion fuses</p> <p>Switchgear Layout and Standards: Indoor vs outdoor switchgear, GIS and AIS systems, Safety and maintenance practices</p>	8
Pedagogy	Chalk and Talk, Animated/NPTEL videos	
5	<p>Protection of Power System Components:</p> <p>Transformer Protection: Differential protection, Buchholz relay and temperature-based methods. Generator Protection: Stator and rotor protection, Loss of excitation, unbalanced loading</p> <p>Busbar, Motor, and Feeder Protection: Busbar differential schemes, Motor overload, stall, and single phasing protection, Feeder protection using IDMT and numerical relays</p>	8
	Chalk and Talk, , Animated/NPTEL videos	
	<p>Pedagogical Initiatives (Not limited to):</p> <ul style="list-style-type: none"> • Think Pair and Share (Blended Learning): provides an opportunity for students to learn from one another • Problem Solving: encourages cognitive thinking and enables creative problem solving • Poster Presentation: allows students to represent the concepts visually in order to understand the topics easily. • Case studies: maps different domains in real time applications • Demonstration: exhibits the implementation process 	

List of Programs

Text Books	
Sl. No.	Title of the Book/Name of the author/Name of the publisher/Edition and Year
1	High Voltage Engineering, M.S.Naidu and Kamaraju- 5th Edition, THM, 2013
2	Power System Protection and Switchgear Badri Ram, D.N. Vishwakarma McGraw Hill 2nd Edition
Reference Books	
1	High Voltage Engineering Fundamentals, E.Kuffel and W.S. Zaengl, 2nd Edition, Elsevier Press, 2000
2	High Voltage Engineering, C.L.Wadhwa, New Age International Private limited, 3rd Edition, 2012.
3	Protection and Switchgear, Bhavesh et al, Oxford, 1st Edition, 2011.
4	Power System Switchgear and Protection, N. Veerappan, S.R. Krishnamurthy, S. Chand, 1st Edition, 2009

Sl. No.	Experiments/Programs
1	Over Current Relay: (a) Inverse Definite Minimum Time (IDMT) Non - Directional Characteristics (b) Directional Features (c) IDMT Directional.
2	IDMT Characteristics of Over Voltage or Under Voltage Relay (Solid State or Electromechanical type)
3	Operating Characteristics of Microprocessor Based (Numeric) Over –Current Relay.
4	Operating Characteristics of Microprocessor Based (Numeric) Over/Under Voltage Relay.
5	Motor Protection against Faults.
6	Spark Over Characteristics of Air subjected to High Voltage AC with Spark Voltage Corrected to Standard Temperature and Pressure for Uniform [as per IS1876: 2005]and Non-uniform [as per IS2071(Part 1) : 1993] Configurations: Sphere – Sphere, Point –Plane, Point – Point and Plane – Plane.
7	Spark Over Characteristics of Air subjected to High voltage DC.
8	Measurement of HVAC and HVDC using Standard Spheres as per IS 1876 :2005
9	Measurement of Breakdown Strength of Transformer Oil as per IS 1876 :2005
10	Fuse time characteristics

Sl. No	Course Outcomes (COs):	RBT Level	RBT Level Indicator
1	Interpret testing standards and safety protocols for HV equipment. (Understand)	Remember & understand	L ₁ , L ₂
2	Classify and select appropriate protective relays for various power system components.	Apply	L ₃
3	Analyze high voltage phenomena and insulation coordination.	Analyze	L ₄
4	Evaluate performance of circuit breakers and switchgear under fault conditions.	Evaluate	L ₅
5	Design basic protection schemes for transformers, lines, and generators.	Create	L ₆

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													2	2
CO2	3												2	2
CO3		3											2	2
CO4				2						2			3	2
CO5			3	2	3					2			3	2

Weblinks and Video Lectures (e-Resources)

1	https://www.youtube.com/watch?v=B4Ej3E3Rgpw&list=PLiE0cr_0lcyT6bkGhLDNWC6CVzH0J2N4Q
2	https://nptel.ac.in/courses/108105167 (NPTEL)

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Theory (25M)				Practical (25M)
	Continuous Assessment Tests (IAT)		Continuous Comprehensive Assessment (CCA)		
	IAT-1	IAT-2	CCA-1	CCA-2	
	50 Marks	50 Marks	50 Marks	50 Marks	
Remember	15	10	5	5	5
Understand	15	5	5	5	5
Apply	10	10	5	5	5
Analyse	5	10	5	5	5
Evaluate	5	5	5	5	5
Create		10	25	25	25

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage(%)
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	15	5	5	0	5	5	35	35
CO2	5	5	0	0	5	5	20	20
CO3	0	5	5	0	5	5	20	20
CO4	0	5	0	0	5	5	15	15
CO5	0	0	0	5	0	5	10	10
Total	20	20	10	5	20	25	100	100

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks
Remember	8
Understand	7
Apply	15
Analyse	10
Evaluate	5
Create	5

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage (%)
	Module-1	Module-2	Module-3	Module-4	Module-5		
CO1	5	5	0	0	5	15	15
CO2		3	3	4		10	10
CO3			6	4		10	10
CO4				5		5	5
CO5					10	10	10
Total	5	8	9	13	15	50	50

**PROFESSIONAL CORE
COURSE (PCC)**

PCC Course - Professional Core Course

Teaching Hours/Week (L: T:P: S)	3:0:0:0 /2:2:0:0
Total Hours of Pedagogy	40 hours
Credits:	03
Each Module	8 Hrs
CIE Marks	50
SEE Marks	50
Total Marks	100
Exam Hours	3
Examination nature (SEE)	Theory

3 Credit Course – Professional Core Course (PCC)

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) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).
- A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures 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:

Internal Assessment Test (IAT):

- For the Internal Assessment Test component of CIE, there are 25 marks and for Assignment component of the CIE, there are 25 marks. Two Tests, each of 50 Marks with 01-hour 30 minutes' duration, are to be conducted and average of two tests to be reduced to 25 marks
 - The first test will be administered after 40-50% of the syllabus has been covered, and
 - The second test will be administered after 85-90% of the syllabus has been covered

- Any two assignment methods, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.
- Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

The IA test questions are to be framed to map the Course Outcomes (COs), Program Outcomes (POs) and the Blooms RBT Levels. Emphasis to be given for higher order RBT levels

Semester-End Examination:

Theory SEE will be conducted as per the scheduled timetable (duration 03 hours).

- The question paper will have ten questions. Each question is set for 20 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.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks.

Continuous and Comprehensive Assessment (CCA):

Two of continuous and comprehensive assessment (CCA) to be conducted to attain COs and POs, evaluated each for **50 Marks**. Total Marks scored will be CCA1+CCA2 and scaled down to **10 Marks**.

- CCA1 after 4th week and CCA2 after 9th week. The evaluation includes either through quiz or rubrics
- CCA as project-based learning,
 - CCA is evaluated for **50 Marks** with review 1 of **20 Marks** after and review 2 of **30 Marks** includes project demonstration/competition and report submission.
 - The evaluation of review 1 after 6th weeks of semester and review 2 after 12th week of semester with project demonstration and submission of the report

Total score for CCA is **10 Marks**

Total Marks scored for theory component of CIE (IAT+ CCA) is **25 Marks**

Possible Continuous and Comprehensive Assessment (CCA):

- Project based, Problem Based, Building Models, Lab-to-Land, Mobile Studio, Design and Programming Contest, Certification, Concept Map (Collage presentation/poster presentation), Case studies, Think-Pair-Share, Flipped classroom,

- The assessment of these techniques shall be in rubrics.
- The faculty can adopt any other CCA method of implementation and its assessment with prior approval of Program Assessment Committee (PAC).

Professional Core Course (PCC) – 3 Credit course – Theory

Assessment Method	Component	Type of Assessments	Syllabus Coverage	Maximum Marks	Average	Reduced Marks	Minimum Passing Marks	Evaluation Details	
Total CIE Theory + Practical				50	----	----	20		
	Theory	Internal Assessment Test (IAT) - II	Module – 1 to 2.5	50	$(50+50) / 2$	25	10	Average of Two Internal test each of 50 Marks scale down the marks to 25 Marks	
		Internal Assessment Test (IAT) - II	Module – 2.5 to 5	50					
	Continuous Comprehensive Assessment (CCA)	CCA-1- Pedagogical Initiatives / Activity Based learning	Considering all the Modules	50	$(50+50) / 2$	25	10		Two CCA methods as per VTU Clause 22OB4.2 of regulations to be adopted. If CCA chosen is Project Based Learning, then one assessment method may be adopted
		CCA-2- Pedagogical Initiatives / Activity Based learning		50					
Total CIE Theory						50	20	Total Marks of IAT and CCA is 50	

SEE		Theory exam	Entire theory syllabus including questions from lab Component in respective Modules	100	----	50	20	SEE Exam is theory Exam conducted for 100 Marks, scored Marks are scaled down to 50 Marks
CIE + SEE				100	----	----	40	



Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	6			
Course Title	:	Power System Analysis			
Course Code	:	BEE602			
Course Type (Theory/ Practical/ Integrated)	:	Integrated			
Category	:	PCC			
Stream	:	EEE	CIE	:	50
Teaching hours/ week (L:T:P:S)	:	3:2:0	SEE	:	50
Total Hours	:	50 hrs of theory	SEE	:	3 hrs
Credits	:	4	Duration	:	

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To introduce and explain the concepts of various power system problems.
2	To discuss and provide the knowledge about p.u quantities, SC and symmetrical components applied to power system problems.
3	To explain the analysis of various power system problems
4	To introduce and discuss the evaluation of different power system problems.
5	To explain how to solve various power system problems using pedagogical methods.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to of basic MATLAB programming
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL)**, which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.



DSATM

Scheme of Teaching and Examinations for BE Programme -2025-26

Outcome Based Education and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2025-26)

COURSE CURRICULUM

Module No.	Topics	Hours
1	<p>Representation of Power System Components: Introduction, Single-phase Representation of Balanced Three Phase Networks ,One-Line Diagram, Steady State Model of Synchronous Machine, Transformer, Transmission line, Impedance or Reactance Diagram, Per Unit (p.u) System, Numerical examples on p.u systems. Representation of Loads.</p> <p>Transients in Power Systems: Introduction , Transient on a Transmission Line, Short Circuit of a Synchronous Machine on no Load and load with Illustrative examples.</p>	10
Pedagogy	Blended Mode, Experiential Learning.	
2	<p>Symmetrical Fault Analysis :Symmetrical fault analysis - Z_{bus} Formulation by Step by step building algorithm without mutual coupling between the elements by addition of link and addition of branch with Illustrative examples.</p> <p>Symmetrical Components Introduction, Synthesis of Unsymmetrical phasors from symmetrical components, symmetrical components of unsymmetrical Phasors(no derivation), Power in terms of symmetrical components , Sequence Impedances and Sequence Network of Power System, transmission lines, Synchronous Machine and transformers. Construction of Sequence Networks of a Power Systems. Illustrative examples.</p>	10
Pedagogy	Blended Mode, Experiential Learning.	
3	<p>Unsymmetrical Fault Analysis: Introduction , Single Line-To-Ground (LG) Fault, Line-To-Line (LL) Fault, Double Line-To-Ground (LLG) Faults on unloaded synchronous machine and power system, Open Conductor Faults. . Illustrative examples.</p> <p>Note: No derivation, only analysis will be carried out</p> <p>Network Topology: Introduction and basic definitions of elementary graph theory , Primitive networks ,Formation of bus incidence matrix and Y_{bus} by Singular Transformation. Y_{bus} by Inspection Method. Illustrative examples.</p>	10
Pedagogy	Blended Mode, Experiential Learning.	
4	<p>Load Flow Studies: Introduction, Classification of buses. Power flow equation, Operating Constraints, data for Load flow, Gauss Seidal iterative method (no derivation, treat with flow chart and LFEs). Illustrative examples. Newton-Raphson method in Polar form (no derivation, treat with flow chart and LFEs), Fast decoupled load flow method (no derivation, treat with flow chart and LFEs), Illustrative examples. Comparison of Load Flow Methods.</p>	10
Pedagogy	Blended Mode, Experiential Learning.	

5	Power System Stability: Introduction, classification of power system stability, Power angle equation and characteristics of salient and non-salient pole synchronous machines (without derivation) Dynamics of a Synchronous Machine , swing equation concepts (without derivation), ., Equal Area Criterion with area 1 and 2 concepts (no derivation for critical clearing time and angle), Numerical Solution of Swing Equation by Point by Point method and Runge Kutta Method. Illustrative examples. Factors Affecting Transient Stability,	10
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Text Books	
Sl. No.	Title of the Book/Name of the author/Name of the publisher/Edition and Year
1	Elements of Power System Analysis: W. D. Stevenson, McGraw Hill.
2	Power System Analysis: A. R. Bergen & V. Vittal, Pearson Education
3	Modern Power System Analysis ,D. P. Kothari, McGraw Hill ,4 th Edition, 2011
Reference Books	
1	Computer-Aided Power System , Analysis ,G. L. Kusic,CRC Press ,2nd Edition.2010
2	Power System Analysis,Hadi Sadat,McGraw Hill, 1 st Edition, 2002
3	

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Recall and comprehend the key concepts related to various power system problems.	Remember & Understand	L ₁ ,L ₂
CO2	Apply the knowledge of per unit quantities, short-circuit analysis, and symmetrical components to solve different power system issues.	Apply	L ₃
CO3	Analyze and interpret various power system problems, including faults and transient behaviors.	Analyze	L ₄
CO4	Evaluate per unit values and fault currents for different fault conditions in power systems.	Evaluate	L ₅
CO5	Solve power system problems using appropriate pedagogical methods, tools and techniques.		L ₁ to L ₅

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													3	1
CO2	3												2	1
CO3		3											2	1
CO4			3										3	1
CO5	3	3	3	3	3			2	1	3	2	3	3	3

Weblinks and Video Lectures (e-Resources)

1	https://www.youtube.com/playlist?list=PLksY_ktXf8HwmNzGAHbKghyCN_OwJ5GaY
2	https://www.youtube.com/playlist?list=PLksY_ktXf8HwFQPdLLSLV7wGtjVKcu9GL
3	https://www.electricalindia.in/
4	https://www.youtube.com/watch?v=NFCdDRkvXzQ
5	https://www.nptel.ac.in/

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Theory				Practical
	Continuous Assessment Tests (IAT)		Continuous Comprehensive Assessment (CCA)		Practical Test
	IAT-1	IAT-2	CCA-1	CCA-2	
	50 Marks	50 Marks	50 Marks	50 Marks	
Remember	15	10	5	5	25M
Understand	15	10	5	5	5
Apply	10	15	5	5	5
Analyze	5	10	5	5	5

Evaluate	5	5	5	5	2
Create			25	25	3

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	15	5	5	5	5	5	40	40
CO2	5	5	0	0	5	5	20	20
CO3	0	5	5	0	5	5	20	20
CO4	0	5	0	0	5	10	20	20
Total	20	20	10	5	20	25	100	100

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (90% Theory+10% Practical Questions)
Remember	10
Understand	10
Apply	15
Analyze	10
Evaluate	5
Create	--

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage (%)
	Module-1	Module-2	Module- 3	Module-4	Module-5		
CO1	5	5	0	0	5	15	15
CO2		3	3	4	10	20	20
CO3			6	4		10	10
CO4				5		05	5
CO5							
Total	5	8	9	13	15	50	50



Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	6					
Course Title	:	Solar & Wind Energy Systems					
Course Code	:	BEE603					
Course Type (Theory/ Practical/ Integrated)	:	Theory					
Category	:	PCC					
Stream	:	EEE		CIE	:	50	
Teaching hours/ week (L:T:P:S)	:	3:0:0		SEE	:	50	
Total Hours	:	40 hrs of theory		SEE	:	3 hrs	
Credits	:	3		Duration	:		

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Discuss the importance of the role of renewable energy, the concept of energy storage and the principles of energy storage devices.
2	Discuss the concept of solar radiation data and solar PV system fabrication, operation of solar cell, sizing and design of PV system.
3	Describe the process of harnessing solar energy and its applications in heating and cooling.
4	Explain basic Principles of Wind Energy Conversion, collection of wind data, energy estimation and site selection.
5	Discuss the performance of Wind-machines, energy storage, applications of Wind Energy and environmental aspects.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to of basic MATLAB programming
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL)**, which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.



DSATM

Scheme of Teaching and Examinations for BE Programme -2025-26
Outcome Based Education and Choice Based Credit System (CBCS)
 (Effective from the Academic Year 2025-26)

COURSE CURRICULUM

Module No.	Topics	Hours
1	<p>Fundamentals of Energy Science and Technology: Introduction, Energy, Economy and Social Development, Classification of Energy Sources, Importance of Non -conventional Energy Sources, Salient features of Non-conventional Energy Sources, World Energy Status, Energy Status in India. Energy Conservation and Efficiency: Introduction, Important Terms and Definitions, Important Aspects of Energy Conservation, Global Efforts, Achievements and Future Planning, Energy Conservation/Efficiency Scenario in India, Energy Audit, Energy Conservation Opportunities. Energy Storage: Introduction, Necessity of Energy Storage, Specifications of Energy Storage Devices. Solar Energy-Basic Concepts: Introduction, The Sun as Source of Energy, The Earth, Sun, Earth Radiation Spectrum, Extraterrestrial and Terrestrial Radiations, Spectral Power Distribution of Solar Radiation, Depletion of Solar Radiation.</p>	10
Pedagogy	Blended Mode, Experiential Learning.	
2	<p>Solar Energy-Basic Concepts (continued): Measurement of Solar Radiation, Solar Radiation Data, Solar Time, Solar Radiation Geometry, Solar Day Length, Extraterrestrial Radiation on Horizontal Surface, Empirical Equations for Estimating Terrestrial Solar Radiation on Horizontal Surface, Solar Radiation on Inclined Plane Surface. Solar Thermal Systems: Introduction, Solar Collectors, Solar Water Heater, Solar Passive Space Heating and Cooling Systems, Solar Industrial Heating Systems, Solar Refrigeration and Air Conditioning Systems, Solar Cookers.</p>	9
Pedagogy	Blended Mode, Experiential Learning.	
3	<p>Solar Photovoltaic Systems: Introduction, Solar Cell Fundamentals, Solar Cell Characteristics, Solar Cell Classification, Solar Cell Technologies, Solar Cell, Module, and Array Construction, Maximizing the Solar PV Output and Load Matching. Maximum Power Point Tracker. Balance of System Components, Solar PV Systems, Solar PV Applications.</p>	9
Pedagogy	Blended Mode, Experiential Learning.	
4	<p>Wind Energy: Introduction, Basic Principles of Wind Energy Conversion, History of Wind Energy, Wind Energy Scenario – World and India. The Nature of the Wind, The Power in the Wind, Forces on the Blades, Wind Energy Conversion, Wind Data and Energy Estimation, Site Selection Considerations Wind energy systems: Environment and Economics Environmental benefits and problems of wind energy, Economics of wind energy, Factors influence the cost of energy generation, machine parameters, Life cycle cost analysis</p>	9
Pedagogy	Blended Mode, Experiential Learning.	
5	<p>Basic Components of a Wind Energy Conversion(WEC) System: Classification of WEC systems, Advantages and Disadvantages of WECS, Types of Wind Machines (Wind Energy Collectors), Analysis of Aerodynamic Forces Acting on the Blade, Performance of Wind-machines, Generating Systems, Energy Storage, Applications of Wind Energy, Environmental Aspects.</p>	8

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Text Books

Sl. No.	Title of the Book/Name of the author/Name of the publisher/Edition and Year
1	Non-Conventional Energy Resources- B. H. Khan McGraw Hill 2nd Edition 2017
2	Non-Conventional Sources of Energy Rai G. D. Khanna Publishers 4th Edition, 2009

Reference Books

1	Non-Conventional Energy Resources ShobhNath Singh Pearson 1st Edition, 2015
2	Solar Energy – Principles of Thermal Collections and Storage S.P. Sukhatme J.K.Nayak McGraw Hill 3rd Edition, 2008
3	Wind Turbine Technology Ahmad Hemami Cengage 1st Edition, 2012

PROFESSIONAL ELECTIVE-II



Dayananda Sagar Academy of Technology & Management
(Autonomous Institute under VTU)

Semester	:	6				
Course Title	:	Electric Motor and Drive Systems for Electric Vehicles				
Course Code	:	BEE613A				
Course Type (Theory/ Practical/ Integrated)	:	Theory				
Category	:	Professional elective				
Stream	:	EEE		CIE	:	50
Teaching hours/ week (L:T:P:S)	:	4		SEE	:	50
Total Hours	:	40		SEE	:	3 hours
Credits	:	3		Duration		

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Understand the concept of electric vehicles technology
2	Gain knowledge on power requirement of EV
3	Know the performance and control of various motors for EVs

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Encourage collaborative (Group) Learning to encourage team building.
- Include videos to demonstrate various concepts.
- Discuss various case studies and certification course to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.



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Scheme of Teaching and Examinations for BE Programme -2025-26
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(Effective from the Academic Year 2025-26)

COURSE CURRICULUM

Module No.	Topics	Hours
1	Introduction -History of Electric and Hybrid Electric Vehicles. Vehicle Fundamentals -General Description of Vehicle Movement, Power Train Tractive Effort and Vehicle Speed. Vehicle Performance –Maximum Speed of a Vehicle, Gradeability, Acceleration Performance, Braking Performance, Braking Force, Braking Distribution on Front and Rear Axles.	8
Pedagogy	Chalk and Talk, PPT	
2	Vehicle Performance Parameters: Configurations of Electric Vehicles, Performance of Electric Vehicles , Traction Motor Characteristics, Tractive Effort and Transmission Requirement , Vehicle Performance , Energy Consumption.	8
Pedagogy	Chalk and Talk, PPT	
3	DC Motor Drives: Control Methods- Two-Quadrant Control -Single Chopper with a Reverse Switch, Class C Two-Quadrant Chopper, Four-Quadrant control. Brushless DC Motor Drives: Drive scheme, Half-wave and full wave converter topology. Merits and Demerits of Half-wave and full wave converter topology.	8
Pedagogy	Chalk and Talk, Think Pair and Share.	
4	Induction Motor Drives: Field Orientation Control (FOC): Principles of FOC. Control methods- Direction Rotor Flux control, Indirect Rotor Flux control, Voltage Source Inverter control - Voltage Control, Current Control. Permanent-Magnet Synchronous machine drive: vector control method. Control Strategies: Constant ($\delta= 90^\circ$) Torque-Angle Control, Unity-Power-Factor Control, Constant-Mutual-Flux-Linkages Control, Optimum-Torque-Per-Ampere Control. Space Vector Modulation for induction motors and permanent magnet synchronous motors (PMSM).	8
Pedagogy	Chalk and Talk, case study and seminar	
5	BLDC Motor Drives: BLDC Machine Construction and Classification, Performance Analysis, Control of BLDC Motor Drives. Control Techniques - Methods Using Observers, Methods Using Back EMF Sensing. Switched Reluctance Motor Drives (SRM) -Basic Magnetic Structure, Torque Production, Methods of Control -Phase Flux Linkage Method, Mutually Induced Voltage Method, Observer-Based Method, Self-Tuning Using an Artificial Neural Network.	8
Pedagogy	Chalk and Talk, Demonstration video, Quiz.	

Pedagogical Initiatives (Not limited to):

- **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another
- **Demonstration:** exhibits the implementation process
- **Quiz:** For continuous study and Reinforce Learning.

Text Books

Sl. No.	Title of the Book/Name of the author/Name of the publisher/Edition and Year
1	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles.Fundamentals, Theory, and Design by Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay, Ali Emadi, CRC Press, 2004.
2	Electric and Hybrid Vehicles Design Fundamentals Third Edition Iqbal Husain, CRC Press

Reference Books

1	Electric Motor Drives Modeling, Analysis, And Control by R Krishnan Prentice Hall.Inc.
2	Permanent Magnet Synchronous and Brushless DC Motor Drives , R Krishnan, CRC Press Switched Reluctance Motor Drives, Berker B., James W. J. & A. Emadi, CRC Press

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Understand the types, operation of electric vehicle and its drives like DC motor, Induction Motor, BLDC and SR Motor drives.	R/U	L1/L2
CO2	Apply the basic Electrical principle to check Electric vehicles performance and select suitable motor drive for its applications.	A	L3
CO3	Analyze the different control methods for various electric drives.	An	L4
CO4	Design a Model of induction motor and PMSM for EV applications.	D	L5

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	3	-	3	-	-	-	3	3	3	-	3	3

CO4														
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Weblinks and Video Lectures (e-Resources)	
1	https://archive.nptel.ac.in/courses/108/106/108106182
2	https://archive.nptel.ac.in/courses/108/102/108102121/
3	https://archive.nptel.ac.in/courses/108/103/108103009/

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Theory			
	Continuous Assessment Tests (IAT)		Continuous Comprehensive Assessment (CCA)	
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks
Remember	-	-	-	-
Understand	35	20	20	
Apply	15	20	30	20
Analyze		10		30

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	15	15	5	10	10		55	27
CO2	5	5	5	10		10	35	18
CO3					10		10	5
CO4	-	-	-	-	-	-	100	50
Total	20	20	10	20	20	10	200	100

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (90% Theory+10% Practical Questions)
Remember	10
Understand	40
Apply	40
Analyze	10

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage
	Module-1	Module-2	Module- 3	Module-4	Module-5		
CO1	10	10	10	10	10	50	50
CO2	10	10	10		10	40	40



Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	6 th Sem		
Course Title	:	Power Electronics for RES		
Course Code	:	BEE613B		
Course Type (Theory/ Practical/ Integrated)	:	Theory		
Category	:	PEC-2		
Stream	:	EEE	CIE	: 50
Teaching hours/ week (L:T:P:S)	:	3:0:0:0	SEE	: 50
Total Hours	:	40	SEE	: 3
Credits	:	3	Duration	

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To provide a comprehensive understanding of power electronics and control strategies for the efficient conversion, integration, and protection of renewable energy systems such as solar, wind, and hybrid sources
2	To enable students to analyze, design, and evaluate power electronic converters and storage systems with a focus on power quality, system reliability, and grid compatibility.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Include videos to demonstrate various concepts.
- Encourage collaborative (Group) Learning to encourage team building.
- Adopt **Problem-Based Learning (PBL)**, which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.



DSATM

Scheme of Teaching and Examinations for BE Programme -2025-26

Outcome Based Education and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2025-26)

COURSE CURRICULUM

Module No.	Topics	Hours
1	Prerequisite : Basic knowledge of electrical circuits, semiconductor devices (diodes, transistors), and power systems Introduction to Power Electronics and Renewable Energy Systems : Overview of renewable energy resources: Solar, Wind, Biomass, Small Hydro, Fuel Cells. Basics of power electronic devices: GTOs, POWER MOSFETS, IGBTs, MCTs. Advantages and challenges of using power electronics in renewable energy systems.	8
Pedagogy		
2	Prerequisite: Knowledge of DC circuit analysis and power electronic switches, solar PV DC-DC Converters in Renewable Systems : Principles of Buck, Boost, Buck-Boost, Cuk, and SEPIC converters. Solar PV characteristics, Maximum Power Point Tracking (MPPT) techniques: Perturb & Observe, Incremental Conductance. MPPT implementation using DC-DC converters in PV systems.	8
Pedagogy		
3	Prerequisite : Understanding of AC circuit theory, switching devices, inverter operation, PWM techniques DC-AC Converters (Inverters) : Single-phase and three-phase inverter configurations. PWM Techniques: Sinusoidal PWM (SPWM). Voltage Source Inverters (VSI) and Current Source Inverters (CSI). Grid synchronization, Phase Locked Loop (PLL). Harmonics, filters, and TTD & THD analysis.	8
Pedagogy		
4	Prerequisite :Basic knowledge of electrical machines (especially induction and synchronous generators), wind turbine operation and control fundamentals Drives in Wind Energy Systems : Overview of wind turbines: fixed-speed and variable-speed systems. Wind turbine generator types: Squirrel Cage Induction Generator (SCIG), Doubly Fed Induction Generator (DFIG), Permanent Magnet Synchronous Generator (PMSG). Control strategies for wind energy conversion systems : Power Electronic Converter Control, Reactive power control.	8
Pedagogy		
5	Prerequisite: Knowledge of power systems, power electronics, and grid fundamentals. Integration and Protection of Renewable Energy Systems : Grid integration standards and challenges (IEEE 1547, IEC 61727). Islanding and anti-islanding detection methods. Energy Storage Systems (ESS): Battery interfacing, bidirectional converters. Power quality considerations: voltage sag/swell, flicker, harmonics. Emerging trends: Smart grid integration, hybrid systems, wide bandgap devices (SiC, GaN).	8
	Pedagogical Initiatives (Not limited to):	
	<ul style="list-style-type: none"> • Think Pair and Share (Blended Learning): provides an opportunity for students to learn from one another • Problem Solving: encourages cognitive thinking and enables creative problem solving 	

- **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily.
- **Case studies:** maps different domains in real time applications
- **Demonstration:** exhibits the implementation process

Text Books

Sl. No.	Title of the Book/Name of the author/Name of the publisher/Edition and Year
1	Bimal K. Bose , Power Electronics and Motor Drives – Advances and Trends, Elsevier, 2006.
2	Muhammad H. Rashid , Power Electronics: Circuits, Devices and Applications, Pearson.

Reference Books

1	Erickson & Maksimovic , Fundamentals of Power Electronics, Springer.
2	James Larminie , Fuel Cell Systems Explained, Wiley.
3	IEEE and IEC standards related to renewable energy and power electronics.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	To understand the need for and role of power converters in renewable energy	Understand	L ₂
CO2	Apply power electronics in wind energy conversion and control	Apply	L ₃
CO3	To analyze different inverter topologies and their application in grid-connected systems.	Analyze	L ₄
CO4	Evaluate system-level aspects such as protection, storage, and grid compliance.	Evaluate	L ₅
CO5	Design and analyze DC-DC converters for photovoltaic applications	Design	L ₆

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						2									
CO2	3					2									
CO3		3				2									
CO4			3												
CO5				3											

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Continuous Comprehensive Assessment (CCA)			
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks
Remember	15	10	5	5
Understand	15	5	5	5
Apply	10	10	5	5
Analyse	5	10	5	5
Evaluate	5	5	5	5
Create		10	25	25

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage(%)
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	15	5	5	5	5	5	40	40
CO2	5	5	0	0	5	5	20	20
CO3	0	5	5	0	5	5	20	20
CO4	0	5	0	0	5	0	10	10
CO5	0	0	0	0	0	10	10	10



Dayananda Sagar Academy of Technology & Management (Autonomous Institute under VTU)

Semester	:	6	
Course Title	:	EVT: Battery Energy storage and Charging Infrastructure for Electric Vehicles	
Course Code	:	BEE613C	
Course Type (Theory/ Practical/ Integrated)	:	Theory	
Category	:	Professional elective	
Stream	:	EEE	CIE : 50
Teaching hours/ week (L:T:P:S)	:	2:2:0:0	SEE : 50
Total Hours	:	40	SEE : 3 hours
Credits	:	3	Duration

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To introduce the fundamental principles, key components, and operational functions of battery energy storage systems (BESS) and electric vehicle (EV) charging infrastructure
2	To impart knowledge on design methodologies for energy storage systems, enabling students to evaluate critical performance metrics such as energy density, efficiency, and life cycle.
3	To familiarize students with various battery chemistries, including their classifications, comparative characteristics, and suitability for different energy storage applications.
4	To develop analytical skills through the review of real-world case studies addressing current challenges in EV battery performance and charging infrastructure deployment.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to of basic MATLAB programming
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL)**, which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.



DSATM

Scheme of Teaching and Examinations for BE Programme -2025-26
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2025-26)

COURSE CURRICULUM

Module No.	Topics	Hours
1	Energy Storage Technologies: Storage types, Components of a Battery Energy Storage System, Battery Chemistry Types- Lead Acid battery, Nickel Cadmium battery, Nickel-Metal hydride battery, Lithium Ion battery, Sodium Sulfur battery, redox flow battery Grid Applications of Battery Energy Storage Systems: Scoping of BESS Use Cases, General Grid Applications of BESS, Technical Requirements- Round-Trip Efficiency, Response Time, Lifetime and Cycling, Sizing, Operation and Maintenance, Use Cases-Frequency Regulation, Renewable Energy Integration, Peak Shaving and Load Levelling	8
Pedagogy	Chalk and Talk, Experiential Learning.	
2	BESS controls: Battery management system, Energy management system, power plant controller and SCADA systems, Fleet level controls, Virtual power plants, cybersecurity. Future of energy storage: Growth of battery sector, evolution of battery technology, Vehicle-to-grid(V2G),Regulatory Outlook.	8
Pedagogy	Chalk and Talk, Experiential Learning.	
3	Business models for energy storage services: Ownership models- Third party ownership, Outright purchase and full ownership, Electric co-operative approach to energy storage procurement, factors affecting viability of BESS projects, Financial and economic Analysis-Criteria for the economic analysis of BESS projects, key assumptions in the cost benefit analysis of BESS projects. Challenges and Risk: General Challenges and Risks, Challenges of Reducing Carbon Emission, Battery Recycling and Reuse Risks- Examples of Battery Reuse and Recycling, Reuse of Electric Vehicle Batteries for Energy Storage, Recycling Process	8
Pedagogy	Chalk and Talk, Experiential Learning.	

4	Charging Infrastructure 1: Overview of charging infrastructure-characteristics, Standards for operability, charging stations to charging points, classification of EV charging infrastructure, roles and responsibilities of government stake holders, assessing charging demand and setting targets.	8
Pedagogy	Chalk and Talk, Experiential Learning.	
5	Charging Infrastructure 2: Location planning and land allocation, Connecting EV's to electricity grid-regulatory framework, Role of DISCOM, improving the utilization of electricity grid and integrating EV charging in grid planning, models of EV charging Implementation-typical roles of EV charging infrastructure implementation, models of implementation.	8
Pedagogy	Chalk and Talk, Experiential Learning.	
	Pedagogical Initiatives (Not limited to): <ul style="list-style-type: none"> ● Think Pair and Share (Blended Learning): provides an opportunity for students to learn from one another ● Problem Solving: encourages cognitive thinking and enables creative problem solving ● Demonstration: exhibits the implementation process ● Experiential Learning: conducts experiments substantiating the concept more effectively 	

Text Books	
Sl. No.	Title of the Book/Name of the author/Name of the publisher/Edition and Year
1	"Handbook On Battery Energy Storage System", Asian Development Bank
2	"Handbook Of Electric Vehicle Charging Infrastructure Implementation", NITI Aayog-Amitabh Kant Randheer Singh, Ministry of Power (MoP)- Sanjeev Kumar Kassi, Department of Science and Technology (DST)- Ashutosh Sharma Sajid Mubashir,Bureau of Energy Efficiency (BEE)- Abhishek Sharma,WRI India- Chaitanya Kanuri Shyamasis Das Pawan Mulukutla
Reference Books	
1	"The BESS Book: A Cell-to-Grid Guide to Utility-Scale Battery Energy Storage Systems" by Drew Lebowitz, Sean Daly, Swetha Sundaram

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Explain the basic principles, components, and functions of battery energy storage systems and charging infrastructure	U	L
CO2	Apply energy storage system design principles to evaluate performance metrics like energy density, efficiency, and life cycle.	A	L3
CO3	Classify and compare various types of battery chemistries and their applications in energy storage	An	L4
CO4	Summarize the case studies for current EV battery storage issues and charging infrastructure.	C	L5

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	3	-	-	-	-	-	2	-	-	-	3

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Theory				Practical
	Continuous Assessment Tests (IAT)		Continuous Comprehensive Assessment (CCA)		Practical Test
	IAT-1	IAT-2	CCA-1	CCA-2	
	50 Marks	50 Marks	50 Marks	50 Marks	25M
Remember	15	10	5	5	5
Understand	15	10	5	5	5

Apply	10	15	5	5	5
Analyze	5	10	5	5	5
Evaluate	5	5	5	5	2
Create			25	25	3

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	15	5	5	5	5	5	40	40
CO2	5	5	0	0	5	5	20	20
CO3	0	5	5	0	5	5	20	20
CO4	0	5	0	0	5	10	20	20
Total	20	20	10	5	20	25	100	100

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (90% Theory+10% Practical Questions)
Remember	10
Understand	10
Apply	15
Analyze	10
Evaluate	5
Create	--

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage (%)
	Module-1	Module-2	Module- 3	Module-4	Module-5		
CO1	5	5	0	0	5	15	15
CO2		3	3	4	10	20	20
CO3			6	4		10	10
CO4				5		05	5
CO5							
Total	5	8	9	13	15	50	50



Semester	:	6th		
Course Title	:	Embedded Systems Design		
Course Code	:	BEE613D		
Course Type (Theory/ Practical/ Integrated)	:	Theory		
Category	:	Professional Elective-1		
Stream	:	Electrical & Electronics Branch	CIE	: 50 Marks
Teaching hours/ week (L:T:P:S)	:	2:2:0:0	SEE	: 50 Marks
Total Hours	:	40 Hrs Theory	SEE	: 3 Hours
Credits	:	03	Duration	

Course Learning Objectives: Students will be taught

Sl. No.	Course Objectives
1	Understanding the Basic Concepts of ARM Micro Controller, Embedded C used in Embedded Systems
2	Apply the Programming Concepts of Embedded C, Hardware Software Co Design and Firmware Concepts to develop Efficient Embedded Systems
3	Analyze the performance of C programs for execution on microcontroller/SOC development board based on ARM architecture

Teaching-Learning Process

Pedagogy (General Instructions):

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the infrastructures and the mechanism involved in the principle.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOT (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
6. Topics will be introduced in multiple representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
9. Individual teachers can devise innovative pedagogy to improve teaching-learning.



Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2025-26)

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	Module-1:- ARM architecture: ARM product profiles and features, Cortex M features and applications, performance, operation modes and privilege levels, switching of operation modes, register classification and importance, memory map, advantages of bit band region, aligned and unaligned access, endianness and performance, SYSTICK timer and interrupt, exception types, NVIC, interrupt and execution sequences, vector fetches, tail chaining, faults caused by exceptions, ARM busses and their role to enhance performance. (Text Book 1-Chapter 2, Chapter 5.5,5.6,5.8,Chapter 8.2,8.5 Chapter 9.3,9.4)	8
Pedagogy	1. Chalk and talk 2. Animated/NPTEL videos 3. Problem Based Learning	
2	Module -2:- Embedded C Programming: C and embedded C data types, bit manipulation, advanced pointer use, function pointers arrays and dynamic memory allocation, introduction to data structures, enumerations, unions, structures and encapsulation, bit fields, LIFO buffer, circular buffer, linked list. Modular C programming, writing header files and exception handlers. ARM memory access using variables and pointers, design of CPU Core and Peripheral register structures using bit fields, IO port configuration example, creating software interfaces for hardware, Pre-processor directives in C. Storage Classes of C. Storage type qualifiers, inline assembly, performance optimization through appropriate data type selection and data alignment. (Text Book 3)	8
Pedagogy	1. Chalk and talk 2. Animated/NPTEL videos 3. Problem Based Learning	
3	Module- 3:- Hardware Software Co design and Program Modelling : Fundamental issues in Hardware Software Co-design, Computational models in Embedded System Design (Chapter 7 – Text 1: 7.1, 7.2) Embedded Hardware Design and Development: Analog Electronic Components, Digital Electronic Components, VLSI & Integrated Circuit Design, Electronic Design Automation Tools (Chapter 8 – Text 4: 8.1, 8.2, 8.3, 8.4)	8
Pedagogy	1. Chalk and talk 2. Animated/NPTEL videos 3. Problem Based Learning 4. Experiential Learning	
4	Module- 4:- Embedded Firmware Design and Development: Embedded Firmware Design Approaches, Embedded Firmware Development Languages (Chapter 9 – Text 1: 9.1, 9.2) Embedded System Development Environments: Types of files generated on cross compilation (only explanation – programming codes need not be dealt), disassemble/decompiler, Simulators, Emulators and Debugging (Chapter 13 – Text 4: 13.2, 13.3,13.4)	8
Pedagogy	1. Chalk and talk 2. Animated/NPTEL videos 3. Experiential Learning 4. Demonstration	
5	Module- 5:- Develop an embedded system using different approaches: using GPP, using FPGA and as a SPP. Debugging Techniques for Embedded Systems: Introduction to GNU Debugger gdb. uVision IDE based debugging techniques. Single Stepping, Break Points, Watch Points, and Memory Probing. Simulation using uVision.(Text book 5 Chapter 9)	8
Pedagogy	1. Chalk and talk 2. Animated/NPTEL videos	

Text Books	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	Joseph Yiu, "Definitive guide to the ARM Cortex-M3", Latest available edition
2	Hennessy and Patterson, "Computer Architecture: A Quantitative Approach", Latest available edition
3	Michael J Pont, "Embedded C", latest available edition
4	Introduction to Embedded Systems : Shibu K. V. (TMH)
5	Embedded Systems: A Contemporary Design Tool" by James K. Peckol

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	Level Indicator
CO1	Understand the basic Concepts of ARM Cortex Micro Controller, Embedded C Concepts used in Embedded Systems	Remember and Understand	L1 & L2
CO2	Apply the knowledge of ARM Micro Controller and Embedded C to write programs to develop efficient Embedded Systems	Apply	L3
CO3	Analyze the performance of Hardware Software Co Design and Firmware design for efficient Embedded System Design	Analyze	L4
CO4	Develop embedded systems using different approaches	Design	L6

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CO2	3	--	--	--	--	--	--	--	--	--	--	--	--	--
CO3	--	3	--	--	--	--	--	--	--	--	--	--	--	--
CO4	--	--	3	3	3	--	--	--	2	2	--	--	2	2

Weblinks and Video Lectures (e-Resources)	
1	https://nptel.ac.in/courses/106105159
2	https://nptel.ac.in/courses/108102045
3	Embedded Software and Hardware Architecture by University of Colorado Boulder – Coursera

Open Elective course-1



Dayananda Sagar Academy of Technology & Management
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Semester	:	6 th Sem		
Course Title	:	UTILIZATION OF ELECTRICAL POWER		
Course Code	:	BEE654A		
Course Type (Theory/ Practical/ Integrated)	:	Theory		
Category	:	Open Elective		
Stream	:	EEE	CIE	: 50
Teaching hours/ week (L:T:P:S)	:	4	SEE	: 50
Total Hours	:	40	SEE	: 3
Credits	:	3	Duration	

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Understand the concept of electric heating, air-conditioning, electric welding, laws of electrolysis, illumination and electric traction.
2	Design of interior and exterior lighting systems
3	Know the performance and control of various motors used for traction system
4	awareness of technology of electric and hybrid electric vehicles.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Include videos to demonstrate various concepts.
- Encourage collaborative (Group) Learning to encourage team building.
- Adopt **Problem-Based Learning (PBL)**, which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.



DSATM

Scheme of Teaching and Examinations for BE Programme -2025-26
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COURSE CURRICULUM

Module No.	Topics	Hours
1	<p>Heating and welding: Electric Heating, Resistance ovens, Radiant Heating, Induction Heating, High frequency Eddy Current Heating, Dielectric Heating, The Arc Furnace, Heating of Buildings, Air – Conditioning, Electric Welding, Modern Welding Techniques.</p> <p>Electrolytic Electro – Metallurgical Process: Ionization, Faraday’s Laws of Electrolysis, Definitions, Extraction of Metals, Refining of Metals, Electro Deposition</p>	8
Pedagogy	PPT, Blended Learning, Problem Solving	
2	<p>Illumination: Introduction, Radiant Energy, Definitions, Laws of Illumination, Polar Curves, Photometry, Measurement of Mean Spherical Candle Power by Integrating Sphere, Illumination Photometer, Energy Radiation and luminous Efficiency, electric Lamps, Cold Cathode Lamp, Lighting Fittings, Illumination for Different Purposes, Requirements of Good Lighting.</p>	8
Pedagogy	Chalk and Talk, Problem Solving, Market survey	
3	<p>Electric Traction Speed - Time Curves and Mechanics of Train Movement: Introduction, Systems of Traction, Systems of electric Traction, Speed - Time Curves for Train Movement, Mechanics of Train Movement, Train Resistance, Adhesive Weight, Coefficient of Adhesion.</p> <p>Motors for Electric traction: Introduction, Series and Shunt Motors for Traction Services, Two Similar Motors (Series Type) are used to drive a Motor Car, Tractive Effort and Horse Power, AC Series Motor, Three Phase Induction Motor.</p> <p>Control of motors: Control of DC Motors, Tapped Field Control or Control by Field Weakening, Multiple Unit Control, Control of Single Phase Motors, Control of Three Phase Motors.</p>	8
Pedagogy	Chalk and Talk, Problem Solving, Demonstration.	
4	<p>Braking: Introduction, Regenerative Braking with Three Phase Induction Motors, Braking with Single Phase Series Motors, Mechanical braking, Magnetic Track Brake, Electro – Mechanical Drum Brakes.</p> <p>Electric Traction Systems and Power Supply: System of Electric Traction, AC Electrification, Transmission Lines to Sub - Stations, Sub – Stations, Feeding and Distribution System of AC Traction Feeding and Distribution System for DC Tramways, Electrolysis by Currents through Earth, Negative Booster, System of Current Collection, Trolley Wires.</p> <p>Trams, Trolley Buses and Diesel – Electric Traction: Tramways, The Trolley – Bus, Diesel Electric Traction.</p>	8
Pedagogy	Chalk and Talk, PPT	
5	<p>Electric Vehicles: Configurations of Electric Vehicles, Performance of Electric Vehicles, Tractive Effort in Normal Driving, Energy Consumption. Hybrid Electric Vehicles: Concept of Hybrid Electric Drive Trains, Architectures of Hybrid Electric Drive Trains.</p>	8
Pedagogy	PPT	

Pedagogical Initiatives (Not limited to):

- **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another
- **Problem Solving:** encourages cognitive thinking and enables creative problem solving
- **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily.
- **Market survey:** survey research and unit of analysis of the market for a particular product/service with design ratings.

Text Books

Sl. No.	Title of the Book/Name of the author/Name of the publisher/Edition and Year
1	Utilization, Generation and Conservation of Electrical Energy, Sunil S Rao, Khanna Publishers, 1st Edition, 2011
2	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals Theory, and Design, (Chapters 04 and 05 for module 5), Mehrdad Ehsani et al, CRC Press, 1st Edition, 2005.

Reference Books

1	A Text Book on Power System Engineering, A. Chakrabarti et al, Dhanpat Rai and Co, 2nd Edition, 2010.
2	Utilization of Electric Power by R.K Rajput. Second Edition, January 2016

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Understand the basic concept of Electrical Energy Utilization and Electric vehicles.	U	L2
CO2	Apply the engineering knowledge for various applications of Electrical Energy.	A	L3
CO3	Analyze the types of traction motors configurations and their energy consumption.	An	L4
CO4	Illustrate the impact of the Electrical Energy Utilization in societal and environmental context.	E	L6

Weblinks and Video Lectures (e-Resources)

1	https://nptel.ac.in/courses/ 108102047
2	https://nptel.ac.in/courses/ 108105060
3	https://nptel.ac.in/courses/ 112105221

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2	3													
CO3		3												
CO4						3			3	3		3	3	

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Theory			
	Continuous Assessment Tests (IAT)		Continuous Comprehensive Assessment (CCA)	
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks
Remember	-	-	-	-
Understand	35	20	20	
Apply	15	20	30	20
Analyze		10		30

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	15	15	5	10	10		55	27
CO2	5	5	5	10		10	35	18
CO3					10		10	5

CO4	-	-	-	-	-	-	100	50
Total	20	20	10	20	20	10	200	100

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (90% Theory+10% Practical Questions)
Remember	10
Understand	40
Apply	40
Analyze	10

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage
	Module-1	Module-2	Module- 3	Module-4	Module-5		
CO1	10	10	10	10	10	50	50
CO2	10	10	10		10	40	40
CO3				10		10	10
Total	20	20	20	20	20	100	100



Dayananda Sagar Academy of Technology & Management
(Autonomous Institute under VTU)

Semester	:	6 th Sem		
Course Title	:	Industrial Servo Control Systems		
Course Code	:	BEE654B		
Course Type (Theory/ Practical/ Integrated)	:	Theory		
Category	:	OEC-1		
Stream	:	EEE	CIE	: 50
Teaching hours/ week (L:T:P:S)	:	3:0:0:0	SEE	: 50
Total Hours	:	40	SEE	: 3
Credits	:	3	Duration	

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To provide a comprehensive understanding of servo system components, modeling, and control strategies used in industrial automation and motion control applications.
2	To equip students with the skills to design, analyze, and implement servo control systems using motors, sensors, PID controllers, and digital platforms like microcontrollers and PLCs.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Include videos to demonstrate various concepts.
- Encourage collaborative (Group) Learning to encourage team building.
- Adopt **Problem-Based Learning (PBL)**, which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.



DSATM

Scheme of Teaching and Examinations for BE Programme -2025-26
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2025-26)

COURSE CURRICULUM

Module No.	Topics	Hours
1	<p>Prerequisite: Basics of feedback systems and block diagrams from Control Systems</p> <p>Introduction to Servo Systems: Basics of control systems and automation, Components of servo systems, Types: position, speed, and torque control systems, Open-loop vs. closed-loop servo systems, Block diagram representation, Industrial applications: CNC, robotics, elevators, defense systems</p>	8
Pedagogy		
2	<p>Prerequisite: Knowledge of motor principles and Laplace transforms</p> <p>Servo Motor Modeling and Dynamics: DC servo motors: armature and field control, AC servo motors: two-phase and three-phase systems, Modeling and transfer function derivation, Torque-speed characteristics, Stepper motors, brushless DC motors, Synchros and resolvers</p>	8
Pedagogy		
3	<p>Prerequisite: Knowledge of basic sensors, transducers, and analog signal processing</p> <p>Sensors and Feedback Devices: Position sensors: Potentiometers, Encoders (Incremental & Absolute), LVDT, Speed sensors: Tachogenerators, Hall-effect sensors, Resolvers and Synchros, Feedback signal processing and error generation, Basics of signal conditioning: filters, amplifiers</p>	8
Pedagogy		
4	<p>Module Prerequisite: Classical control system design methods</p> <p>Servo Control System Design: PID controllers: theory, tuning methods (Ziegler–Nichols), Frequency domain analysis: Bode plot, stability margins, Root locus method, Lead, lag, and lead-lag compensators, Introduction to fuzzy and adaptive control.</p>	8
Pedagogy		
5	<p>Module Prerequisite: Microcontrollers or PLC basics, digital logic, and industrial automation fundamentals</p>	8

	Implementation and Industrial Applications: Power electronics for servo drives: PWM, H-bridge, inverter control, Digital implementation using microcontrollers/DSP, PLC interfacing and ladder logic basics, SCADA overview for monitoring servo systems, Industrial communication protocols: MODBUS, PROFIBUS, Case studies: robotics arm, conveyor, CNC	
	Pedagogical Initiatives (Not limited to): <ul style="list-style-type: none"> • Think Pair and Share (Blended Learning): provides an opportunity for students to learn from one another • Problem Solving: encourages cognitive thinking and enables creative problem solving • Poster Presentation: allows students to represent the concepts visually in order to understand the topics easily. • Case studies: maps different domains in real time applications • Demonstration: exhibits the implementation process 	

Text Books	
Sl. No.	Title of the Book/Name of the author/Name of the publisher/Edition and Year
1	George Ellis, <i>Control System Design Guide</i> , Academic Press
Reference Books	
1	Power Electronics, P.S. Bimbhra, Khanna Publishers, 5th Edition, 2012.
2	R. Krishnan, <i>Electric Motor Drives: Modeling, Analysis, and Control</i> , Pearson
3	Katsuhiko Ogata, <i>Modern Control Engineering</i> , Prentice Hall

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Understand industrial servo systems and their key components	Understand	L2
CO2	Apply sensors and feedback in servo loop implementation	Apply	L3
CO3	Model and analyze DC/AC servo motor dynamics	Analyze	L4
CO4	Design and tune controllers (PID, compensators) for servo control	Design	L6

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2	3														
CO3		3													
CO4			3		3										

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Continuous Comprehensive Assessment (CCA)			
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks
Remember	15	10	5	5
Understand	15	10	10	10
Apply	10	10	5	5
Analyse	10	10	5	5
Create		10	25	25

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage(%)
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	15	5	5	5	5	5	40	40
CO2	5	5	0	0	5	5	20	20
CO3	0	5	5	0	5	5	20	20
CO4	0	5	0	0	5	10	20	20
Total	20	20	10	5	20	25	100	100

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks
Understand	40
Apply	20
Analyse	20
Create	20

SEE Course Plan

CO's	Marks Distribution					Total Marks	Weightage (%)
	Module-1	Module-2	Module-3	Module-4	Module-5		
CO1	15	5	10	5	5	40	40
CO2	5	5	0	5	5	20	20
CO3	0	5	5	5	5	20	20
CO4	0	5	0	5	10	20	20
Total	20	20	15	20	25	100	100



Dayananda Sagar Academy of Technology & Management
(Autonomous Institute under VTU)

Semester	:	6th			
Course Title	:	Technologies of Renewable Energy Sources			
Course Code	:	BEE654C			
Course Type (Theory/ Practical/ Integrated)	:	Theory			
Category	:	Open Elective			
Stream	:	Electrical & Electronics Branch	CIE	:	50 Marks
Teaching hours/ week (L:T:P:S)	:	3:0:0:0	SEE	:	50 Marks
Total Hours	:	40 Hrs Theory	SEE	:	3 Hours
Credits	:	03	Duration	:	

Course Learning Objectives: Students will be taught

Sl. No.	Course Objectives
1	Understand the concepts of various energy sources of Renewable & Non-renewable power production
2	Apply the basic knowledge on solar, wind, tidal, hydro, biogas, biomass & ocean power generation technology
3	Analyse the responses non-conventional type of power generation

Teaching-Learning Process

Pedagogy (General Instructions):

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the infrastructures and the mechanism involved in the principle.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOT (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
6. Topics will be introduced in multiple representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
9. Individual teachers can devise innovative pedagogy to improve teaching-learning.



DSATM

**Scheme of Teaching and Examinations for BE Programme -2025-26
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2025-26)**

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	<p>Module-1:- Introduction: Causes of Energy Scarcity, Solution to Energy Scarcity, Factors Affecting Energy Resource Development, Energy Resources and Classification, Renewable Energy – Worldwide Renewable Energy Availability, Renewable Energy in India.</p> <p>Energy from Sun: Sun- earth Geometric Relationship, Layer of the Sun, Earth – Sun Angles and their Relationships, Solar Energy Reaching the Earth’s Surface, Solar Thermal Energy Applications.</p>	8
Pedagogy	1. Chalk and talk 2. Animated/NPTEL videos 3. Problem Based Learning	
2	<p>Module -2:- Solar Thermal Energy Collectors: Types of Solar Collectors, Configurations of Certain Practical Solar Thermal Collectors, Material Aspects of Solar Collectors, Concentrating Collectors, Parabolic Dish – Stirling Engine System, Working of Stirling or Brayton Heat Engine, Solar Collector Systems into Building Services, Solar Water Heating Systems, Passive Solar Water Heating Systems, Applications of Solar Water Heating Systems, Active Solar Space Cooling, Solar Air Heating, Solar Dryers, Crop Drying, Space Cooing, Solar Cookers, Solar pond.</p> <p>Solar Cells: Components of Solar Cell System, Elements of Silicon Solar Cell, Solar Cell materials, Practical Solar Cells, I – V Characteristics of Solar Cells, Efficiency of Solar Cells, Photovoltaic panels (series and parallel arrays).</p>	8
Pedagogy	1. Chalk and talk 2. Animated/NPTEL videos 3. Problem Based Learning	
3	<p>Module- 3:- Hydrogen Energy: Benefits of Hydrogen Energy, Hydrogen Production Technologies, Hydrogen Energy Storage, Use of Hydrogen Energy, Advantages and Disadvantages of Hydrogen Energy, Problems Associated with Hydrogen Energy.</p> <p>Wind Energy: Windmills, Wind Turbines, Wind Resources, Wind Turbine Site Selection. Geothermal Energy: Geothermal Systems, Classifications, Geothermal Resource Utilization, Resource Exploration, Geothermal Based Electric Power Generation, Associated Problems, environmental Effects.</p> <p>Solid waste and Agricultural Refuse: Waste is Wealth, Key Issues, Waste Recovery Management Scheme, Advantages and Disadvantages of Waste Recycling, Sources and Types of Waste, Recycling of Plastics.</p>	8
Pedagogy	1. Chalk and talk 2. Animated/NPTEL videos 3. Problem Based Learning 4. Experiential Learning	
4	<p>Module- 4:- Biomass Energy: Biomass Production, Energy Plantation, Biomass Gasification, Theory of Gasification, Gasifier and Their Classifications, Chemistry of Reaction</p>	8

	<p>Process in Gasification, Updraft, Downdraft and Cross-draft Gasifiers, Fluidized Bed Gasification, Use of Biomass Gasifier, Gasifier Biomass Feed Characteristics, Applications of Biomass Gasifier, Cooling and Cleaning of Gasifiers.</p> <p>Biogas Energy: Introduction, Biogas and its Composition, Anaerobic Digestion, Biogas Production, Benefits of Biogas, Factors Affecting the Selection of a Particular Model of a Biogas Plant, Biogas Plant Feeds and their Characteristics.</p> <p>Tidal Energy: Introduction, Tidal Energy Resource, Tidal Energy Availability, Tidal Power Generation in India, Leading Country in Tidal Power Plant Installation, Energy Availability in Tides, Tidal Power Basin, Turbines for Tidal Power, Advantages and Disadvantages of Tidal Power, Problems Faced in Exploiting Tidal Energy.</p>	
Pedagogy	1. Chalk and talk 2. Animated/NPTEL videos 3. Experiential Learning 4. Demonstration	
5	<p>Module- 5:- Sea Wave Energy: Introduction, Motion in the sea Waves, Power Associated with Sea Waves, Wave Energy Availability, Devices for Harnessing Wave Energy, Advantages and Disadvantages of Wave Power.</p> <p>Ocean Thermal Energy: Introduction, Principles of Ocean Thermal Energy Conversion (OTEC), Ocean Thermal Energy Conversion plants, Basic Rankine Cycle and its Working, Closed Cycle, Open Cycle and Hybrid Cycle, Carnot Cycle, Application of OTEC in Addition to Produce Electricity, Advantages, Disadvantages and Benefits of OTEC.</p>	8
Pedagogy	1. Chalk and talk 2. Animated/NPTEL videos	

Reference Books

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1	Nonconventional Energy Resources, Shobh Nath Singh, Pearson, 1st Edition, 2015.
2	Nonconventional Energy Resources, B.H. Khan, McGraw Hill, 3rd Edition.
3	Renewable Energy; Power for a sustainable Future, Godfrey Boyle, Oxford, 3rd Edition, 2012.
4	Renewable Energy Sources: Their Impact on global Warming and Pollution, Tasneem Abbasi S.A. Abbasi, PHI, 1st Edition, 2011.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	Level Indicator
CO1	Understand the concepts of various energy sources of Renewable & Non-renewable power production	Remember and Understand	L1 & L2
CO2	Apply the basic knowledge on solar, wind, tidal, hydro, biogas, biomass & ocean power generation technology	Apply	L3
CO3	Analyse the responses non-conventional type of power generation	Analyse	L4
CO4	Build the simple circuits for power generation of solar PV Cells and Wind Mills.	Design	L6

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CO2	3	--	--	--	--	--	--	--	--	--	--	--	--	--
CO3	--	3	--	--	--	--	--	--	--	--	--	--	--	--
CO4	--	--	3	3	3	--	--	--	2	2	--	--	2	2

Laboratory



Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	6 th Sem			
Course Title	:	Power System Simulation Lab			
Course Code	:	BEEL604			
Course Type (Theory/ Practical/ Integrated)	:	Practical			
Category	:	PCCL			
Stream	:	EEE		CIE	: 50
Teaching hours/ week (L:T:P:S)	:	2		SEE	: 50
Total Hours	:	24		SEE Duration	: 3
Credits	:				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To introduce students to the use of computational tools and software platforms for analyzing and simulating various aspects of power systems.
2	To provide hands-on experience in modeling power system components such as generators, transformers, transmission lines, and loads.
3	To enable students to perform and analyze load flow studies using different numerical techniques
4	To facilitate the simulation of power system stability, including transient and steady-state stability, using industry-standard tools.
5	To strengthen analytical and problem-solving skills by working on real-time case studies involving power system operations and planning.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Include videos to demonstrate various concepts.
- Encourage collaborative (Group) Learning to encourage team building.
- Adopt **Problem-Based Learning (PBL)**, which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.

Sl. No.	Experiments/Programs
1	Formation for symmetric π /T configuration for Verification of Determination of Efficiency and Regulation.
2	Determination of Power Angle Diagrams, Reluctance Power, Excitation, EMF and Regulation for Salient and Non-Salient Pole Synchronous Machines
3	To obtain Swing Curve and to Determine Critical Clearing Time, Regulation, Inertia Constant/Line Parameters /Fault Location/Clearing Time/Pre-Fault Electrical Output for a Single Machine connected to Infinite Bus through a Pair of identical Transmission Lines Under 3-Phase Fault On One of the two Lines
4	Y Bus Formation for Power Systems with and without Mutual Coupling, by Singular Transformation and Inspection Method.
5	Determination of Bus Currents, Bus Power and Line Flow for a Specified System Voltage.
6	Load Flow Analysis using Gauss Siedel Method, NR Method and Fast Decoupled Method for Both PQ and PV Buses
7	To Determine Fault Currents and Voltages in a Single Transmission Line System with Star-Delta Transformers at a Specified Location for LG and LLG faults by simulation.
8	Optimal Generation Scheduling for Thermal power plants by simulation.
9	Write a program to evaluate transient stability of single machine connected to infinite bus.
10	Write a program to calculate the sequence components of line currents, given the unbalanced phase currents in a three phase i) 3-wire system ii) 4 wire system.
OPEN ENDED	
1	Formation of Z Bus (without mutual coupling) using Z-Bus Building Algorithm
2	Formation of Jacobian for a System not Exceeding 4 Buses in Polar Coordinates.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Apply appropriate computational tools and software to analyze and simulate power system operations and behaviors.	A	L3
CO2	Perform load flow studies using various numerical methods and interpret the results for decision-making in power system planning	An	L4
CO3	Simulate power system stability scenarios—including transient and steady-state—and evaluate system response using industry-standard tools.	E	L5
CO4	Develop accurate models of power system components such as generators, transformers, transmission lines, and loads using simulation software.	E/C	L6
CO5	Solve real-world power system case studies by integrating modeling, simulation, and analytical techniques to support planning and operation strategies.	C	L6

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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Ability Enhancement Course (AEC)



Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	6 th			
Course Title	:	Energy Management in Electric Vehicles			
Course Code	:	BEE657A			
Course Type (Theory/ Practical/ Integrated)	:	Experiential learning Project Practical			
Category	:	AEC			
Stream	:	EEE	CIE	:	50
Teaching hours/ week (L:T:P:S)	:	1:0:0:0	SEE	:	50 MCQ
Total Hours	:	24 Hours	SEE	:	3 hours
Credits	:	1	Duration		

COURSE CURRICULUM

Module No.	Topics	Hours
1	Introduction to Electric Vehicles and Energy Management Overview of electric vehicles (EVs) - Types of EVs (Battery Electric Vehicles, Plug-in Hybrid Electric Vehicles); Advantages and challenges of EVs. Introduction to energy management in EVs - Importance of energy management; Key objectives of energy management in EVs. Electric vehicle components and systems- Battery systems; Power electronics and motor drive systems; Regenerative braking systems; Energy storage and management systems	
Pedagogy	Chalk and Talk, NPTEL Videos and Group Discussion, Pictorial Demo	
2	Fundamentals of Energy Management Energy storage technologies for EVs - Lithium-ion batteries; Solid-state batteries; Supercapacitors; Fuel cells. Battery charging and discharging techniques - Charging infrastructure for EVs; Charging modes (AC and DC charging); Fast charging vs. slow charging; Battery management systems (BMS). Energy efficiency and energy loss analysis - Losses in power electronics and motor drive systems; Losses in battery systems; Factors affecting energy efficiency in EVs.	
Pedagogy	Chalk and Talk, NPTEL Videos and Group Discussion, Pictorial Demo	
3	Advanced Energy Management Strategies State-of-charge (SoC) estimation and management - SoC estimation techniques (Coulomb counting, Kalman filtering, etc.); SoC balancing techniques; Impact of SoC on battery life and performance. Power management strategies - Optimal power allocation between different vehicle systems; Dynamic power allocation based on driving conditions; Power flow control in EVs. Regenerative braking and	

	energy recovery - Principles of regenerative braking; Control strategies for regenerative braking; Energy recovery and utilization.	
Pedagogy	Chalk and Talk, NPTEL Videos and Group Discussion, Pictorial Demo	
4	Optimization Techniques for Energy Management Optimization models for energy management - Linear programming and nonlinear optimization; Model predictive control (MPC) for energy management; Genetic algorithms and other heuristic optimization techniques. Intelligent energy management systems - Artificial intelligence (AI) and machine learning techniques for energy management; Reinforcement learning-based energy management; Datadriven approaches for energy optimization. Realtime energy management algorithms - Real-time optimization algorithms for energy allocation; Adaptive control strategies for energy management; Integration of energy management with navigation systems.	
Pedagogy	Chalk and Talk, NPTEL Videos and Group Discussion, Pictorial Demo	
5	Case Studies and Applications Energy management in electric buses and fleet management - Challenges and strategies for energy management in public transportation; Fleet management and scheduling optimization. Energy management in electric vehicles charging infrastructure - Smart charging stations and grid integration; Demand-side management and load balancing. Emerging trends and future directions in energy management - Wireless charging technologies; Vehicle-to-vehicle (V2V) communication for energy optimization; Advanced energy storage and conversion technologies.	
Pedagogy	Chalk and Talk, NPTEL Videos and Group Discussion, Pictorial Demo	

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) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures 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 Examination (CIE)

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.

- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examinations (SEE)

- SEE paper shall be set for 50 questions, each of the 01 marks.
- The pattern of the question paper is MCQ (multiple choice questions).
- The time allotted for SEE is 01 hour.
- The student has to secure a minimum of 35% of the maximum marks meant for SEE.

Text Books	
Sl. No.	Title of the Book/Name of the author/Name of the publisher/Edition and Year
1	Electric Vehicle Technology by H. C. Rai 2.
2	Electric Vehicle Energy Management System for Efficiency Optimization" by Jingang Han, Linlin Tan, and Xinbo Ruan
Reference Books	
1	Advanced Electric Drive Vehicles" edited by Ali Emadi
2	Electric Vehicle Technology Explained by James Larminie and John Lowry

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Explain the fundamental concepts of energy storage, power flow, and energy efficiency in electric vehicle systems.		L2
CO2	Apply energy management strategies to optimize battery usage, regenerative braking, and power converter operations in EVs.		L3
CO3	Analyse the performance and energy consumption of electric vehicles under various driving conditions using data and simulation tools.		L4
CO4	Design an integrated energy management system for electric vehicles that enhances efficiency, range, and battery life by combining control strategies and		L5

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	-							3						
C02	3													
C03		3												
C04			3	3	3			3	3	3				

Weblinks and Video Lectures (e-Resources)

1	https://www.studocu.com/in/document/visvesvaraya-technological-university/research-
2	https://eprints.itn.ac.id/13571/1/Methods-for-engineers.pdf

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Continuous Comprehensive Assessment (CCA)			
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks
Remember	15	15		
Understand	15	15	10	10
Apply	15	15	10	10
Analyse	5	5	10	10
Evaluate			10	10
Create			10	10

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	15	10	5		10	15	55	55
CO2	5	5	5	5	5	5	30	30
CO3		5		5	5		15	15
CO4								
CO5								
Total	20	20	10	10	20	20	100	100

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (90% Theory+10% Practical Questions)
Remember	25
Understand	30
Apply	30
Analyse	15
Evaluate	
Create	



Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	6 th		
Course Title	:	Energy Audit Project		
Course Code	:	BEE657B		
Course Type (Theory/ Practical/ Integrated)	:	Experiential learning Project Practical		
Category	:	AEC		
Stream	:	EEE	CIE	: 50
Teaching hours/ week (L:T:P:S)	:	0:0:1:0	SEE	: 50
Total Hours	:	24 Hours	SEE	: 3 hours
Credits	:	1	Duration	

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To enable students to perform experiments and programs flexibly at their own pace, location, and convenience promoting deeper conceptual understanding through repeated practice.
2	To provide continuous and unrestricted access to virtual laboratory tools and learning resources.
3	To facilitate safe experimentation by allowing variation of circuit parameters without the risk of equipment damage or personal injury.
4	To carryout Energy Audit for an industry, business establishment, organization and its computation using Software and proposing possible remedial measures to reduce the energy consumption.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts IoT Based Projects
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL)**, which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.



Scheme of Teaching and Examinations for BE Programme -2024-25
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DSATM

List of Projects:

Students shall select a real-time project/audit with the guide's approval. The following shall be considered by the students and guide while auditing.\

(1) Building and Utility Data Analysis:

The main purpose of this step is to evaluate the characteristics of the energy systems and the patterns of energy use for the premises considered. The premises characteristics can be collected from the architectural/ mechanical/electrical drawings and/or from consultation/discussions with premises operators. The energy use patterns can be obtained from a compilation of utility bills over a period.

(2) Walk-Through Survey:

This step should identify potential energy savings measures. The results of this step are important since they determine if the building warrants any further energy auditing work. Some of the tasks involved in this step are

- Identify the customer's concerns and needs
- Check the current operating and maintenance procedures
- Determine the existing operating conditions of major energy use equipment (lighting, HVAC systems, motors, etc.)
- Estimate the occupancy, equipment, and lighting (energy use density and hours of operation).

(3) Baseline for Building Energy



Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	6 th			
Course Title	:	Solar Rooftop PV Systems: Design, Integration, and Policy			
Course Code	:	BEE657C			
Course Type (Theory/ Practical/ Integrated)	:	Theory			
Category	:	AEC			
Stream	:	EEE	CIE	:	50
Teaching hours/ week (L:T:P:S)	:	1:0:0:0	SEE	:	50 MCQ
Total Hours	:	24 Hours	SEE	:	3 hours
Credits	:	1	Duration		

COURSE CURRICULUM

Module No.	Topics	Hours
1	Introduction to Solar Energy & the PM Suryaghar Scheme- Basics of solar energy and its significance. Evolution and types of solar PV systems. Overview of PM Suryaghar Muft Bijli Yojana. Objectives, eligibility criteria, and benefits of the scheme. Contribution to SDGs and national renewable targets	
Pedagogy	Chalk and Talk, NPTEL Videos and Group Discussion, Pictorial Demo	
2	Components and Design of Rooftop PV Systems- Major components: solar panels, inverters, batteries, structures, etc. System sizing and load estimation. Rooftop assessment and shadow analysis. Software tools for PV system design. Case examples of residential and institutional systems.	
Pedagogy	Chalk and Talk, NPTEL Videos and Group Discussion, Pictorial Demo	
3	Installation Practices and Safety Standards- Step-by-step installation procedures. Mounting methods and structural considerations. Electrical wiring and grounding techniques. Fire and electrical safety protocols. BIS standards and MNRE technical guidelines	
Pedagogy	Chalk and Talk, NPTEL Videos and Group Discussion, Pictorial Demo	
4	Policy, Administration & Regulatory Framework- Detailed administrative flow under the PM Suryaghar Yojana. Online application, vendor registration, and subsidy process. Net metering: concepts, processes, and consumer billing. Regulatory policies by MNRE, KERC, and DISCOMs. Roles of stakeholders: consumers, DISCOMs, installers	

Pedagogy	Chalk and Talk, NPTEL Videos and Group Discussion, Pictorial Demo	
5	Inspection, Testing, and Commissioning- Visual and functional inspection checklist. Performance testing and quality control. Post-installation documentation	
Pedagogy	Chalk and Talk, NPTEL Videos and Group Discussion, Pictorial Demo	

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) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures 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 Examination (CIE)

- For the Assignment component of the CIE, there are 25 marks, and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based, then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

The Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examinations (SEE)

- SEE paper shall be set for 50 questions, each of the 01 marks.
- The pattern of the question paper is MCQ (multiple choice questions).
- The time allotted for SEE is 01 hour.
- The student has to secure a minimum of 35% of the maximum marks meant for SEE.

Text Books	
Sl. No.	Title of the Book/Name of the author/Name of the publisher/Edition and Year
1	<i>C. S. Solanki, Solar Photovoltaics: Fundamentals, Technologies and Applications, 3rd ed. New Delhi, India: PHI Learning Pvt. Ltd., 2015.</i>
2	<i>G. N. Sahashrabudhe, Solar PV System Design: A Practitioner's Guide. New Delhi, India: McGraw Hill Education, 2021</i>
Reference Books	
1	<i>G. Stapleton and S. Neill, Grid-Connected Solar Electric Systems: The Earthscan Expert Guide, 2nd ed. London, U.K.: Routledge, 2012.</i>

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Explain the principles of solar energy and the structure of rooftop PV systems.	Understand	L2
CO2	Demonstrate awareness of installation standards and safety protocols.	Apply	L3
CO3	Analyze the administrative, regulatory, and financial processes under the PM Suryaghar Yojana.	Analyze	L4
CO4	Design a rooftop solar PV system considering load profile and site constraints.	Design	L5
CO5	Evaluate system performance and understand inspection and commissioning procedures.	Evaluate	L6

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-							3					3	
CO2	3												3	
CO3		3											3	
CO4			3	3	3			3	3	3			3	
CO5			3	3	3			3	3	3			3	

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Continuous Comprehensive Assessment (CCA)			
	IAT-1	IAT-2	CCA-1	CCA-2
	50 Marks	50 Marks	50 Marks	50 Marks
Remember	15	15		
Understand	15	15	10	10
Apply	15	15	10	10
Analyse	5	5	10	10
Evaluate			10	10
Create			10	10

CIE Course Assessment Plan

CO's	Marks Distribution						Total Marks	Weightage
	Test-1			Test-2				
	Module-1	Module-2	Module 2 to 2.5	Module-2.5 to 3	Module-4	Module-5		
CO1	15	10	5		10	15	55	55
CO2	5	5	5	5	5	5	30	30
CO3		5		5	5		15	15
CO4								
CO5								
Total	20	20	10	10	20	20	100	100

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (90% Theory+10% Practical Questions)
Remember	25
Understand	30
Apply	30
Analyse	15
Evaluate	
Create	



Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	6 th		
Course Title	:	Simulation of Control of Power Electronics Circuits		
Course Code	:	BEE657D		
Course Type (Theory/ Practical/ Integrated)	:	Practical		
Category	:	AEC		
Stream	:	EEE	CIE	: 50
Teaching hours/ week (L:T:P:S)	:	0:0:1:0	SEE	: 50
Total Hours	:	24 Hours	SEE	: 3 hours
Credits	:	1	Duration	

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To be able to simulate any DC-DC converter and observe the performance under various test conditions
2	To be able to simulate single phase and three phase DC –AC converters and observe the performance under various test conditions
3	To be able to simulate uncontrolled, half controlled and fully controlled AC-DC converters and observe the performance under various test conditions

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts IoT Based Projects
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL)**, which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.

- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.



Scheme of Teaching and Examinations for BE Programme -2024-25
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2024-25)

DSATM

(1)	(a) Simulate a single phase half wave diode bridge rectifier. Input 100V, 50 Hz. AC supply. At the out put, resistance of 50 ohms. (b) Simulate a single phase full wave diode bridge rectifier. Input 100V, 50 Hz. AC supply. At the out put, resistance of 50 ohms.
(2)	(a) Simulate a single phase half controlled full wave rectifier. Input 100V, 50 Hz. AC supply. At the out put, resistance of 50 ohms. (b) Simulate a single phase fully controlled full wave rectifier. Input 100V, 50 Hz. AC supply. At the out put, resistance of 50 ohms.
(3)	Simulate a buck converter with 20 V DC input, and regulate the output at 10 V by implementing a PI controller for closed loop operation. The out put power to vary from 10 W to 20 W. Ensure that voltage ripple is limited to 1%.
(4)	Simulate a boost converter with 20 V DC input, and regulate the output at 35 V by implementing a PI controller for closed loop operation. The out put power to vary from 30W to 60 W. Ensure that voltage ripple is limited to 1%
(5)	Simulate a single phase AC voltage controller using a triac with 100V ,50 Hz. AC supply for an RL load of 10 oms and 2 mH.
(6)	Simulate a three phase inverter with 180 degree conduction mode with DC input of 100V and a star connected balanced resistive of 40 ohms each. Use IGBT for inverter.
(7)	Simulate a single phase SPWM inverter with 50V DC input with modulation indices of 0.5, 0.6 and 0.8. connect a resistance of 25 ohms at the output of inverter. Use power Mosfets for inverter.
(8)	Simulate a three phase inverter with 120 degree mode of conduction. Take input DC voltage of 100V and three phase star connected balanced resistive load of 50 ohms each.
(9)	In expt. 8. connect suitable LC filter at the output to obtain a sinusoidal output with THD of less than 8 %.
(10)	Simulate a three phase SPWM inverter with 50V DC input with modulation indices of 0.5, 0.6 and 0.8. connect a star connected resistances of 25 ohms each at the output of the inverter. Use power Mosfets for inverter.
(11)	Simulate a three phase, 5 level, neutral point clamped (NPC) inverter. Input DC voltage is 100V. The inverter output is connected to a balanced 3 phase resistive load of 40 Ohms each.
(12)	Simulate a forward converter with input DC voltage of 30 V. Take transformer ratio of 1.5:1. Observe the output voltages for duty cycles of 0.4, 0.6 and 0.8. Ensure that the output voltage ripple is less than 0.5 V. The load resistance is 10 Ohms.

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) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures 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):

CIE marks for the practical course are 50 Marks. The split-up of CIE marks for record journal and test are in the ratio 60:40.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus, and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to 30 marks (60% of maximum marks). • Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to 20 marks (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted by the two examiners. One from the same institute as an internal examiner
- and another from a different institute as an external examiner, appointed by the university.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for the practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script are to be strictly adhered to by the examiners. OR, based on the course requirement evaluation rubrics, shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions to prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here: writeup-20%, Conduction procedure and result in - 60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners) • Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made

The minimum duration of SEE is 02 hours

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Apply systematic thinking and problem-solving skills to enhance analytical and practical performance in energy audit and management tasks.	Apply	L2
CO2	Analyze and interpret data collected during energy audits of buildings, industries, or organizations.	Analyze	L3
CO3	Perform comparative assessments of energy consumption patterns with and without audit interventions.	Evaluate	L4
CO4	Suggest and design potential energy-saving measures considering technical feasibility and economic viability.	Create	L5

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-												3	
CO2	3												3	
CO3		3											3	
CO4			3	3	3	3	3	3	3	3	3		3	



DSATM

Scheme of Teaching and Examinations for BE Programme -2025-26

Outcome Based Education and Choice Based Credit System (Autonomous Version)

(Effective from the Academic Year 2025-26)

Yoga (VI Sem)

Course Code		CIE Marks	100
Teaching Hours/Week (L:T:P:S)	0:0:2:0	SEE Marks	000
Total Hours of Pedagogy per semester	24 – 28 hours (Theory + Practical)	Total Marks	100
Examination nature		Objective type Theory/Practical/Viva voce	

Course Objectives:

1. To enable the student to have good health
2. To practise mental hygiene
3. To possess emotional stability
4. To integrate moral values
5. To attain higher level of consciousness

Syllabus

Ashtanga Yoga

1. Dharana
2. Dhyana (Meditation)
3. Samadhi

Asana its meaning by name, technique, precautionary measures and benefits of each asana

Different types of Asanas

- a. Sitting
 1. Bakasana
 2. Hanumanasana
 3. Yogaamudra in Vajrasana
- b. Standing
 1. Vatayanasana
 2. Garudasana

- c. Balancing 1. Veerabhadrasana
 2. Sheershasana
- d. Supine line 1. Sarvangasana
 2. Setubandha Sarvangasana
 3. Shavasana (Relaxation posture)

Revision of Kapalabhati practice 80 strokes/min 3 rounds

Different types : Meaning by name, technique, precautionary measures and benefits of each Pranayama

1. Bhastrika 2. Bhramari

Meaning by name, technique, precautionary measures and benefits of each Kriya

1. Jalaneti & Sutraneti 2. Nauli(Only for men) 3. Sheetkarma Kapalabhati

Course Outcomes:

At the end of the course, the student will be able to

CO1 : Understand and teach different Asanas by name, its importance, methods and benefits

CO2: Instruct Kapalabhati and its need and importance

CO3: Coach different types of kriyas, methods to follow and usefulness

Assessment Details:

- Students will be assessed with internal test (Two internal assessment tests with 25 marks/test)
- Final test shall be conducted for the whole syllabus for 50 marks
- Continuous Internal Evaluation shall be for 100 marks (including IA test)

Suggested Learning Resources:

Books:

1. Yogapravesha in Kannada by Ajitkumar
2. Light on Yoga by BKS Iyenger
3. Teaching methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly
4. Yoga Instructor Course hand book published by SVYASA University, Bengaluru

Web links and Video lectures(e-resources):

3. <https://youtu.be/KB-TYIgd1wE>
4. <https://youtu.be/aa-TG0Wg1Ls>