B.V.V.S

Proceedings of
21st Board of Studies Meeting in E&EE

30th August 2025 (Saturday)

Time: 10.00 am – 12.00 noon **Venue: Seminar Hall**

Submitted by

Head of Department

Electrical and Electronics Engineering

Submitted to

The Principal

Basaveshwar Engineering College

Bagalkote-587102

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Proceedings of 21st Board of Studies Meeting in E&EE

30th August 2025 (Saturday) **Time: 10.00 am – 12.00 Noon** **Venue: Seminar Hall**

The Chairman of Board of Studies in E&EE, Dr. Dr. R. L. Naik, HoD, Dept. of E&EE extended a hearty welcome to all the members. Further, introduction of new members was conducted.

Sub. (1)	:	Seeking approval for the proceedings of 18th, 19th and 20th Board of Studies Meetings
Res.	:	The Chairman presented the minutes of the 18th, 19th and 20th Board of Studies Meetings held on 23.11.2024, 20.03.2025 and 23.07.2025 respectively. The members confirmed the minutes of all the three meetings. (Annexure – 1)
Sub. (2)	:	To apprise of the department activities
Res.	:	The Chairman briefly presented the department activities, faculty and student's achievements. For the information of new members the department profile was presented in brief. Achievements by faculty members and students, project grant received by students was highlighted. List of Ph.Ds awarded, best practices employed in the department and outreach initiatives were presented. The members appreciated the performance and expressed their happiness. (Annexure – 2)
Sub. (3)	:	To discuss Vision, Mission, PEOs & PSOs
Res.	:	The Vision, Mission, Program Educational Objectives, and Program Specific Outcomes of the Department were presented before the members of the Board. The members appreciated the statements and observed that they are well aligned with the present needs of the discipline. They further noted that the Department Vision and Mission are in line with the Institution's Vision and Mission. Overall, the members expressed their appreciation for the clarity and relevance of the statements.

Dr. R. L. Naik	Dr. Nagendrappa H.	Dr. Arunkumar Patil	Dr. Animesh Kumar Sahoo	Mr. Sreekant Kollur	Mr. Prasad Jigajinni
Mr. R. S. Allurkar	Smt. S. S. Tambakad	Dr. S. Y. Goudappanavar	Mr. S. G. Nayak	Mr. M. L. Chikkadesai	Mr. S. S. Kandagal
Mr. B. S. Hadapad	Mr. Kathik Bairadar	Ms. Ashwini R Bidaralli	Ms. Nanditha G. Hiremath	Mr. Prathamesh M.	Dr. Basanagouda Ronad

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

		(Annexure – 3)
Sub. (4)	:	Seeking approval for scheme of Teaching-Evaluation and syllabus of VII and VIII Semesters B.E. (E&EE) of 160 credit program (As per NEP) for 2022-23 admitted batch students
Res.	:	The Chairman presented the scheme of Teaching-Evaluation and syllabus of VII and VIII Semesters B.E. (E&EE) of 160 credit program for 2022-23 admitted batch students. The following key decisions and observations were recorded: • Course Outcomes and Mapping: Course outcomes of various courses have been updated, and the corresponding CO–PO mappings were revised in alignment with the new outcomes. 11 POs are employed as per new NBA SAR (2024). • Course Replacement: The existing course on Intellectual Property Rights has been replaced with a newly designed course titled Research Methodology and IPR. • Internship Component: The component earlier titled Industrial Bar Research Internship has been renamed as Internship. • The evaluation structure for the internship has been revised to include 100 marks for CIE, to be awarded by the external supervisor, and 100 marks for SEE, to be assessed by the department faculty committee. • Swappable Semesters: The practice of employing swappable semesters in the 7th and 8th semesters was acknowledged and appreciated by the committee. (Annexure –4, Annexure – 5)
Sub. (5)	:	Seeking approval for scheme of Teaching-Evaluation and syllabus of V to VIII Semesters B.E. (E&EE) of 160 credit program (As per NEP) for 2023-24 admitted batch students
Res.	:	The Chairman presented the scheme of Teaching-Evaluation and syllabus of V and VIII Semesters B.E. (E&EE) of 160 credit program for 2023-24 admitted batch students.

Dr. R. L. Naik	Dr. Nagendrappa H.	Dr. Arunkumar Patil	Dr. Animesh Kumar Sahoo	Mr. Sreekant Kollur	Mr. Prasad Jigajinni
Mr. R. S. Allurkar	Smt. S. S. Tambakad	Dr. S. Y. Goudappanavar	Mr. S. G. Nayak	Mr. M. L. Chikkadesai	Mr. S. S. Kandagal
Mr. B. S. Hadapad	Mr. Kathik Bairadar	Ms. Ashwini R Bidaralli	Ms. Nanditha G. Hiremath	Mr. Prathamesh M.	Dr. Basanagouda Ronad

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

		The committee deliberated on the restructuring of the academic framework and the following points were discussed and approved: • Scheme Revision: The scheme of teaching and examinations has been reframed in line with BEC norms, ensuring compliance with institutional standards. • Credit Distribution: The credit allocation for all courses has been revised and mapped appropriately as per the guidelines provided. • Syllabus Restructuring: The syllabus of all courses has been reformatted and will now be presented in 4 units instead of the earlier structure of 5 modules. • Outcome Mapping: All Course Outcomes (COs) have been mapped to the 11 Program Outcomes (POs) in accordance with the requirements of the new SAR of NBA. The committee agreed to incorporate these revisions into the curriculum and proceed with implementation from the forthcoming academic session. (Annexure – 6, Annexure - 7)
Sub. (6)	:	Seeking approval for scheme of Teaching-Evaluation and syllabus of III to VIII Semesters B.E. (E&EE) of 160 credit program (As per NEP) for 2024-25 admitted batch students
Res.	:	The Chairman presented the scheme of Teaching-Evaluation and syllabus of V and VIII Semesters B.E. (E&EE) of 160 credit program for 2024-25 admitted batch students. The committee reviewed and finalized updates to the academic scheme. The following resolutions were made: • Scheme Revision: The Scheme of Teaching and Examinations has been reframed in line with BEC norms, ensuring compliance with institutional standards. • Credit Distribution: The credit allocation for all courses has been revised and appropriately mapped as per the prescribed guidelines.

Dr. R. L. Naik	Dr. Nagendrappa H.	Dr. Arunkumar Patil	Dr. Animesh Kumar Sahoo	Mr. Sreekant Kollur	Mr. Prasad Jigajinni
Mr. R. S. Allurkar	Smt. S. S. Tambakad	Dr. S. Y. Goudappanavar	Mr. S. G. Nayak	Mr. M. L. Chikkadesai	Mr. S. S. Kandagal
Mr. B. S. Hadapad	Mr. Kathik Bairadar	Ms. Ashwini R Bidaralli	Ms. Nanditha G. Hiremath	Mr. Prathamesh M.	Dr. Basanagouda Ronad

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

- **Course Codes: All course codes have been modified and updated in accordance with the revised scheme and credit distribution.**

The committee approved these modifications for adoption in the upcoming academic implementation. Following observations were made and suggested:

- **Dr. Nagedrappa enquired about the details of credit distribution in the curriculum. He suggested including industrial visits as part of the curriculum; however, for the ongoing scheme, he recommended taking up industrial visit activities under the AICTE 100 Activity Points framework. He also shared information and opportunities related to internships for E&EE students.**
- **Dr. Animesh Kumar Sahoo suggested placing greater emphasis on hydrogen energy–based systems and other sustainable energy systems in the curriculum. He recommended the use of advanced software tools such as PSCAD and OpenDSS to enhance the teaching–learning process. For the Power Electronics Laboratory, he proposed the use of PLECS software, which offers a 90-day free trial version for students, to facilitate better understanding. He also advised the inclusion of Grid Codes in the Solar Photovoltaic System Design subject, particularly in discussions related to grid interconnection.**
- **Dr. Arunkumar Patil suggested increasing the number of core courses by revising the credit distribution. He recommended offering Electrical Machine Design as an integrated course along with AutoCAD software for effective learning. He further proposed that the Field Theory course be included under the list of core courses.**
- **Mr. Sreekant Kollur suggested the inclusion of an Embedded Systems course in the curriculum, emphasizing its relevance in real-time industry applications and its importance in enhancing students' employability. He also recommended integrating a Project Management component within Humanities, Social Sciences, and Management-related courses. Furthermore, he proposed the inclusion of ARM processors in the curriculum to strengthen students' practical exposure and industry readiness.**

Dr. R. L. Naik	Dr. Nagendrappa H.	Dr. Arunkumar Patil	Dr. Animesh Kumar Sahoo	Mr. Sreekant Kollur	Mr. Prasad Jigajinni
Mr. R. S. Allurkar	Smt. S. S. Tambakad	Dr. S. Y. Goudappanavar	Mr. S. G. Nayak	Mr. M. L. Chikkadesai	Mr. S. S. Kandagal
Mr. B. S. Hadapad	Mr. Kathik Bairadar	Ms. Ashwini R Bidaralli	Ms. Nanditha G. Hiremath	Mr. Prathamesh M.	Dr. Basanagouda Ronad

		• Mr. Prasad Jigajinni suggested including Thermal Management as part of the Battery Management Systems course. He further recommended that Electrical Machine Design be offered as a core course rather than as an elective. For enhanced learning outcomes, he advised the use of Motor-CAD software in teaching and practical sessions. Additionally, he emphasized the importance of conducting an awareness session on standards (IEC, IEM, ISI, IEEE, etc.) for the benefit of students. (Annexure – 8, Annexure - 9)
Sub. (7)	:	Seeking approval for scheme of Teaching-Evaluation for 2025-26, admitted batch students
Res.	:	The Chairman presented the scheme of Teaching-Evaluation of I to VIII semesters B.E. (E&EE) for 160 credit program for 2025-26 admitted batch students. The modifications employed in split-up of credits for different categories was presented. After discussion the proposed scheme was approved. (Annexure – 10)
Sub. (8)	:	Seeking approval for the B.E. I/II semesters syllabus for the Academic Year 2025-26
Res.	:	The Chairman presented the syllabus of the following courses for the first year students for the Academic Year 2025-26: • Basic Electrical Engineering • Introduction to Electrical Engineering • Basic Electrical Engineering Laboratory The members suggested that, for students of other departments, only an overview of the subject content be provided, while greater emphasis should be given to Electrical Engineering students. After due discussion, it was resolved to approve the syllabus for the Academic Year 2025–26 for first-year students. (Annexure – 11)

Dr. R. L. Naik	Dr. Nagendrappa H.	Dr. Arunkumar Patil	Dr. Animesh Kumar Sahoo	Mr. Sreekant Kollur	Mr. Prasad Jigajinni
Mr. R. S. Allurkar	Smt. S. S. Tambakad	Dr. S. Y. Goudappanavar	Mr. S. G. Nayak	Mr. M. L. Chikkadesai	Mr. S. S. Kandagal
Mr. B. S. Hadapad	Mr. Kathik Bairadar	Ms. Ashwini R Bidaralli	Ms. Nanditha G. Hiremath	Mr. Prathamesh M.	Dr. Basanagouda Ronad

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Sub. (9)	:	Seeking approval for courses to be taught/handled by industry expert for E&EE students
Res.	:	The proposal of inviting an industry expert to co-handle the course Energy Conservation, Audit and Demand Side Management for final year B.E. (E&EE) students was presented to the members. As per the proposal, 50% of the course will be taught by an industry faculty/expert and the remaining 50% will be handled by a department faculty member. The members appreciated this initiative and granted approval. They further suggested including a few additional subjects to be taught by industry experts in the future to enhance industry–academia collaboration.
Sub. (10)	:	Seeking approval for list of designated industries for industrial internship for B.E. (E&EE) students
Res.	:	The Chairman presented the list of industries identified for B.E. (E&EE) students to undertake their 15-week industrial internship during either the 7th or 8th semester. The members reviewed and verified the proposed list and approved the industries. They also suggested inclusion of additional organizations to broaden the opportunities for students to take up internship activities. (Annexure – 12)
Sub. (11)		Seeking approval for list of online courses (NPTEL) for B.E. (E&EE) students
Res.		The Department presented the list of NPTEL courses identified for B.E. (E&EE) students to undertake in order to avail credits — three credits under the Ability Enhancement Course category and three credits under the Open Elective Course category. The members reviewed the lists and approved the proposed courses. Additionally, the members suggested the inclusion of selected courses from the Information and Technology domain under the Open Elective category, so that students can orient themselves towards advanced AI-based power system applications. (Annexure – 13)

Dr. R. L. Naik	Dr. Nagendrappa H.	Dr. Arunkumar Patil	Dr. Animesh Kumar Sahoo	Mr. Sreekant Kollur	Mr. Prasad Jigajinni
Mr. R. S. Allurkar	Smt. S. S. Tambakad	Dr. S. Y. Goudappanavar	Mr. S. G. Nayak	Mr. M. L. Chikkadesai	Mr. S. S. Kandagal
Mr. B. S. Hadapad	Mr. Kathik Bairadar	Ms. Ashwini R Bidaralli	Ms. Nanditha G. Hiremath	Mr. Prathamesh M.	Dr. Basanagouda Ronad

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Sub. (12)	:	Seeking approval for panel of examiners for B.E. (E&EE) program
Res.	:	The proposed panel of examiners for the B.E. (E&EE) program, identified from engineering colleges based on their expertise, was presented before the members for consideration. After due discussion, the members approved the panel of examiners for the upcoming academic year. (Annexure – 14)
Sub. (13)	:	Any other matter with the permission of the Chair
Res.	:	Since no other points came for discussions, the 21st Board of Studies meeting concluded with vote of thanks by Smt. Sunita S Tambakad.

Member Secretary
BoS - E&EE

Chairman BoS - EE
HoD-EEE, BEC Bagalkot

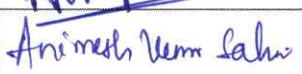
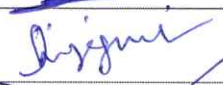
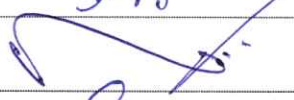
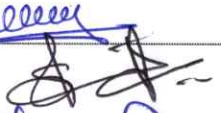
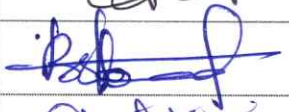
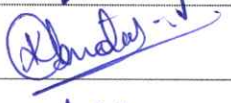
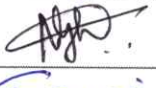
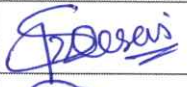
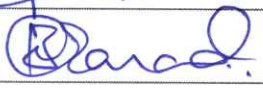
Dr. R. L. Naik	Dr. Nagendrappa H.	Dr. Arunkumar Patil	Dr. Animesh Kumar Sahoo	Mr. Sreekant Kollur	Mr. Prasad Jigajinni
Mr. R. S. Allurkar	Smt. S. S. Tambakad	Dr. S. Y. Goudappanavar	Mr. S. G. Nayak	Mr. M. L. Chikkadesai	Mr. S. S. Kandagal
Mr. B. S. Hadapad	Mr. Kathik Bairadar	Ms. Ashwini R Bidaralli	Ms. Nanditha G. Hiremath	Mr. Prathamesh M.	Dr. Basanagouda Ronad

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

21st Board of Studies Meeting

Date: 30.08.2025 **Time: 10.00 AM – 12.00 Noon** **Venue: Seminar Hall, EEED**

Sl.	Member Details	BoS Designation	Signature
1	**Dr. R. L. Naik**	Chairman, HoD E&EE	
2	**Dr. Nagendrappa H.**	VTU Nominee	
3	**Dr. Arunkumar Patil**	Member- Subject Expert	
4	**Dr. Animesh Kumar Sahoo**	Member- Subject Expert	
5	**Mr. Sreekant Kollur**	Member-Meritorious Alumni	
6	**Mr. Prasad Jigajinni**	Member-Industry Representative	
8	**Mr. R. S. Allurkar**	Member	
9	**Smt. S. S. Tambakad**	Member	
10	**Dr. S. Y. Goudappanavar**	Member	
11	**Mr. S. G. Nayak**	Member	
12	**Mr. M. L. Chikkadesai**	Member	
13	**Mr. S. S. Kandagal**	Member	
14	**Mr. B. S. Hadapad**	Member	
13	**Mr. Kathik Bairadar**	Student Member	
14	**Ms. Ashwini R. Bidaralli**	Student Member	
15	**Ms. Nanditha G. Hiremath**	Student Member	
16	**Mr. Prathamesh M.**	Student Member	
17	**Dr. Basanagouda Ronad**	Member Secretory	

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

21st Board of Studies Meeting in E&EE

30th August 2025 (Saturday) **Time: 10.00 AM – 12.00 Noon**

Venue: EE Seminar Hall

AGENDA

Welcome and Introduction of Members.

Sub. (1)	:	**Seeking approval for the proceedings of 18th, 19th and 20th Board of Studies Meetings**
Sub. (2)	:	**To apprise of the department activities**
Sub. (3)	:	**To discuss Vision, Mission, PEOs & PSOs**
Sub. (4)	:	**Seeking approval for scheme of Teaching-Evaluation and syllabus of VII and VIII Semesters B.E. (E&EE) of 160 credit program (As per NEP) for 2022-23 admitted batch students**
Sub. (5)	:	**Seeking approval for scheme of Teaching-Evaluation and syllabus of V to VIII Semesters B.E. (E&EE) of 160 credit program (As per NEP) for 2023-24 admitted batch students**
Sub. (6)	:	**Seeking approval for scheme of Teaching-Evaluation and syllabus of III to VIII Semesters B.E. (E&EE) of 160 credit program (As per NEP) for 2024-25 admitted batch students**
Sub. (7)	:	**Seeking approval for scheme of Teaching-Evaluation for 2025-26, admitted batch students**
Sub. (8)	:	**Seeking approval for the B.E. I/II semesters syllabus for the Academic Year 2025-26**
Sub. (9)	:	**Seeking approval for courses to be taught/handled by industry expert for E&EE students**
Sub. (10)	:	**Seeking approval for list of designated industries for industrial internship for B.E. (E&EE) students**
Sub. (11)	:	**Seeking approval for list of online courses (NPTEL) for B.E. (E&EE) students**
Sub. (12)	:	**Seeking approval for panel of examiners for B.E. (E&EE) program**
Sub. (13)	:	**Any other matter with the permission of the Chair**

Vote of Thanks

Chairman BoS-EE
Head of the Department,
Electrical and Electronics Engg.
BEC, Bagalkot-587102

Annexure 1

B.V.V.S

Proceedings of
18th Board of Studies Meeting in E&EE

23rd November 2024 (Saturday)

Time: 10.00 am – 12.00 noon **Venue: Seminar Hall**

Submitted by

Head of Department

Electrical and Electronics Engineering

Submitted to

The Principal

Basaveshwar Engineering College

Bagalkote-587102

B.V.V. Sangha's

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Proceedings of 18th Board of Studies Meeting in E&EE

23rd November 2024 (Saturday) **Time: 10.00 am – 12.00 Noon** **Venue: Seminar Hall**

The Chairman of Board of Studies in E&EE, Dr. Dr. R. L. Naik, HoD, Dept. of E&EE extended a hearty welcome to all the members. Further, introduction of new members was conducted.

Sub. (1)	:	Seeking approval for the minutes of 16th and 17th Board of Studies Meeting held on 25.07.2023 and 14.08.2024 respectively
Res.	:	The Chairman presented the minutes of the 16th and 17th Board of Studies Meetings held on 25.07.2023 and 14.08.2024 respectively. The members confirmed the minutes of both meetings. (Annexure – I & II)
Sub. (2)	:	To apprise of the department activities, faculty and student's achievements during 26.07.2023 to 22.11.2024
Res.	:	The Chairman briefly presented the department activities, faculty and student's achievements for the academic year 2023-24 for the period of June 2023 to November 2024. Achievements by faculty members and students, project grant received by students was highlighted. List of NPTEL courses completed by students and faculty members was presented. The members appreciated the performance and expressed their happiness. (Annexure – III)
Sub. (3)	:	Seeking approval for scheme of Teaching-Evaluation and syllabus of VII and VIII Semesters B.E. (E&EE) of 160 credit program (As per NEP) for 2021-22 admitted batch students
Res.	:	The Chairman presented the scheme of Teaching-Evaluation and syllabus of VII and VIII Semesters B.E. (E&EE) of 160 credit program for 2021-22 admitted batch students.

Dr. R. L. Naik	Dr. Abhijit Kshirsagar	Dr. Santhosha kumar A	Dr. B Venkatesa Perumal	Shri. V. Suresh Babu	Dr. Jayaprakash Sabarad
Mr. R. S. Allurkar	Mr. S. G. Nayak	Smt. S. S. Tambakad	Dr. S. Y. Goudappanavar	Mr. M. L. Chikkadesai	Mr. S. S. Kandagal
Mr. B. S. Hadapad	Mr. Kathik Bairadar	Ms. Ashwini R Bidaralli	Ms. Sanjana Talewad	Mr. Vijaykumar. Purutageri	Dr. B. F. Ronad

		• The implementation of swapped semesters was bought to the notice of BoS Members. Dr. Abhijit appreciated the concept of internship at 7th semester and suggested to carry out the industry oriented projects at the 8th semester. • The proposal of modification in the evaluation of internship is proposed. After the discussion it was resolved to approve the evaluation of internship with CIE for 100 Marks and SEE for 100 Marks. After discussion the proposed scheme and syllabus was approved for the academic year 2024-25. (Annexure-IV & V)
Sub. (4)	:	Seeking approval for scheme of Teaching-Evaluation and syllabus of V to VIII Semesters B.E. (E&EE) of 160 credit program (As per NEP) for 2022-23 admitted batch students
Res.	:	The Chairman presented the scheme of Teaching-Evaluation and syllabus of V to VIII Semesters B.E. (E&EE) of 160 credit program for 2022-23 admitted batch students. • Inclusion of the course Indian Knowledge Systems at V semester was proposed. After the discussions it was approved to include 1 credit course at V semester and Credits of Mini Project is changed from 2 credits to 1 credit. • Dr. Abhijit suggested to include the design of rectifier circuits as first experiment in power electronics laboratory. He suggested to conduct experiments with discrete components rather using the kits. • Dr. Jayaprakash suggested to provide training to students about waveform reading and analysing for identification of the systems components (R, L, C). Further, he also suggested to engage students to measure actual voltage and currents in the experiments rather using the voltage from the power packs. • Dr. Jayaprakash suggested to include load characteristics study in the course contents to enhance the operational smartness in the experiments. After discussion the proposed scheme and syllabus was approved for the academic year 2024-25. (Annexure-VI & VII)

Dr. R. L. Naik	Dr. Abhijit Kshirsagar	Dr. Santhosha kumar A	Dr. B Venkatesa Perumal	Shri. V. Suresh Babu	Dr. Jayaprakash Sabarad
Mr. R. S. Allurkar	Mr. S. G. Nayak	Smt. S. S. Tambakad	Dr. S. Y. Goudappanavar	Mr. M. L. Chikkadesai	Mr. S. S. Kandagal
Mr. B. S. Hadapad	Mr. Kathik Bairadar	Ms. Ashwini R Bidaralli	Ms. Sanjana Talewad	Mr. Vijaykumar. Purutageri	Dr. B. F. Ronad

B.V.V. Sangha's

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Sub. (5)	:	Seeking approval for scheme of Teaching-Evaluation and syllabus of III to VIII Semesters B.E. (E&EE) of 160 credit program (As per NEP) for 2023-24 admitted batch students
Res.	:	The Chairman presented the scheme of Teaching-Evaluation of III to VIII semesters B.E. (E&EE) and syllabus of III & IV semesters of 160 credit program as per NEP for 2023-24 admitted batch students. It was also bought to the notice of the members that, from 24-25 academic year the scheme proposed by VTU is being followed. In this connection members expressed their unhappiness for this decision. • Dr. Abhijit suggested to make the course Digital Logic Circuits as mandatory course for all students. He suggested that the sequencing of the courses is not properly made. • He appreciated the course PCB design and suggested to use open source software's for the laboratories. He also assured his guidance in this regard. • In the course proposed for Arduino and Raspberry Pi, it was suggested by members to employ one of the kit for experiments. • Members suggested to provide the list of courses for MOOC's under AEC and OEC category well in advance to students. After discussion the proposed scheme and syllabus was approved for the academic year 2024-25. (Annexure-VIII & IX)
Sub. (6)	:	Seeking approval for scheme of Teaching-Evaluation for 2024-25, admitted batch students
Res.	:	The Chairman presented the scheme of Teaching-Evaluation of I to VIII semesters B.E. (E&EE) for 160 credit program for 2024-25 admitted batch students. The modifications employed in split-up of credits for different categories was presented. It was bought to the notice of members that the scheme proposed by VTU is followed. Two modifications (Indian Knowledge Systems and Soft Skills) made were presented to members. After discussion the proposed scheme was approved. (Annexure-X)

Dr. R. L. Naik	Dr. Abhijit Kshirsagar	Dr. Santhosha kumar A	Dr. B Venkatesa Perumal	Shri. V. Suresh Babu	Dr. Jayaprakash Sabarad
Mr. R. S. Allurkar	Mr. S. G. Nayak	Smt. S. S. Tambakad	Dr. S. Y. Goudappanavar	Mr. M. L. Chikkadesai	Mr. S. S. Kandagal
Mr. B. S. Hadapad	Mr. Kathik Bairadar	Ms. Ashwini R Bidaralli	Ms. Sanjana Talewad	Mr. Vijaykumar. Purutageri	Dr. B. F. Ronad

B.V.V. Sangha's

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Sub. (7)	:	Seeking approval for the B.E. I/II semesters syllabus for the Academic Year 2024-25
Res.	:	The Chairman presented the syllabus of first year courses offered by E&EE department for the academic year 2024-25. The courses are: • Introduction to Electrical Engineering • Elements of Electrical Engineering • Renewable Energy Sources Members appreciated the structure of syllabus. After discussion the syllabus of courses offered at B.E. I/II semesters for the academic year 2024-25 was approved. (Annexure-XI)
Sub. (8)	:	Seeking approval for scheme of evaluation for the following courses: Theory courses, Lab Integrated courses, Internships, Project works, Seminar
Res.	:	The Chairman presented the details of evaluation scheme proposed for Theory courses, Lab Integrated courses, Internships, Project works, Seminar. After discussion the schemes for evaluation of said components are approved. (Annexure-XII)
Sub. (9)	:	Seeking approval for inclusion of Indian Knowledge Systems course at VI semester for 21-22 admitted batch and at V semester for 22-23 admitted batch and syllabus for the said course
Res.	:	The Chairman presented the syllabus of Indian Knowledge Systems. Further, it was bought to the notice of members that Indian Knowledge Systems course is included at VI semester for 21-22 admitted batch (AY 23-24) and at V semester for 22-23 admitted batch (AY 24-25). After the discussions the syllabus and inclusion of the IKS course was approved. (Annexure-XIII)
Sub. (10)	:	Seeking approval for courses to be taught/handled by industry expert for E&EE students in hybrid mode

Dr. R. L. Naik	Dr. Abhijit Kshirsagar	Dr. Santhosha kumar A	Dr. B Venkatesa Perumal	Shri. V. Suresh Babu	Dr. Jayaprakash Sabarad
Mr. R. S. Allurkar	Mr. S. G. Nayak	Smt. S. S. Tambakad	Dr. S. Y. Goudappanavar	Mr. M. L. Chikkadesai	Mr. S. S. Kandagal
Mr. B. S. Hadapad	Mr. Kathik Bairadar	Ms. Ashwini R Bidaralli	Ms. Sanjana Talewad	Mr. Vijaykumar. Purutageri	Dr. B. F. Ronad

Res.	:	The Chairman presented the proposal of courses being taught by industry exerts during the regular semesters. The members appreciated and approved the proposal. Further, members suggested to engage the sessions by industry experts in the offline mode for effective interaction. Members also suggested to initiate the process by part of the syllabus of ongoing semesters.
Sub. (11)		To apprise of the MoU partners and internship opportunities offered to E&EE students
Res.		The Chairman presented the list of MoU partners of the department and the ongoing activities with MU partners. Further, the list of MoU partners providing the internship opportunities. Members appreciated and suggested to take up projects with MoU organization for finial project of UG students.
Sub. (12)	:	Seeking approval for list of designated industries for industrial internship for B.E. (E&EE) students
Res.	:	The Chairman presented the list of industries proposed for taking up industrial internship for B.E. (E&EE) students at VII sem (2021-22 admitted batch). After the discussion the list of designated industries for internship was approved. (Annexure-XIV)
Sub. (13)	:	Seeking approval for list of online courses (NPTEL) for B.E. (E&EE) students
Res.	:	The Chairman presented the details of MOOCs (NPTEL) course list, to be approved for AEC and OEC course for B.E. (E&EE) students for the academic year 2024-25. After the discussion it was resolved to approve the list of online courses suggested. (Annexure-XV)
Sub. (14)	:	Seeking approval for panel of examiners for B.E (E&EE) program
Res.	:	The Chairman presented the list of experts for the inclusion in the panel of examiners for B.E (E&EE) program. After the discussion the list was approved. (Annexure-XVI)

Dr. R. L. Naik	**Dr. Abhijit Kshirsagar**	**Dr. Santhosha kumar A**	**Dr. B Venkatesa Perumal**	**Shri. V. Suresh Babu**	**Dr. Jayaprakash Sabarad**
Mr. R. S. Allurkar	**Mr. S. G. Nayak**	**Smt. S. S. Tambakad**	**Dr. S. Y. Goudappanavar**	**Mr. M. L. Chikkadesai**	**Mr. S. S. Kandagal**
Mr. B. S. Hadapad	**Mr. Kathik Bairadar**	**Ms. Ashwini R Bidaralli**	**Ms. Sanjana Talewad**	**Mr. Vijaykumar. Purutageri**	**Dr. B. F. Ronad**

B.V.V. Sangha's

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Sub. (15)	:	Any other matter with the permission of the Chair
Res.	:	Since no other points came for discussions, the 18th Board of Studies meeting concluded with vote of thanks by member secretary.

Member Secretary
BoS - E&EE

Chairman BoS - EE
HoD-EEE, BEC Bagalkot

Dr. R. L. Naik	Dr. Abhijit Kshirsagar	Dr. Santhosha kumar A	Dr. B Venkatesa Perumal	Shri. V. Suresh Babu	Dr. Jayaprakash Sabarad
Mr. R. S. Allurkar	Mr. S. G. Nayak	Smt. S. S. Tambakad	Dr. S. Y. Goudappanavar	Mr. M. L. Chikkadesai	Mr. S. S. Kandagal
Mr. B. S. Hadapad	Mr. Kathik Bairadar	Ms. Ashwini R Bidaralli	Ms. Sanjana Talewad	Mr. Vijaykumar. Purutageri	Dr. B. F. Ronad

B.V.V.S

Proceedings of
19th Board of Studies Meeting in E&EE
(Internal Meeting)

20th March 2025 **12.15 PM – 1.00 PM**

Venue: EE Seminar Hall

Submitted by

Head of Department

Electrical and Electronics Engineering

Submitted to

The Principal

Basaveshwar Engineering College

Bagalkote-587102

B.V.V. Sangha's

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Proceedings of 19th Board of Studies Meeting in E&EE

(Internal Members Meeting)

20th March 2025 **Time: 12.15 PM – 1.00 PM** **Venue: EE Seminar Hall**

The Chairman of Board of Studies in E&EE, Dr. R. L. Naik, HoD, Dept. of E&EE extended a hearty welcome to all the members.

Sub. (1)	:	Seeking approval for correction of subject code of the course "Indian Knowledge Systems" offered at V semester for 2022-2023 admitted batch students during academic year 2024-2025, ODD semester
Res.	:	The Chairman presented the correction of subject code for the course "Indian Knowledge Systems" at V semester for 2022-2023 admitted batch students. The course was offered during 2024-2025 ODD semester. Previously subject code was noted as 21UHS500C. The proposed code was 22UHS500C. The modification was employed to maintain the uniformity of the subject codes for 2022-2023 admitted batch students. After the discussions it was resolved to approve the said subject code as **22UHS500C**.
Sub. (2)	:	Any other matter with the permission of the Chair
Res.	:	Since no other matters were brought for the discussions, meeting concluded with vote of thanks.

Member Secretary
BoS - E&EE

Chairman BoS - EE
HoD-EEE, BEC Bagalkot

Dr. R. L. Naik	Mr. R. S. Allurkar	Mr. S. G. Nayak	Smt. S. S. Tambakad	Dr. S. Y. Goudappanavar
Mr. M. L. Chikkadesai	Mr. S. S. Kandagal	Mr. B. S. Hadapad	Dr. Basangouda Ronad	

B.V.V.S

Proceedings of
20th Board of Studies Meeting in E&EE

23rd July 2025

Time: 10.00 am – 11.00 am **Venue: Seminar Hall**

Submitted by

Head of Department

Electrical and Electronics Engineering

Submitted to

The Principal

Basaveshwar Engineering College

Bagalkote-587102

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Proceedings of 20th Board of Studies Meeting in E&EE

(Internal Members Meeting)

23rd July 2025 **Time: 10.00 AM – 11.00 AM** **Venue: EE Seminar Hall**

The Chairman of Board of Studies in E&EE, Dr. R. L. Naik, HoD, Dept. of E&EE extended a hearty welcome to all the members.

Sub. (1)	:	Seeking approval for scheme of Teaching-Evaluation and syllabus of VII and VIII Semesters B.E. (E&EE) of 160 credit program (As per NEP) for 2022-23 admitted batch students
Res.	:	The Chairman presented the scheme of Teaching-Evaluation and syllabus of VII and VIII Semesters B.E. (E&EE) of 160 credit program for 2022-23 admitted batch students. The committee recorded several key decisions and observations during the meeting. The course outcomes of various courses have been updated, and the corresponding CO–PO mappings were revised in alignment with the new outcomes, with all course outcomes now mapped to the 11 program outcomes as per the new NBA SAR (2024). The existing course on Intellectual Property Rights has been replaced with a new titled Research Methodology and IPR. The internship component, earlier titled Industrial/Research Internship, has been renamed simply as "Internship", and its evaluation structure has been revised to include 100 marks for CIE, to be awarded by the external supervisor, and 100 marks for SEE, to be assessed by the department faculty committee. Furthermore, the practice of employing swappable semesters in the 7th and 8th semesters was acknowledged. Annexure – 1: Scheme of Teaching and Examinations (2022-23 Admitted Batch) Annexure – 2: Syllabus of 7th and 8th semesters

Dr. R. L. Naik	Mr. R. S. Allurkar	Mr. S. G. Nayak	Smt. S. S. Tambakad	Dr. S. Y. Goudappanavar
Mr. M. L. Chikkadesai	Mr. S. S. Kandagal	Mr. B. S. Hadapad	Dr. Basangouda Ronad	

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Sub. (2)	:	Seeking approval for scheme of Teaching-Evaluation and syllabus of V to VIII Semesters B.E. (E&EE) of 160 credit program (As per NEP) for 2023-24 admitted batch students
Res.	:	The Chairman presented the scheme of Teaching-Evaluation and syllabus of V and VIII Semesters B.E. (E&EE) of 160 credit program for 2023-24 admitted batch students. The committee deliberated on the restructuring of the academic framework and approved several key revisions. The scheme of teaching and examinations has been reframed in line with BEC norms to ensure compliance with institutional standards, and the credit distribution for all courses has been revised and mapped appropriately as per the prescribed guidelines. The syllabus of all courses has been reformatted and will henceforth be presented in four units instead of the earlier five-module structure. Further, all Course Outcomes (COs) have been mapped to the 11 Program Outcomes (POs) in accordance with the requirements of the new SAR of NBA. The committee resolved to incorporate these revisions into the curriculum and implement them from the forthcoming academic session. Annexure – 3: Scheme of Teaching and Examinations (2023-24 Admitted Batch) Annexure – 4: Syllabus of 5th, 6th, 7th and 8th semesters
Sub. (3)	:	Seeking approval for scheme of Teaching-Evaluation and syllabus of III to VIII Semesters B.E. (E&EE) of 160 credit program (As per NEP) for 2024-25 admitted batch students
Res.	:	The Chairman presented the scheme of Teaching-Evaluation and syllabus of V and VIII Semesters B.E. (E&EE) of 160 credit program for 2024-25 admitted batch students. The committee reviewed and finalized updates to the academic scheme, and the following resolutions were made. The Scheme of Teaching and Examinations has been reframed in line with BEC norms to ensure compliance with institutional standards, and the credit allocation for all courses has been revised and

Dr. R. L. Naik	Mr. R. S. Allurkar	Mr. S. G. Nayak	Smt. S. S. Tambakad	Dr. S. Y. Goudappanavar
Mr. M. L. Chikkadesai	Mr. S. S. Kandagal	Mr. B. S. Hadapad	Dr. Basangouda Ronad	

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

		appropriately mapped as per the prescribed guidelines. In addition, all course codes have been modified and updated in accordance with the revised scheme and credit distribution. The committee approved these modifications for adoption in the upcoming academic implementation. Annexure – 5: Scheme of Teaching and Examinations (2024-25 Admitted Batch) Annexure – 6: Syllabus of 3rd, 4th, 5th, 6th, 7th and 8th semesters
Sub. (4)	:	Any other matter with the permission of the Chair
Res.	:	Since no other matters were brought for the discussions, meeting concluded with vote of thanks.

Member Secretary
BoS - E&EE

Chairman BoS - EE
HoD-EEE, BEC Bagalkot

Dr. R. L. Naik	**Mr. R. S. Allurkar**	**Mr. S. G. Nayak**	**Smt. S. S. Tambakad**	**Dr. S. Y. Goudappanavar**
Mr. M. L. Chikkadesai	**Mr. S. S. Kandagal**	**Mr. B. S. Hadapad**	**Dr. Basangouda Ronad**	

Annexure 2

Basaveshwar Engineering College
BAGALKOTE

Profile of EE Research Centre

Overview	
Faculty with PhD	04
Research Guides	03
Research scholars completed	16
Research scholars ongoing	07
Books published	03
Book Chapters	03
International / National Journals	49
International / National Conferences	66
Total Research Grants Received	157 Lakhs
Patents (Granted/Filed)	01/02

Research Grants Received (Last 5 years)

Sl.	Name of the PI	Name of the Co-PI	Sanctioning Authority	Amount (INR)	Present Status
1	Dr. R L Naik	--	TEQIP-III BEC	5,30,000	Completed
2	Dr. R L Naik	--	VTU	2,00,000	Completed
3	Dr. Basanagouda Ronad	Dr. S Y Goudappanavar	VGST, GoK	3,00,000	Completed
4	Dr. R L Naik	S S Tambakad	VTU	12,00,000	Ongoing (Amount Not Yet Received)

Total Grants Received since Inception of Research Centre is 1.57 Cr.

Programs Offered by EE Department

- BE Electrical & Electronics Engineering 1963 – 2006 KUD & VTU
- BE Electrical & Electronics Engineering 2006 Autonomous(VTU)
- M.Tech Power & Energy Systems – 2006-07 VTU
- M.Tech Power & Energy Systems – 2007-18 Autonomous(VTU)
- M.Tech Energy Science & Technology– 2020 Autonomous(VTU)
- Ph.D – 2003 VTU
- Ph.D – QIP (MHRD-MoE)

Ph.D Awarded since Inception of Research Centre

Sl.	Name of the Research Scholar	Name of the Guide	Date of award
1	Suhaib Mohammed Shaikh	Dr. R. L. Naik	08.01.2025
2	S Y Goudappanavar	Dr. S H Jangamshetti	01.08.2023
3	Anand Unnibhavi	Dr. D S Jangamshetti	06.03.2023
4	S S Sobarad	Dr. S H Jangamshetti	04.03.2021
5	Muttakka Annigeri	Dr. S H Jangamshetti	08.02.2020
6	Manjula Sutagundar	Dr. D S Jangamshetti	08.02.2020
7	Vijayalakshmi S Jigajinni	Dr. D S Jangamshetti	08.02.2020
8	Kotresh	Dr. G B Mukarthihal	18.03.2019
9	Chayalakshmi C L	Dr. D S Jangamshetti	18.03.2019
10	Basanagouda Ronad	Dr. S H Jangamshetti	01.09.2018
11	G Suchitra	Dr. S H Jangamshetti	27.05.2016
12	R L Naik	Dr. S H Jangamshetti	09.05.2015
13	A Shridevi	Dr. D S Jangamshetti	05.04.2013
14	S C Byalihal	Dr. S H Jangamshetti	08.04.2012
15	P N Kulkarni	Dr. D S Jangamshetti	05.08.2011
16	D R Joshi	Dr. S H Jangamshetti	18.04.2011

Research Facilities Available

Sl.	Name of the Instrument	Procurement Details (Year and Cost in Rs.)	
1	Wind Turbine Generator	2013	1,63,525
2	Equipment for Light Laboratory	2014	2,98,845
3	Inverters & instrumentation for wind-solar hybrid systems	2014	75,960
4	SCADA and distribution Automation Laboratory	2014	25,84,280
5	Sound Level Meter	2013	3,52,846
6	Data Acquisition Cards	2013	29,593
7	Mi Power	2013	4,49,440
8	4-quadrant DC motor (Inverters, Chopper & Accessories)	2016	16,98,550
9	Performance Monitoring Unit for SPV Powered DC Pumps	2016	1,74,075
10	Grid tie Inverter with FCU, Installation and Configuration	2017	1,85,834
11	4-Phase SRM Motor, 4-phase IGBT based Inverter Stack	2018	5,33,360
12	Solar PV operated DC water pumps with accessories	2014	4,20,000
13	Automatic weather station	2012	3,86,650
14	Solar photo voltaic training kit[75 W, 150 W]	2012	1,35,000
15	Wind turbine generator (Vertical axis) Training kit	2012	4,27,500
16	Software Package for wind data analysis	2012	1,50,000
17	SPV based DC Distribution Unit for Domestic Loads	2021	2,64,563

Profile of Department of Electrical & Electronics

Overview	
Year of commencement	1963
Grant-in Aid, GoK	1968
R&D center recognition	2003-04
Intake UG	60
Accreditation by NBA	2003, 2006, 2018, 2021, 2022-25
Affiliation	VTU Belagavi
Faculty UG	12
Staff	10
No of faculty with Ph.D	04
Department Library	1256
Professional bodies	IEEE PES Student Chapter (35261A)

Research Scholars Currently Pursuing Ph.D

Sl.	USN	Name of the Research Scholar	Name of the Guide	Current Status	Category
1	2BA16PEJ11	Seema P Diwan	Dr. S H Jangamshetti	Registered	GM
2	2BA19PEE02	M L Chikkadesai	Dr. S H Jangamshetti	Comprehensive Viva Completed	GM
3	2BA19PEE01	Vikas Jainkeri	Dr. S H Jangamshetti	Registered	GM
4	2BA18PEE01	Suvarna Kolli	Dr. R L Naik	Registered	GM
5	2BA17PEA10	Suhaib S Shaik	Dr. R L Naik	Comprehensive Viva Completed	OBC
6	2BA19PEE03	Basavaraju Hadapad	Dr. R L Naik	Comprehensive Viva Completed	GM
7	2BA20PEE01	Prashant Kadi	Dr. Basangouda Ronad	Comprehensive Viva Completed	GM
8	2BA21PEE01	Hamjadali Umachagi	Dr. Basangouda Ronad	Registered	OBC

IREDA-NIWE (MNRE) National Award for Best Institute of Higher Learning in Wind Energy Research 2021
Honble Minister for Power & MNRE, GoI Shri. R. K. Singh
Date: 15.06.2022 Venue: MNRE Auditorium, New Delhi

IREDA-NIWE (MNRE) National Award for Best Research in Wind Energy 2022.
Honble Minister for Power & MNRE, GoI Shri. R. K. Singh
Date: 15.06.2022 Venue: MNRE Auditorium, New Delhi

AICTE 100 Activity Points

Further, college has initiated online platform for documentation of activity points of individual students.

http://119.161.97.228/Activity100/Faculty/Dashboardf.php

Research Facilities Available

Details of Classrooms

EE- Placement Details

Students/ Academic Year	2024-25	2023-24	2022-23	2021-22	2020-21	2019-20
No. of Students	58	65	58	60	69	73
No. of Students Placed	35	42	32	48	49	48

BEC(A) Renewable Energy Park – MNRE-KREDL-BVVS (2007)

AICTE 100 Activity Points

Department has prepared data sheets for the following community service/ survey for carrying activity points.

- Agriculture Information
- Health Awareness
- Energy Conservation Awareness
- Enrollment in professional education from rural areas
- Rural Profession's in North Karnataka
- Educational Status in Rural Areas

http://119.161.97.228/Activity100/Faculty/Dashboardf.php

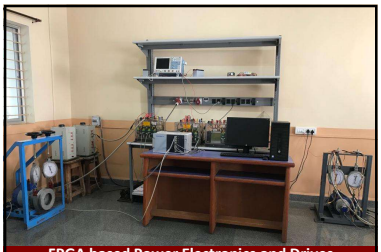
Academic Audit

- Academic Audit Report: 2023-24
- Academic Audit Report: 2022-23
- Academic Audit Report: 2021-22
- Academic Audit Report: 2020-21
- Academic Audit Report: 2019-20
- Academic Audit Report: 2018-19

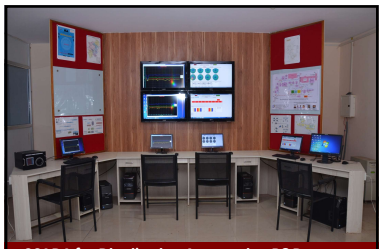
BEC(A) Renewable Energy Park – MNRE-KREDL-BVVS (2007)

Solar PV Direct Drive Irrigation Pump (2015)

Renewable Energy Research Center - Energy Conservation using lighting - funded by VGST and TEQIP-II (2014)



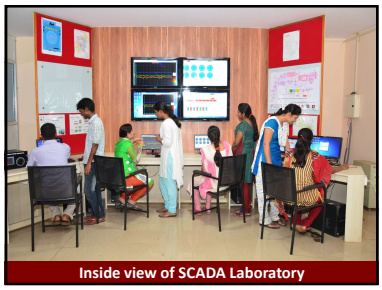
FPGA based Power Electronics and Drives Applications - funded by TEQIP-II (2017)



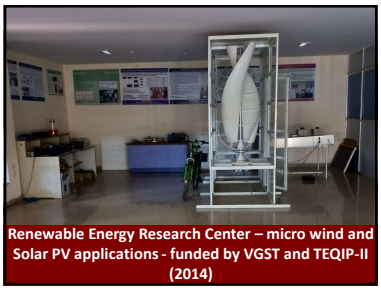
SCADA for Distribution Automation R&D center - funded by VGST and TEQIP-II (2014)

Inside view of Renewable Energy Lab

Solar DC IP Test system at Energy Park, BEC (2015)



Inside view of SCADA Laboratory



Renewable Energy Research Center – micro wind and Solar PV applications - funded by VGST and TEQIP-II (2014)

Memorandum of Understanding

List of MoU's

Sl.	Name of the Organization	Organization Address	MoU Signed Date	Contact Person Details
1	FLEXITRON	1234, 22nd 'A' Main, 11th 'A' Cross, Sector-I, HSR Layout, Bangalore - 560102	17.05.2010	Mr. R. S. Hiremath CEO
2	PRDC Bengaluru Power Research and Development Consultant Pvt Ltd	# 5, 11th Cross, 2nd Stage, West Of Chord Road, Bangalore - 560086	17.06.2010	Dr. R. Nagaraja Managing Director
3	AG Electro Services	Plot No.6, Koyana Audyogik Vasahat, P.B.Road, Karad-415110 Maharashtra	17.06.2013	Mr. S. V. Ramdurgkar Managing Director
4	HESCOM - Hubli Electricity Supply Company Limited	Pb Road, Navanagar Hubballi- 580025	10.01.2018	Er. Krishnamurthy Asst. Exe. Engineer
5	Shanthala Power Limited	"Shanthala" No.24 Priyadarshini Colony, Gokul Road, Hubballi-580030	19.01.2024	Mr. Vinod Narayana Managing Director
6	Krishitharanga Farmtech LLP	747/E Plot No-17, Athani Road, Opposite Town Palace, Vijayapura	28.02.2024	Mr. Girish Bhadragond Founder & MD
7	Flensburg University of Applied Sciences	Hochschule Flensburg Kanzleistrasse 91-93 24943 Flensburg, Germany	06.06.2024	Dr. Rajesh Saiju Professor
8	Saaketh Electrocircuit Private Limited	Saaketh Electrocircuit Pvt Ltd, Gate No. 69, Jyotiba Nagar, Talawade Pune - 411062	14.06.2024	Mr. Rahul Sultane Director

Official Launch of Alumni Mentorship Program

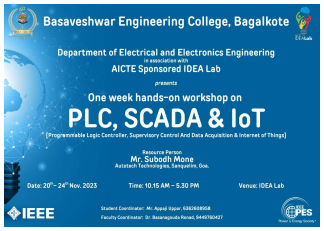
FLEXITRON - Mr. R. S. Hiremath, CEO

PRDC Bengaluru - Dr. R. Nagaraja, MD

AG Electro Services - Mr. S. V. Ramdurgkar, MD

HESCOM - S M Sasalatti, Director Tech.

Activities @ BEC-EEE



Krishitharanga - Mr. Girish Bhadragond, MD

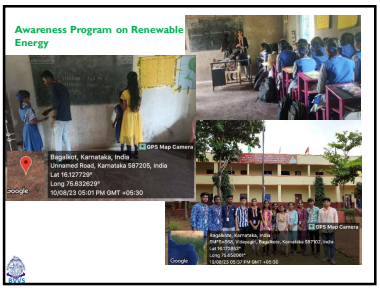
Shanthala Power Ltd. - Dr. Sumangala, MD

Saaketh Electrocircuit Private Limited - Mr. Rahul Sultane, Director

Basaveshwar Engineering College, Bagalkote
Department of Electrical & Electronics Engineering
BEC-IEEE PES Student Chapter (35261A)
Celebrating
National Energy Conservation Day
Public Awareness Program
14th December 2022
Time: 11.00 AM – 12.00 Noon
Venue: Seminar hall (EEE Dept.)
Basaveshwar Engineering College, Bagalkote
IEEE Power & Energy Society
Student Chapter (35261R)
Celebrating
National Energy Conservation Day
14th December 2022
Department of Electrical & Electronics Engineering
Venue: Seminar hall (EEE Dept.)
Time: 5:15pm

Industrial Visit to Hydel Power Plant

Public Awareness About Energy Conservation


Awareness Program on Renewable Energy

Thank You

Annexure 3

Vision, Mission, PEOs & PSOs

Basaveshwar Engineering College, Bagalkote
[AICTE Recognized, TEQIP-I, II & III, Permanently Affiliated to VTU Belagavi, NBA & NAAC Accredited]
Bagalkote-587102, Karnataka state, India

Department of Electrical & Electronics Engineering
[Govt. Aided, Accredited by NBA 2003, 2006, 2018, 2021, 2022-2025, Recognized R&D center of VTU]

Basaveshwar Engineering College, Bagalkote

Vision:

To be an institution of excellence in education, research and innovation for a sustainable future

To be recognized as a premier technical institute committed to developing exemplary professionals, offering research based innovative solutions and inspiring inventions for holistic socio-economic development

2

Basaveshwar Engineering College, Bagalkote

Mission:

1. Develop globally competent professionals for future talent requirements
2. Nurture a culture of research, innovation and entrepreneurship
3. Promote collaborations, extension and outreach programs for addressing industrial and societal needs
4. Imbibe moral and ethical values
5. Foster ecological and environmental consciousness

1. To pursue excellence through student centric dynamic teaching-learning processes, encouraging freedom of inquiry and openness to change.
2. To carry out innovative cutting edge research and transfer technology for industrial and societal needs.
3. To imbibe moral and ethical values and develop compassionate, humane professionals.

3

Basaveshwar Engineering College, Bagalkote (2024)

Vision:

To be an institution of excellence in education, research and innovation for a sustainable future

Mission:

1. Develop globally competent professionals for future talent requirements
2. Nurture a culture of research, innovation and entrepreneurship
3. Promote collaborations, extension and outreach programs for addressing industrial and societal needs
4. Imbibe moral and ethical values
5. Foster ecological and environmental consciousness

4

Basaveshwar Engineering College, Bagalkote (2024)

Values:

- Work is Worship
- Ethics and Integrity
- Empathy and compassion
- Indian ethos
- Mutual respect

5

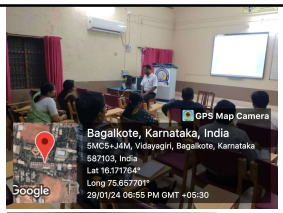
Department of Electrical and Electronics Engineering

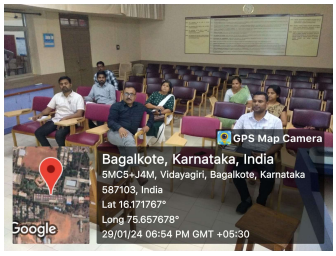
i. To reframe Vision and Mission of department
   - Series of faculty meetings are conducted in department
   - Brainstorming activities are conducted to recollect ideas and thoughts

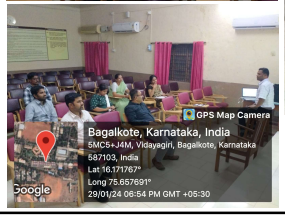
i. Feedback from stakeholders are received through google form
   https://forms.gle/pBi5o33p1fa2rXEB8

6

Faculty Meetings and Activities

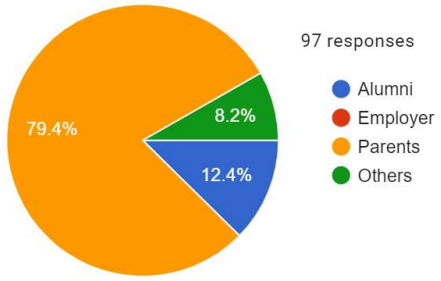






7

i. Feedback Received from Stakeholders



10

Vision Statements Presented by Faculty Members

The department of Electrical and Electronics Engineering serves globally in education, research and innovation for sustainable future - **RLN**

The department of Electrical and Electronics Engineering produces competent professionals to address the global issues through research and innovation for sustainable future - **RLN**

To be in the global forefront of academic excellence, research and innovation in Electrical and Electronics Engineering for sustainable future - **BFR**

To be a centre of excellence in Electrical and Electronics Engineering producing globally competent and socially responsible professionals for sustainable socio economic development - **MSA**

To empower the professionals with disruptive techniques to resolve Electrical and Electronics Engineering problems for sustainable future - **CL**

To be recognized as a centre of excellence to produce competent and ethical Electrical and Electronics Engineers capable of finding solutions to problems related to society environment, industry and innovation technologies – **SYG**

To be a frontliner in Electrical and Electronics Engineering education, research and innovation addressing energy, industry and socio economic development - **SGN**

To evolve as globally recognized centre of excellence for quality education, research and innovation with integrity and ethical standards in the field of Electrical and Electronics Engineering- **MLC**

To be an excellence in school of Electrical and Electronics Engineering for sustainable future – **SYG**

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Department of Electrical and Electronics Engineering

Vision:

To be in the global forefront of education, research and innovation in Electrical and Electronics Engineering to meet energy, ecology, industrial and societal needs

To be in the global forefront of Academic Excellence, Research, and Innovation in Electrical and Electronics Engineering to influence and meet the energy, environment, industrial and societal needs.

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Mission Statements Presented by Faculty Members

CL
Practice innovative teaching learning process in the field of E&EE
Excel in E&EE research and innovation towards industrial and societal development
Imbibe moral and ethical values
Foster ecological consciousness

SYG
To provide quality technical education using modern tools in the field of Electrical & Electronics Engineering.
To create competent and skilled professionals who are well trained to design, implement and control electrical efficient systems.

MAS
To impart quality education to produce globally competent electrical engineers.
To foster research, innovation and industrial collaboration.
To provide value based education to address societal problems of multidisciplinary dimensions.

SST
To impart quality education in the field of Electrical & Electronics Engineering to produce globally competent engineers
To collaborate with industry, research organizations and academia to encourage creativity and innovation.
To imbibe moral & ethical values and create engineering manpower for contributing effectively towards societal development

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Department of Electrical and Electronics Engineering

Mission:

1. **Develop globally competent professionals adapting to technological transformations in the field of Electrical and Electronics Engineering**
2. **Promote collaborations with higher learning institutes and industries for research, innovation and entrepreneurship**
3. **Imbibe moral & ethical values and render empathetical services to energy, ecology & environmental issues.**

1. **To practice dynamic teaching-learning processes adapting to ongoing global technological developments in the field of Electrical and Electronics Engineering.**
2. **To involve ourselves in national/international (industry/institute) collaborations for higher studies, research, development and innovation.**
3. **To carryout inter-disciplinary projects, skill development activities and field visits to imbibe real life experiences in students.**
4. **To render empathetical services to resolve energy, ecology and environmental issues.**

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Department of Electrical and Electronics Engineering (2024)

Vision:

To be in the global forefront of education, research and innovation in Electrical and Electronics Engineering to meet energy, ecology, industrial and societal needs

Mission:

1. Develop globally competent professionals adapting to technological transformations in the field of Electrical and Electronics Engineering
2. Promote collaborations with higher learning institutes and industries for research, innovation and entrepreneurship
3. Imbibe moral & ethical values and render empathetical services to energy, ecology & environmental issues.

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Department of Electrical and Electronics Engineering (2024)

Values:

- Work is Worship
- Ethics and Integrity
- Empathy and compassion
- Indian ethos
- Mutual respect

14

Vision Statements (2024)

Basaveshwar Engineering College, Bagalkote

To be an institution of excellence in education, research and innovation for a sustainable future

Department of Electrical and Electronics Engineering

To be in the global forefront of education, research and innovation in Electrical and Electronics Engineering to meet energy, ecology, industrial and societal needs

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Mission Statements (2024)

Basaveshwar Engineering College, Bagalkote

1. Develop globally competent professionals for future talent requirements
2. Nurture a culture of research, innovation and entrepreneurship
3. Promote collaborations, extension and outreach programs for addressing industrial and societal needs
4. Imbibe moral and ethical values
5. Foster ecological and environmental consciousness

Department of Electrical and Electronics Engineering

1. Develop globally competent professionals adapting to technological transformations in the field of Electrical and Electronics Engineering
2. Promote collaborations with higher learning institutes and industries for research, innovation and entrepreneurship
3. Imbibe moral & ethical values and render empathetical services to energy, ecology & environmental issues.

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Program Educational Objectives - PEOs

1. The graduates will be able to design the solutions to industrial challenges
2. The graduates will be able to take up higher studies and research
3. The graduates will be able to engage in multi-disciplinary innovation and entrepreneurship activities
4. The graduates will be able to adopt emerging technologies to provide solutions to the societal and environmental issues

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Program Specific Outcomes - PSOs

1. Graduates shall be able to specify, formulate and analyze concepts used in power systems and electrical machines as per requirements of power & energy sector
2. Graduates shall be able to identify, analyze, design and test technologies used in power electronics, electronic & signal processing circuits and control systems
3. Graduates shall be able to apply conventional concepts and contemporary tools to design, simulate and analyze electrical and electronic systems for real time applications through hands on learning gained in SCADA, energy systems and power electronics laboratories

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Annexure 4

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Scheme of Teaching and Evaluation for B.E Electrical and Electronics Engineering

2022-23 (admitted batch), 2023-24 (sem 3&4), 2024-25 (sem 5&6), 2025-26 (sem 7&8).

Total Credits for BE=160 (as per VTU/AICTE)

Table-1: Breakdown of Credits suggested by the VTU Belagavi/AICTE New Delhi

Sl.	Category	VTU New (old)	BEC (old)	BEC (New)
1.	HSMC: HSS (2 English, 1 Kannada, 1 UHV, 1 Constitution, 1 EV), 3 HRM (Offered by Dept.), 1 IKS = 10 AEC: (1 Scientific foundations of Health, 1 Innovation and design Thinking, 2 SS, 3 MOOCS, 3 Dept. specific) = 10	16 (10)	10	19
2.	ASC: Basic Science Courses (Physics, Chemistry and Mathematics)	22 (23)	23	22
3.	ESC/ETC: Engineering Science Courses (Basic Elect/ Electronics/ Computer/ Mechanics/ Workshop/ Drawing etc.)	24 (20)	19	18
4.	PCC: Professional Core Courses	59 (46)	49	56
5.	PEC: Professional Elective Courses relevant to the branch with at least one course either fully or partially supported by industry	12 (09)	12	12
6.	OEC: Open Electives Courses/ Subjects from other technical/Arts/Commerce (3 MOOCS + 6)	12 (04)	9+11=20	09
7.	Mini (1) and Major projects (12)/ Industrial Internships (10)	15 (33)	26	23
8.	Mandatory Course: PE, Yoga, NSS, Bridge course Maths 1 and 2 (lateral Entry)	00 (04)	01	00
	Total	160	160	160

Table-2: Semester wise Breakdown of Credits

Sem.	BSC	ESC/ETC	HSSM	AEC	PCC	PEC	OEC	Proj.	Int.	Total
I	08	09	02	1						20
II	08	09	02	1						20
III	03			3 (Dept.)	14					20
IV	03		01		16					20
V			02	2 (SS)	09	03	03	01		20
VI					14	03	03			20
VII			03		03	06		12		24
VIII				3 (MOOCS)			3 (MOOCS)		10	16
Tot.	22	18	10	10	56	12	09	13	10	160*

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Semester-1 **CAY 2022-23 (160 Credits 2022-23 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	ASC (IC)	22UMA101C	Mathematics for Electrical Sciences-I	4	3	0	2	50	50	100
2.	ASC (IC)	22UPH105C	Physics for Electrical Sciences	4	3	0	2	50	50	100
3.	ESC	22UEE115C	Elements of Electrical Engineering	3	3	0	0	50	50	100
4.	ESC - I	22UxxxxxN	Engineering Science Course – I	3	2	0	2	50	50	100
5.	ETC - I	22UxxxxxB	Emerging Technology Course – I	3	3	0	0	50	50	100
6.	HSSC	22UHS124C	Communicative English	1	1	0	0	50	50	100
7.	HSSC	22UHS125C	Constitution of India	1	1	0	0	50	50	100
8.	AEC	22UHS128C	Scientific Foundations of Health	1	1	0	0	50	50	100
			Total	20						

Semester-2 **CAY 2022-23 (160 Credits 2022-23 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	ASC (IC)	22UMA201C	Mathematics for Electrical Sciences-II	4	3	0	2	50	50	100
2.	ASC (IC)	22UCH209C	Chemistry for Electrical Sciences	4	3	0	2	50	50	100
3.	ESC	22UME223C	CAED	3	2	0	2	50	50	100
4.	ESC - II	22UxxxxxN	Engineering Science Course – II	3	3	0	0	50	50	100
5.	PLC - I	22UxxxxxB	Programming Language Course-I	3	2	0	2	50	50	100
6.	HSSC	22UHS224C	Professional Writing Skills in English	1	1	0	0	50	50	100
7.	HSSC	22UHS226C 22UHS227C	Samskruthika Kannada* Balake Kannada**	1	1	0	0	50	50	100
8.	AEC	22UHS229C	Innovation and Design Thinking	1	1	0	0	50	50	100
			Total	20						

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

(ESC - I) Engineering Science Courses - I				
Code	Title	L	T	P
22UME122N/222N	Introduction to Mechanical Engineering	3	0	0
22UCV118N/218N	Introduction to Civil Engineering	3	0	0
22UEE116N/216N	Introduction to Electrical Engineering	3	0	0
22UEC114N/214N	Introduction to Electronics Engineering	3	0	0
22UCS120N/220N	Introduction to 'C' Programming	2	0	2

(ETC - I) Emerging Technology Courses - I				
Code	Title	L	T	P
22UEC134B/234B	Introduction to Embedded Systems	3	0	0
22UEC135B/235B	Introduction to Communication Technology	3	0	0
22UEE136B/236B	Renewable Energy Sources	3	0	0
22UCV138B/238B	Green Buildings	3	0	0
22UCV139B/239B	Waste Management	3	0	0
22UCS140B/240B	Introduction to Internet of Things (IOT)	3	0	0
22UCS141B/241B	Introduction to Cyber Security	3	0	0
22UME142B/242B	Composite Materials	3	0	0
22UME143B/243B	Introduction to Robotics	3	0	0
22UBT148B/248B	Biomass and Bio-energy	3	0	0

(PLC - I) Programming Language Courses - I				
Code	Title	L	T	P
22UCS130B/230B	Introduction to Web Programming	2	0	2
22UCS131B/231B	Introduction to Python Programming	2	0	2
22UCS132B/232B	Basics to JAVA programming	2	0	2
22UCS133B/233B	Introduction to C++ Programming	2	0	2

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Semester-3 **CAY 2023-24 (160 Credits 2022-23 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	ASC	22UMA303C	Computation Techniques for Electrical Systems-I	3	3	0	0	50	50	100
2.	PCC	22UEE305C	Network Analysis	3	2	2	0	50	50	100
3.	PCC	22UEE306C	Electronic Circuits	3	3	0	0	50	50	100
4.	PCC	22UEE307C	Electrical Machines – I	3	3	0	0	50	50	100
5.	IPCC	22UEE308C	Electrical & Electronic Measurement	3	2	0	2	50	50	100
6.	PCC	22UEE310L	Electronic Circuits Laboratory	1	0	0	2	50	50	100
7.	PCC	22UEE311L	Electrical Machines – I Laboratory	1	0	0	2	50	50	100
8.	AEC	22UEE315C	Sustainable Energy Technologies in Agriculture	3	3	0	0	50	50	100
9.	ASC	22UMA300C	Bridge Course Mathematics - I	0	3	0	0	50	50	100
10.	NCMC	22UHS001M	Yoga	0	--	--	--	--	--	--
		22UHS002M	National Service Scheme	0						
		22UHS003M	Physical Education (Sports and Athletics)	0						
			Total	20						

All students have to register for any one of the courses namely National Service Scheme, Physical Education (Sports and Athletics), and Yoga with the concerned coordinator of the course during the first week of III semester. The activities shall be carried out between III semesters to VI semester (for 4 semesters). The accumulated marks are considered for CIE. Successful completion of the registered course is mandatory for the award of the degree.

Semester-4 **CAY 2023-24 (160 Credits 2022-23 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	ASC	22UMA403C	Computation Techniques for Electrical Systems -II	3	3	0	0	50	50	100
2.	PCC	22UEE405C	Power Systems – I	3	3	0	0	50	50	100
3.	PCC	22UEE406C	Logic Design	3	3	0	0	50	50	100
4.	PCC	22UEE407C	Electrical Machines – II	3	3	0	0	50	50	100
5.	PCC	22UEE408C	Control Systems	4	4	0	0	50	50	100
6.	PCC	22UEE410L	Power System – I Laboratory	1	0	0	2	50	50	100
7.	PCC	22UEE411L	Control System Laboratory	1	0	0	2	50	50	100
8.	PCC	22UEE412L	Electrical Machines – II Laboratory	1	0	0	2	50	50	100
9.	HSMC	22UHS424C	Universal Human Values - II	1	1	0	0	50	50	100
10.	ASC	22UMA400C	Bridge Course Mathematics-II	0	3	0	0	50	50	100
			Total	20						

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Semester-5 **CAY 2024-25 (160 Credits 2022-23 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	22UEE505C	Power System – II	3	3	0	0	50	50	100
2.	PCC	22UEE506C	Power Electronics	3	3	0	0	50	50	100
3.	PCC	22UEE510L	Power Electronics Laboratory	1	0	0	2	50	50	100
4.	PCC	22UEE511L	Auto CAD Electrical Laboratory	1	0	0	2	50	50	100
5.	PCC	22UEE512L	Logic Design Laboratory	1	0	0	2	50	50	100
6.	PEC	22UEE5xxE	Professional Elective Course – I	3	3	0	0	50	50	100
7.	OEC	22Uxx5xxN	Open Elective Course – I	3	3	0	0	50	50	100
8.	Proj	22UEE518P	Mini Project	1	0	0	2	50	50	100
9.	AEC	22UHS521C	Quantitative Aptitude and Professional Skills	2	2	0	0	50	50	100
10.	HSMC	22UBT523C	Environmental Studies	1	1	0	0	50	50	100
11.	HSMC	22UHS500C	Indian Knowledge Systems	1	1	0	0	50	50	100
			Total	20						

Semester-6 **CAY 2024-25 (160 Credits 2022-23 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	22UEE605C	Power System – III	3	3	0	0	50	50	100
2.	PCC	22UEE606C	Microcontrollers	3	3	0	0	50	50	100
3.	PCC	22UEE607C	Digital Signal Processing	3	3	0	0	50	50	100
4.	PCC	22UEE608C	High Voltage Engineering	3	3	0	0	50	50	100
5.	PCC	22UEE610L	Power System – II Laboratory	1	0	0	2	50	50	100
6.	PCC	22UEE611L	Microcontrollers Laboratory	1	0	0	2	50	50	100
7.	PEC	22UEE6xxE	Professional Elective Course – II	3	3	0	0	50	50	100
8.	OEC	22Uxx6xxN	Open Elective Course – II	3	3	0	0	50	50	100
9.	NCMC	22UHS001M	Yoga	0	--	--	--	100	--	100
		22UHS002M	National Service Scheme	0						
		22UHS003M	Physical Education (Sports and Athletics)	0						
			Total	20						

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Semester-7[#] **CAY 2025-26 (160 Credits 2022-23 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	22UEE705C/805C	Power System – IV	3	3	0	0	50	50	100
2.	PEC	22UEE7xxE/8xxE	Professional Elective Course-III	3	3	0	0	50	50	100
3.	PEC	22UEE7xxE/8xxE	Professional Elective Course-IV	3	3	0	0	50	50	100
4.	Proj	22UEE718P /818P	Project Work	12	0	0	12	50	50	100
5.	HSMC	22UHS711C/811C	Research Methodology and IPR	3	3	0	0	50	50	100
			Total	24						

Semester-8[#] **CAY 2025-26 (160 Credits 2022-23 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	INT	22UEE815I/715I	Internship	10	0	0	--	50	50	100
2.	AEC	22UEE7xxO/8xxO	MOOCs	3	--	--	--	--	--	--
3.	OEC	22UEE7xxO/8xxO	MOOCs	3	--	--	--	--	--	--
			Total	16	--	--	--			

[#] Semester 7 & 8 are flippable (swapped)

Criteria for Bachelor Degree: A student has to earn a minimum of 160 credits for award of Bachelor of Engineering (B.E) at the end of fourth year.

Criteria for Bachelor Degree (Honors): A student has to earn a minimum of 178 [160 + 18 (online)] credits for award of Bachelor of Engineering (B.E honors) at the end of fourth year.

Criteria for Bachelor Degree (with minor degree): A student has to earn a minimum of 178 [160 + 18* (blended)] credits for award of Bachelor of Engineering (B.E) with major and minor streams at the end of fourth year.

Subject Code Indication for Elective Courses: 21UEE741E
21-Year of course introduction/ modification: UEE–UG in E&EE: 7–Semester in which course is being offered: 4-Electives group number: 1-Serial number of course in elective group: E-Elective course

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Semester-5

List of subjects for Professional Elective Course – I (Sem-V)		
1.	22UEE511E	Electrical Machine Design
2.	22UEE512E	Electrical Engineering Materials
3.	22UEE513E	Testing and Commissioning of Electrical Equipment
4.	22UEE514E	Data Base management Systems
5.	22UEE515E	Operation Research
6.	22UEE516E	Field Theory

List of subjects for Open Elective Course I		
1.		Electric Vehicle
2.		Fundamentals of Wind Energy Conversion System

Semester-6

List of subjects for Professional Elective Course – II (Sem-VI)		
1.	22UEE621E	Integration of Distributed Generation
2.	22UEE622E	Automotive Electronics
3.	22UEE623E	Intelligent Instrumentation
4.	22UEE624E	VLSI Design
5.	22UEE625E	Electric Machine Drives
6.	22UEE626E	Modern Control Theory

List of subjects for Open Elective Course II		
1.		Electrical Safety for Engineers
2.		Energy Storage Systems

Semester-7

List of subjects for Professional Elective Course – III (Sem-VII)		
1.	22UEE731E	Smart Grids
2.	22UEE732E	Electric Vehicles
3.	22UEE733E	Solar Photovoltaic System Design
4.	22UEE734E	Reactive Power Management
5.	22UEE735E	Power System Planning
6.	22UEE736E	HVDC Transmission

List of subjects for Professional Elective Course – IV (Sem-VII)		
1.	22UEE741E	Flexible AC Transmission Systems
2.	22UEE742E	Battery Management Systems
3.	22UEE743E	Energy Conservation, Audit and DSM
4.	22UEE744E	Energy Efficient Motors
5.	22UEE745E	Wind Energy Conversion Systems
6.	22UEE746E	AI Applications to Power Systems

Annexure 5

Syllabus for B.E VII - Semester for academic year 2025 – 2026

(For students admitted to I year in 2022-23)

22UEE705C	Power System - IV	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Automatic Load Frequency Control: Introduction, Control loops of power systems modeling of Automatic Load Frequency Control (ALFC) of single area systems, performance of ALFC. ALFC of two area systems, expression for tie-line flow and frequency deviation, parallel operation. Generation Control: Supplementary Control Action, Tie line Control, Generation Allocation.

Control of Voltage and Reactive Power: Introduction, generation and absorption of reactive power, methods of voltage control: Shunt reactor, shunt capacitor, series capacitor, tap changing transformer and booster transformer Compensating Devices-Characteristics of SVC, TCR, TSC and STATCOM. voltage stability, PV and QV curves, voltage collapse, prevention of voltage collapse**.**

UNIT – II	(10 Hours)

Unit Commitment: Statement of the problem, need and importance of unit, constraints in unit commitment, spinning reserve, Thermal Unit Constraints, Other constraints, Hydro constraints, Must Run, Fuel constraints, Unit commitment Solution methods: Priority-List methods, Dynamic Programming solution. Reliability Considerations, Patton's Security Function, Security constrained Optimal Unit Commitment

Interchange of Power and Energy: Introduction, Economy Interchange between Interconnected Utilities, Infertility Economy Energy Evaluation, Multiple-Utility Interchange Transaction, Power pools, Transmissions Effects and Issues

UNIT – III	(10 Hours)

Power System Security: Introduction, factors affecting power system security, power system contingency analysis, detection of network problems, network sensitivity methods, calculation of network sensitivity factor, contingency ranking

Power System State Estimation: Introduction, power system state estimation, maximum likeli-hood weighted least-square estimation, maximum likeli- hood concept with example, matrix formulations, Detection and Identification of bad measurements

UNIT – IV	(10 Hours)

Power System SCADA: Introduction, building blocks of SCADA, Remote Terminal Unit (RTU)-Evolution and Components of RTU, Communication Subsystem, Logic subsystem, Termination subsystem, HMI subsystem, Advanced RTU functionalities.

Intelligent Electronic Device (IED)-IED functional block diagram, hardware and software architecture of IED, IED communication systems. Data concentrator and merging units, SCADA communication system, Master station, Human Machine Interface (HMI), Building SCADA system, Classification of SCADA,SCADA implementation and Case studies in SCADA

Reference Books:

1. Allaen J Wood Bruce F. Wollenberg, “Power Generation, Operation and Control”, 2nd Edition, John Wiley and Sons, Reprint 2014.
2. G.L. Kusic, “Computer Aided Power System Analysis”, 2nd Edition, PHI, 1992.
3. T.J.E Miler, “Reactive Power Control in Electric Power Systems”, John Wiely and Sons NY, 1982.

4. Mini S Thomas, Jhon D. McDonald. "Power System SCADA and Smart Grid", CRC press Taylor and Francis groups, 2015.
5. Nagrath,I.J., Kothari,D.P, "Modern Power SystemAnalysis", 4th Edition, TMH, 2014.
6. Prabha Kundur, "Power System Stability and Control", 9th reprint, TMH, 2009.

Course Outcomes:

After completion of the course the students will be able to,

1. Analyze and design automatic load frequency control (ALFC) and voltage control strategies in power systems, including modeling of single and two-area systems, reactive power management, and the application of compensating devices to enhance system stability and prevent voltage collapse.
2. Evaluate and apply unit commitment strategies and economic interchange methods in interconnected power systems, considering system constraints, reliability, and transmission effects to ensure optimal and secure operation.
3. Assess and improve power system security through contingency analysis, sensitivity methods, and state estimation techniques, using tools like maximum likelihood estimation and matrix formulations to detect network issues and ensure system reliability.
4. Describe the concepts behind the design and operation of SCADA systems, including the roles of Remote Terminal Units (RTUs), Intelligent Electronic Devices (IEDs), communication subsystems, and Human-Machine Interfaces (HMIs) for effective power system monitoring and control.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE705C.1	1	3	2	1							1	3		1
2	22UEE705C.2	1	3	2	1							1	3		1
3	22UEE705C.3	1	3	2	1							1	3		1
4	22UEE705C.4	1	1	1	1							1	3		1

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(For students admitted to I year in 2022-23)

Professional Elective Course – III

Syllabus for B.E VII - Semester for academic year 2025 – 2026

(For students admitted to I year in 2022-23)

22UEE731E	Smart Grids	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Smart Grid Architectural Designs: Introduction, Today's Grid versus the Smart Grid, Energy Independence and Security Act of 2007: Rationale for the Smart Grid, Computational Intelligence, Power System Enhancement, Communication and Standards, Environment and Economics, General View of the Smart Grid Market Drivers, Stakeholder Roles and Function, Working Definition of the Smart Grid Based on Performance Measures, Representative Architecture, Functions of Smart Grid Components. **Smart Grid Communications and Measurement Technology:** Communication and Measurement, Monitoring, PMU, Smart Meters, and Measurements Technologies, GIS and Google Mapping Tools, Multiagent Systems (MAS) Technology, Microgrid and Smart Grid Comparison. **Performance Analysis Tools for Smart Grid Design:** Introduction to Load Flow Studies, Challenges to Load Flow in Smart Grid and Weaknesses of the Present Load Flow Methods, Load, Flow State of the Art: Classical, Extended Formulations, and Algorithms, Congestion Management, Effect, Load Flow for Smart Grid Design.	
UNIT – II	**(10 Hours)**
Stability Analysis: Introduction to Stability, Strengths and Weaknesses of Existing Voltage Stability Analysis Tools, Voltage Stability Assessment, Voltage Stability Assessment Techniques, Voltage Stability Indexing, Analysis Techniques for Steady-State Voltage Stability Studies, Optimizing Stability Constraint through Preventive Control of Voltage Stability, Angle Stability Assessment. **Computation Tools for Smart Grid:** Introduction to Computational Tools, Decision Support Tools, Optimization Techniques, Classical Optimization Method, Heuristic Optimization, Evolutionary Computational Techniques.	
UNIT – III	**(10 Hours)**
Pathway for Designing Smart Grid: : Introduction to Smart Grid Pathway Design, Barriers and Solutions to Smart Grid Development, Solution Pathways for Designing Smart Grid Using Advanced Optimization and Control Techniques for Selection Functions, General Level Automation, Bulk Power Systems Automation of the Smart Grid at Transmission Level, Distribution System Automation Requirement of the Power Grid, End User/Appliance Level of the Smart Grid, Applications for Adaptive Control and Optimization. **Renewable Energy and Storage:** Renewable Energy Resources, Sustainable Energy Options for the Smart Grid, Penetration and Variability Issues Associated with Sustainable Energy Technology, Demand Response Issues, Electric Vehicles and Plug-in Hybrids, PHEV Technology, Environmental Implications, Storage Technologies, Tax Credits.	
UNIT – IV	**(10 Hours)**
Interoperability, Standards, and Cyber Security: Introduction, Interoperability, Standards, Smart Grid Cyber Security, Cyber Security and Possible Operation for Improving Methodology for Other Users. **Research, Education, and Training for the Smart Grid:** Introduction, Research Areas for Smart Grid Development, Research Activities in the Smart Grid, Multidisciplinary Research	

Activities, Smart Grid Education, Training and Professional Development.

Case Studies and Test beds for the Smart Grid:

Introduction, Demonstration Projects, Advanced Metering, Microgrid with Renewable Energy, Power System Unit Commitment (UC) Problem, ADP for Optimal Network Reconfiguration in Distribution Automation, Case Study of RER Integration, Testbeds and Benchmark Systems, Challenges of Smart Transmission, Benefits of Smart Transmission.

Reference Books:

1. James Momoh., "Smart Grid, Fundamentals of Design and Analysis", 1st Edition, Wiley, 2012.
2. Clark W Gellings, "The Smart Grid, Enabling Energy Efficiency and Demand Side Response"- CRC Press, 2009.
3. Yokoyama, Nick Jenkins, "Smart Grid: Technology and Applications"- Wiley, 2012.

Course Outcomes:

After completion of the course the students will be able to,

1. Identify the smart measuring instruments for two way communication of each components in grid.
2. Apply the suitable load flow analysis technique for exiting distribution system.
3. Evaluate the optimal value for distribution system including renewable energy and storage systems.
4. Formulate the existing distribution for the conversion to smartgrid using standards as for the case studies.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE731E.1	3	2	2	2	3					1		3	2	2
2	22UEE731E.2	3	3	2	3	2					1		3	3	2
3	22UEE731E.3	3	3	3	3	3		2		1	2	2	3	3	3
4	22UEE731E.4	3	3	3	3	2	2	2	2	2	3	2	3	3	3

Syllabus for B.E VII - Semester for academic year 2025 – 2026

(For students admitted to I year in 2022-23)

22UEE732E	Electric Vehicles	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
Introduction to EV: Historical Background, Benefits of Using Evs, Overview of types of Evs and its Challenges, EV Motor Drive Technologies, EV Energy Source Technologies, EV Battery Charging Technologies, EV Vehicle to Grid **EV Subsystem**: EV Subsystems and Configurations, HEV Subsystems and Configurations. HEV Subsystems and Configurations, Motion and dynamic equations for vehicles	
UNIT – II	**10 Hours**
Energy Storage: Batteries-Overview of Batteries, Battery Parameters, Lead Acid Batteries, Lithium Batteries, Metal Air Batteries. Alternative and Novel Energy Sources-Solar Photovoltaics, Flywheels, Super Capacitors. Fuel Cells-Main issues in the fuel cell, Hydrogen Fuel Cells: Basic Principles, Fuel Cell Thermodynamics (Introduction)	
UNIT – III	**10 Hours**
Architecture of EV and HEV: Vehicle Power Plant and Transmission Characteristics- Introduction, Drive train Configuration, Vehicle power plant, Internal combustion engine, Electric Motor, The need for gearbox, Drive train tractive effort and vehicle speed, Vehicle performance. Basic Architecture of Hybrid Drive Trains and Analysis of Series Drive Train- The Hybrid Electric Vehicle (HEV), Energy Use in Conventional Vehicles, Energy Savings Potential of Hybrid Drivetrains, HEV Configurations, Series and parallel Hybrid System.	
UNIT – IV	**10 Hours**
Power Flow in HEVs: Introduction, Power Flow Control, Power Flow Control in Series Hybrid, Power Flow Control in Parallel Hybrid, Power Flow Control in series-Parallel Hybrid, Power Flow Control Complex Hybrid Control	

Reference Books:

1. Iqbal Hussein, “Electric and Hybrid Vehicles: Design Fundamentals”, CRC Press, 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 2004.
3. James Larminie, John Lowry, “Electric Vehicle Technology Explained”, Wiley publications, 2003.

Course Outcomes:

After completion of the course the students will be able to,

1. Illustrate the evolution, classification, and components of electric and hybrid vehicles.
2. Analyze different energy storage and alternative energy sources used in EV applications.
3. Interpret the drive-train architecture and vehicle dynamics of electric and hybrid vehicles.
4. Evaluate the power flow control strategies in various hybrid electric vehicle configurations.

Syllabus for B.E VII - Semester for academic year 2025 – 2026

(For students admitted to I year in 2022-23)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE732E.1	3	2					2					3		
2	22UEE732E.2	3	3	2									2	3	
3	22UEE732E.3	3	2	3	2								3	3	2
4	22UEE732E.4	2	2	3	3	2							2	3	3

Syllabus for B.E VII - Semester for academic year 2025 – 2026

(For students admitted to I year in 2022-23)

22UEE733E	Solar Photovoltaic Systems Design	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Chapter-01: Solar Energy – Introduction and its scenario of India and global; Solar Radiation – solar radiation spectrum, diffuse & beam radiation and solar radiation measurement.

Chapter-02: Solar Cells – I-V & P-V characteristics; Technologies; Parameters; Factors affecting electricity generated; series, parallel and series & parallel connections; Numerical problems.

UNIT – II	(10 Hours)

Chapter-03: SPV module – Ratings, standard parameters; factors affecting electricity generated; I-V & P-V Characteristics; connection of modules in series, parallel and series & parallel; Mismatch in series and parallel connections, Introduction to arrays.

Chapter-04: Balance of System (BoS) - Batteries; Charge Controllers; MPPT; Inverters. (BoS to cover functions, working, types, features, typical specifications and cost). Numerical problems.

UNIT – III	(10 Hours)

Chapter-05: Wires – Introduction, basics of current conduction, types of wires, measurement of wire dimensions, wire sizing; junction box;

Chapter-06: Installation, troubleshooting of stand-alone and grid connected solar PV power systems; Safety of SPV power plants; Solar PV plant installation check list – Electrical testing of PV array, inverter; islanding protection; commissioning and system functioning. Field visits within campus to study installations.

UNIT – IV	(10 Hours)

Chapter-07: SPV system design and integration – Types of SPV systems; Design Methodology for Stand-alone SPV systems.

Chapter-08: Grid connected Solar PV Power Systems (GCSPVPS) – Introduction, Configurations & Components of GCSPVPS, GCSPVPS Design for small applications and for power plants.

Reference Books:

1. Chetan Singh Solanki, "Solar Photovoltaics – Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi, 3rd Edition, 2015.
2. Chetan Singh Solanki, "Solar Photovoltaic Technology and Systems – A Manual for Technicians, Trainers and Engineers", PHI Learning Private Limited, New Delhi, 2014
3. Tiwari, G. N and Ghosal, M. K., "Fundamentals of Renewable Energy Sources", Alpha Science International Ltd, New Delhi, 2007.

Course Outcomes:

After completion of the course the students will be able to,

1. Analyze the performance of solar photovoltaic systems under varying load and environmental conditions using numerical and analytical methods.
2. Apply knowledge of solar PV system components and configurations to select appropriate systems for specific applications.
3. Evaluate the operation, testing, and troubleshooting of solar PV systems and their

components ensuring safe and effective performance.

4. Design stand-alone and grid-connected solar photovoltaic systems based on specific load requirements and integration methodologies.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE733E.1	3	3	2	2	2		2			2		3	2	2
2	22UEE733E.2	3	2	2	2	3		2			2		3	3	2
3	22UEE733E.3	3	3	3	3	3	2	2			2	2	3	3	3
4	22UEE733E.4	3	3	3	3	3	2	2		2	3	2	3	3	3

Syllabus for B.E VII - Semester for academic year 2025 – 2026

(For students admitted to I year in 2022-23)

22UEE734E	Reactive Power Management	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction Importance of reactive power control in electrical power system, objectives of load compensation, ideal compensator, load compensation specific of a compensator, power factor correction and voltage regulation in single phase system, reactive power bias.	
UNIT – II	**(10 Hours)**
Basic requirement in AC power transmission Factor affecting stability and voltage, uncompensated Transmission line: performance equations and performance requirement of lines, voltage profile, voltage-power characteristics, load ability characteristics. Transmission line compensation: types passive/active compensators, series/shunt compensation and compensation by sectioning.	
UNIT – III	**(10 Hours)**
Harmonics Characteristics and un characteristics harmonics, sources, troubles caused by harmonics on electrical equipment, means of reducing harmonics, types of harmonic filters, DC filters IEEE 519-1992 guidelines telephone interferences.	
UNIT – IV	**(10 Hours)**
Reactive power co-ordination Reactive power management and planning, utility objectives, practices, transmission benefits, reactive power dispatch & equipment impact, reactive power forecasting, reactive power control by DSM, power pooling.	

Reference Books:

1. T. J. E. Miller, “Reactive Power Control in Electric Power Systems”, John Wiley & Sons NY 2009
2. D. Tagare, “Reactive Power Management”, TMH, 1st Edition, 2004.
3. Prabha Kundur, “Power System Stability and Control”, TMH 9th reprint, 2007.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply suitable compensation scheme for load and power factor correction
2. Investigate performance of the transmission lines through voltage-power and loadability characteristics
3. Identify type of harmonics in transmission line by calculating magnitude of harmonics
4. Develop reactive power management scheme for utilities

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE734E.1	3	2	1	3	2				1	2	2	3	2	2
2	22UEE734E.2	3	3	3	1	3				1	1	2	3	2	1
3	22UEE734E.3	3	2	2	2	2				1	1	2	3	3	2
4	22UEE734E.4	3	2	3	2	3				1	2	2	3	3	2

Syllabus for B.E VII - Semester for academic year 2025 – 2026

(For students admitted to I year in 2022-23)

22UEE735E	Power System Planning	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction of Power Planning: National and regional planning, structure of power system, planning tools, electricity regulation, Load forecasting, forecasting techniques, modeling. **Generation Planning:** Integrated power generation, co-generation / captive power, power pooling and power trading, transmission and distribution planning.	
UNIT – II	**(10 Hours)**
Power System Economics: Power system economics, power sector finance, financial planning, private participation, rural electrification investment, concept of rational tariffs. **Computer Aided Planning:** Wheeling, environmental effects, greenhouse effect, technological impacts, insulation co-ordination, reactive compensation.	
UNIT – III	**(10 Hours)**
Power System Reliability: Reliability definition, system reliability, system adequacy and security, reliability planning, reliability evaluation, functional zones, generation, transmission, reliability target, quality of supply.	
UNIT – IV	**(10 Hours)**
System Operation Planning: Operations, Maintenance, Load management, Load prediction, Reactive power balance, Power grid, Online power flow studies, State estimation, Computerized management, Power system simulator.	

Reference Books:

1. A.S.Pabla, Macmillan “Electrical Power System Planning”, (1st Edition), India Ltd, 2016.
2. M. E. Van Valkenburg, "Network analysis", 3rd Edition, PHI Learning, 2014.
3. Charles E Ebeling by “Reliability and Maintainability Engineering”, 1st Edition, Tata McGraw Hill, 2004.

Course Outcomes:

After completion of the course the students will be able to,

1. **Analyze** the structure of national and regional power systems, and apply forecasting techniques and planning tools for effective generation, transmission, and distribution planning.
2. **Evaluate** the economic aspects of power system planning, including tariff structuring, investment strategies, financial modeling, and the role of private participation in the power sector.
3. **Assess** the reliability of power systems by evaluating generation, transmission, and distribution adequacy using system reliability models and performance indicators.
4. **Develop** strategies for power system operation through load management, state estimation, reactive power balancing, and the application of simulation and computerized planning tools.

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(For students admitted to I year in 2022-23)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE735E.1	3	2	2		2						1	2	3	1
2	22UEE735E.2	2	3	2		2	1					1	2	3	2
3	22UEE735E.3	3	3	2	2	2						1	2	3	1
4	22UEE735E.4	3	2	3	2	3						1	2	3	2

Syllabus for B.E VII - Semester for academic year 2025 – 2026

(For students admitted to I year in 2022-23)

22UEE736E	HVDC Transmission	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
General Aspects of DC Transmission: Historical sketch, constitution of EHVAC and DC links, Limitations and Advantages of AC and DC Transmission and comparison of DC with AC transmission **Analysis of the Bridge Converter:** Analysis with grid control but no overlap, Analysis with grid control and with overlap less than 60 deg, Analysis with overlap greater than 60 deg, complete characteristics of rectifier, Inversion.	
UNIT – II	**(10 Hours)**
Control of HVDC Converters and Systems: Grid control, basic means of control, power reversal, limitations of manual control, constant current versus constant voltage, desired feature of control, actual control characteristics, constant -minimum -Ignition –angle control, constant –current control, constant –extinction –angle control, stability of control. Grid control, basic means of control, power reversal, limitations of manual control, constant current versus constant voltage, desired feature of control, actual control characteristics, constant -minimum -Ignition –angle control, constant –current control, constant –extinction –angle control, stability of control.	
UNIT – III	**(10 Hours)**
Smoothing Reactor and DC Line: Smoothing reactor, voltage oscillations and valve dampers, current oscillations and anode dampers, DC line oscillations and line dampers, clear line faults and reenergizing the line, DC Breakers, Effects of proximity of AC and DC Transmission Lines **Harmonics, Filters and Torsional Interaction:** Generation of Harmonics, design of AC filters, DC filters, harmonic interactions and torsional interaction. Torsional interactions with HVDC systems, counter measures to torsional interaction with DC systems	
UNIT – IV	**(10 Hours)**
Multiterminal DC Systems: Potential Applications of MTDC Systems, Types of MTDC Systems, Control and protection of MTDC systems, study of MTDC systems **Power Flow Analysis in AC/DC Systems:** Modeling of DC Links, solution of DC load flow, per unit system for DC quantities, solution of SC-AC power flow. An example: Five terminal DC system.	
Reference Books: 1. Prabha Kundur, “Power System Stability and Control”, TMH, 5th reprint 2008. 2. EW Kimbark, “Direct current Transmission”,Vol.No1, John Wiley, New York, 1971 3. K R Padiyar, “HVDC Power Transmission Systems Technology and System Interation”, (3rd Edition), New Age International Publishers, Reprint 2017.	
Course Outcomes: After completion of the course the students will be able to, 1. Explain the principles of HVDC transmission and analyze converter characteristics. 2. Evaluate control strategies for HVDC systems and their impact on system performance	

3. Analyze filtering, harmonic effects, line protection, and system stability in HVDC systems
4. Examine MTDC system configurations and perform power flow analysis in AC/DC systems

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE736E.1	3	3	2	2			2					3	2	
2	22UEE736E.2	3	3	3	3	2							2	3	2
3	22UEE736E.3	3	2	3	2	2							2	3	3
4	22UEE736E.4	3	3	3	3	3							3	3	3

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Professional Elective Course – IV

Syllabus for B.E VII - Semester for academic year 2025 – 2026

(For students admitted to I year in 2022-23)

22UEE741E	Flexible AC Transmission Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Review of AC transmission lines: Electrical characteristics, performance equations, natural or surge impedance loading, equivalent circuit of a transmission line, performance requirements of power transmission lines, voltage and current profile under no load.

Power transfer and stability considerations, Principles of transmission system compensation - series and shunt, Compensation by line sectioning, Concept of flexible AC transmission, FACTS-Benefits, Types and Brief descriptions.

UNIT – II	(10 Hours)

Static Shunt Compensators: Objective of shunt compensation, Methods of controllable VAR Generation. SVC and STATCOM: Operating principle, Regulation slope, Transfer function and Dynamic performance, Transient stability enhanced and power oscillation damping, VAR Reserve Control.

Comparison between STATCOM and SVC: V-I and V-Q Characteristics, Transient Stability, Response Time, Capability to Exchange real power, operating with unbalanced AC system, Physical size and Installation, Merit of hybrid compensator, Static Var Systems.

UNIT – III	(10 Hours)

Static Series Compensators GCSC, TSSC, TCSC: Objectives of series compensation, Voltage stability, Improvement of transient stability, power oscillation damping, sub synchronous oscillation damping, approaches to controlled series compensation.

Variable Impedance Type series compensators: GTO Thyristor- controlled series capacitor (GCSC), Thyristor-Switched Series Capacitor (TSSC), Thyristor Controlled Series Capacitor (TCSC), Thyristor- Controlled Voltage and Phase Angle Regulators (TCVRs and TCPARs).

UNIT – IV	(10 Hours)

Unified Power Flow Controller (UPFC): Basic operating principle, control capabilities, implementation, comparison to series compensators and Phase Angle Regulators, Control structure, Dynamic performance. Interline Power Flow Controller (IPFC): operating Principle, control structure and Applications.

Dynamic Voltage Restorer (DVR) – Introduction to DVR, overview of voltage sag and swells.

Reference Books:

1. Narain G. Hingorani and Lazlo Gyugyi, Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, IEEE Press and John Wiley & Sons, Inc, 2000.
2. Prabha Kundur, Power System Stability and Control Tata McGraw Hill Publishers, New Delhi, 2006.
3. R. Mohan Mathur, Static Controllers for Electrical Transmission Systems, IEEE Press and John Wiley & Sons, Inc. 2008.
4. R. Mohan Mathur, Rajiv K Varma, Thyristor-Based FACTS Controllers for Electrical Transmission Systems, IEEE Press and John Wiley & Sons, Inc. 2008.

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(For students admitted to I year in 2022-23)

Course Outcomes:

After completion of the course the students will be able to,

1. Analyze the operations of different FACTS devices on a given transmission line and assess the impact of FACTS controller
2. Choose proper controller for the specific application based on system requirements
3. Interpret the control circuits of Shunt Controllers SVC & STATCOM for various functions viz. Transient stability Enhancement, voltage instability prevention and power oscillation damping
4. Detect the Power and control circuits of Series Controllers GCSC, TSSC and TCSC

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE741E.1	3	2	1	3	2				1	2	2	3	2	2
2	22UEE741E.2	3	2	2	1	3				1	2	2	2	2	1
3	22UEE741E.3	3	2	2	2	2				1	1	2	2	3	2
4	22UEE741E.4	3	2	3	2	3				1	2	2	3	3	2

Syllabus for B.E VII - Semester for academic year 2025 – 2026

(For students admitted to I year in 2022-23)

22UEE742E	Battery Management Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Battery-Management-System Requirements: Introduction and BMS functionality. Requirements: Sensing, High-voltage contactor control, Isolation sensing and thermal control, Protection and interface, State-of-charge estimation and Energy & power estimation.	
UNIT – II	**(10 Hours)**
Battery State Estimation: Preliminary definitions, approaches to estimate state of charge, Review of probability, Overview of vector random (stochastic) processes, Sequential-probabilistic-inference solution, The six-step process, Deriving the linear Kalman filter, Visualizing the Kalman filter, MATLAB code for the Kalman filter steps, Practical considerations, The extended Kalman filter (EKF)	
UNIT – III	**(10 Hours)**
Battery Health Estimation: Introduction, Lithium-ion aging: Negative electrode, Lithium-ion aging: Positive electrode, Sensitivity of voltage to ESR and total capacity, A Kalman filter framework for estimating parameters, EKF for parameter estimation, Simultaneous state and parameter estimation, Robustness and speed, The problem with least-squares capacity estimates, Derivation of weighted ordinary least squares, Derivation of weighted total least squares, Goodness of the model fit and confidence intervals, Simplified method with proportional confidence on xi and yi.	
UNIT – IV	**(10 Hours)**
Cell Balancing: Causes (and not causes) of imbalance, Design choices when implementing balancing, Circuits for balancing (1): Passive, Circuits for balancing (2): Active, capacitive, Circuits for balancing (3): Active, inductive and dc-dc, How quickly must I balance a pack? And results of balancing simulations. Voltage-Based Power-Limit Estimation: Problem definition, Voltage-based rate limits, using simple cell model, Voltage-based rate limits, using comprehensive cell model, Bisection search and Power-limits estimation example.	
Reference Books: 1. A.R. JHA, Next-Generation Batteries and Fuel Cells for Commercial, Military, and Space Applications, CRC Press, 2012. 2. Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric, Springer, 2013. 3. Gregory L. Plett, Battery Management Systems, Volume 1: Battery Modeling , Artech House September 2015	
Course Outcomes: After completion of the course the students will be able to, 1. Explain the functional requirements and critical roles of a Battery Management System (BMS) in electric energy systems. 2. Apply probabilistic and filtering techniques for battery state estimation using Kalman and Extended Kalman Filters. 3. Evaluate battery health and degradation mechanisms using statistical and estimation	

models.

4. Analyze balancing circuits and estimate voltage-based power limits for optimal battery pack performance

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE742E.1	3	2	2									3	2	
2	22UEE742E.2	3	3	3	3	3							2	3	3
3	22UEE742E.3	3	3	3	3	2							2	3	3
4	22UEE742E.4	2	3	3	2	2							2	3	3

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(For students admitted to I year in 2022-23)

22UEE743E	Energy Conservation, Audit and DSM	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Energy Scenario: Introduction to Energy; Units and Conversions; GDP, GNP and Per Capita Energy Consumption; Renewable Energy Act, International Energy Agency, OECD and Kyoto Protocol (only overview)

Economic Analysis of Energy: Economic analysis of investment, Cash Flows and CF diagrams, Economic analysis technique – Simple payback period method, Discounted cash flow method or Time adjustment technique, Net present value method, Present value index method or Profitability index method, Internal rate of return method, Accounting on average rate of return method; Interest Factors – Single Payment Compound Amount (SPCA), Single Payment Present Worth (SPPW), Uniform Series Compound Amount (USCA), Sinking Fund Payment (SFP), Uniform Series Present Worth (USPW), Capital Recovery (CR). (Simple Numerical problems).

UNIT – II	(10 Hours)

Motors: Introduction, Motor Efficiency, Motor Selection; Determination of energy saving, Energy saving options in oversized motors, Effect of variation of voltage on performance of motor, Effect on efficiency due to variation in load; Energy Efficient Motors, Choice of energy efficient motor, Factors Affecting Energy Efficiency, Rewinding Effects on Energy Efficiency, Standards and Star Labeling of Energy Efficient Induction Motors.

Lighting: Introduction, Terms and definitions – Lumen, Lux, Load efficacy, Lamp circuit efficacy, Colour rendering index (CRI); Characteristic of different types of lamps, Aspects of lighting system designing, Installed load efficacy ratio, Various means of energy savings – Use of natural day light, Reduction in light fixture, High efficiency lamps and luminaries, Effect of reduction in supply voltage on energy consumption, Timers and occupancy sensors.

UNIT – III	(10 Hours)

Energy Management and Audit: Energy management; Developing energy use profiles; Sankey Diagram; Process flow diagrams; Material and energy balance; Energy auditing instruments. Energy audit – Need for energy audit, Scope of energy audit, Types of energy audit – Preliminary energy audit, Detailed energy audit.

UNIT – IV	(10 Hours)

Energy Conservation: Introduction, Results of energy conservation, Principles of energy conservation, Energy conservation planning, Energy conservation Act,; Energy conservation in residential and commercial sectors, Energy conservation in transportation, considerations for Energy conservation in industry, Energy conservation in electricity generation, transmission and distribution, Energy conservation in agricultural sector.

Demand Side Management: Introduction to DSM – Definition, Evolution, Benefits and Scope; Role of Energy Companies, Load Management, Application of Load Control, DSM Implementation Issues, Strategies to implement and Promote DSM, Customer acceptance of DSM, Environment & DSM, International experience with DSM, DSM in India.

Reference Books:

1. Suresh Kumar Soni and Manoj Nair, “Energy Conservation and Audit”, Satya Prakashan, New Delhi, 2010.

2. Rajiv Shankar, "Energy Auditing in Electrical Utilities", Viva Books, New Delhi, 2010.
3. Larry C. White, Philip S. Schmidt, David R. Brown, "Industrial Energy Management Systems", Hemisphere Publishing Corp, New York.
4. Albert Thumann, "Fundamentals of Energy Engineering", Prentice Hall Inc, Englewood Cliffs, New Jersey.
5. Gupta, B. R., "Generation of Electrical Energy", Eurasia Publishing House Pvt. Ltd., New Delhi, 6th, 2006

Course Outcomes:

After completion of the course the students will be able to,

1. Solve issues & interpret outcomes related to energy economics and energy efficient motors
2. Compare & contrast on selection of energy economic techniques, lighting criterion, energy efficient motors and energy alternative from DSM techniques
3. Evaluate various methods of energy conservation and DSM in different sectors like agriculture, commercial, transpiration and domestic
4. Design and develop methods/techniques for energy conservation, audit & management

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE743E.1	1	2	2	3								3		1
2	22UEE743E.2	1	2	3	3			1		1	1		3		1
3	22UEE743E.3	1	2	3	3			1		1	1		3		1
4	22UEE743E.4	1	2	3	3						1		3		1

Syllabus for B.E VII - Semester for academic year 2025 – 2026

(For students admitted to I year in 2022-23)

22UEE744E	Energy Efficient Motors	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction: Need for energy efficient machines, energy cost and two part tariff, energy conservation in industries and farms -a necessity, introduction to energy management and energy audit system. Review of induction motor characteristics.	
UNIT – II	**(10 Hours)**
Power Factor: The power factor in sinusoidal systems, power factor improvement, power factor with nonlinear loads, Harmonics and the power factor.	
UNIT – III	**(10 Hours)**
Energy Efficient Motors: Standard motor efficiency, why more efficient motors? An energy efficient motor, efficiency determination methods, Direct Measurement method, Loss segregation method, Comparison, motor efficiency labelling, energy efficient motor standards. Motor life cycle.	
UNIT – IV	**(10 Hours)**
Induction Motors and Adjustable Drive Systems: Energy Conservation, adjustable speed systems, Application of adjustable speed systems to fans, pumps and constant torque loads.	

Reference Books:

1. Witte. L.C., P.S. Schmidt, D.R. Brown, “Industrial Energy Management and Utilisation”, Hemisphere Publishers, Washington, 1988.
2. Callaghn, P.W. “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.
3. Dryden. I.G.C., “The Efficient Use of Energy”, Butterworths, London, 1982
4. Turner. W.C., “Energy Management Hand book”, Wiley, New York, 1982.
5. Murphy. W.R. and G. Mc KAY, “Energy Management”, Butterworths, London 1987.

Course Outcomes:

After completion of the course the students will be able to,

1. Examine the need for energy efficiency in machines and industries, and analyze the role of energy audits and management systems in reducing energy costs.
2. Analyze the concept of power factor under linear and nonlinear loads and evaluate its significance in energy conservation.
3. Evaluate the performance of energy efficient motors using efficiency determination methods and compare with conventional motors.
4. Apply energy conservation techniques in induction motor drive systems and analyze the suitability of adjustable speed drives for various industrial loads.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE744E.1	3	2		2		1	2					2		1
2	22UEE744E.2	3	3		2	2		2					3	2	
3	22UEE744E.3	3	2	3	2								3	3	
4	22UEE744E.4	3	2	3	2	2							3	2	2

Syllabus for B.E VII - Semester for academic year 2025 – 2026

(For students admitted to I year in 2022-23)

22UEE745E	Wind Energy Conversion Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction: Introduction: Nature of wind, historical uses of wind, history of wind electric generation, working principle of wind turbines (lift and drag mechanism), components of horizontal and vertical axis wind turbines, classification, applications, advantages and disadvantages.	
UNIT – II	**(10 Hours)**
Wind Resource Assessment: Wind Data Analysis: Wind velocity – measurement and representation, wind speed statistics, probability distribution functions – Weibull and Raleigh. **Performance of Wind Turbine Generators:** Basics of fluid mechanics (simple terms & definitions), elementary fluid flow concepts,	
UNIT – III	**(10 Hours)**
Power in the wind: maximum power output of wind turbine (Betz limit), axial force and thrust on blades, torque developed by turbine, dynamic matching for maximum power extraction - tip speed ratio & blade pitch angle, power vs wind speed characteristics, electrical power output from wind energy conversion system, capacity factor, energy production.	
UNIT – IV	**(10 Hours)**
Electric Generators for WECS: Classification, basic working principle, advantages and disadvantages. **Grid-connected and Self-excited Induction Generator Operation:** Constant-voltage, constant-frequency generation, reactive power compensation, variable-voltage, variable-frequency generation, effect of wind generator on the network. **Wind Energy Conversion Systems (WECS):** Stand-alone and grid connected wind farms, simulation model of WECS. Site matching of wind turbine generators. Economics of wind systems: Reliability consideration, estimation of O&M costs, capital costs, cost of energy, estimation of payback period	

Reference Books:

1. Bhadra, S. N., Kashta, D., and Bannerjee, S., Wind Electrical Systems, Oxford University Press, New Delhi, 2009.
2. Gary L. Johnson, Wind Energy Systems, Prentice hall Publication, 1985.
3. G. D. Rai, Non-Conventional Energy Sources, Khanna Publishers New Delhi, 2007.
4. B. H. Khan, Non-Conventional Energy Resources, 2nd Edition, Tata McGraw Hill Publishing Ltd. New Delhi, 2009
5. D. Mukhaerjee and S. Chakrabarti, Fundamentals of Renewable Energy Systems, New Age International Publishers New Delhi, 2007.
6. D. P. Kothari, S. Umashankar, “Wind Energy Systems and Applications”, Narosa publishers, 2017.
7. Khan B. H., Non-Conventional Energy Resources, Tata McGraw Hill, 2009.

Syllabus for B.E VII - Semester for academic year 2025 – 2026

(For students admitted to I year in 2022-23)

Course Outcomes:

After completion of the course the students will be able to,

1. Apply the principles of wind energy conversion and turbine operation in analyzing different types of wind turbines and their components.
2. Analyze wind resource data, turbine characteristics, and fluid flow behavior for performance assessment of wind energy systems.
3. Calculate the power output, capacity factor, and economic parameters of wind energy systems using appropriate performance equations and site data.
4. Design wind energy systems for standalone and grid-connected applications considering technical constraints, environmental impact, and economic viability.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE745E.1	3	2	2			2	3					2	1	1
2	22UEE745E.2	3	2	2	2			2					3	1	1
3	22UEE745E.3	3	3	3	3	3		2			2		2	1	1
4	22UEE745E.4	3	3	3	3	3	2	2		2	2		3	1	1

Syllabus for B.E VII - Semester for academic year 2025 – 2026

(For students admitted to I year in 2022-23)

22UEE746E	AI Applications to Power Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Artificial Intelligence: History and Applications Introduction, Intelligence, Communication, Learning, Artificial Intelligence, History, Early Works, Importance, Definitions, Programming Methods, Techniques, Progress of Artificial Intelligence, Growth of AI, AI and Industry, AI and the world, Current Trends in Applied AI, Modeling, Simulation and AI, Intelligent Systems, Role of IS, Comparisons with conventional programs.	
UNIT – II	**(10 Hours)**
Artificial Neural Network: difference between human machine and intelligence, biological neural network, artificial neuron model, Concept of Perceptron, ADALINE, Feedback in Neural Network, Neural Network Architectures: Neural Learning, Application of Neural Network in Power System **Fuzzy Logic:** Introduction, Foundation of Fuzzy Systems, Representing Fuzzy Elements, Basic Terms and Operations, Properties of Fuzzy Sets, Fuzzification, Arithmetic Operations of Fuzzy Numbers.	
UNIT – III	**(10 Hours)**
Genetic Algorithms and Evolutionary Programming: Introduction, Genetic Algorithms, Procedure of Genetic Algorithms, Genetic Representations, Initialization and Selection, Genetic Operators, Mutation, The Working of Genetic Algorithms, Evolutionary Programming, The Working of Evolutionary Programming.	
UNIT – IV	**(10 Hours)**
Application of AI in Power Systems: Application of Neural Network and Expert Systems in Voltage Control, Application of ANN for security assessment, Schedule Maintenance of Electrical Power Transmission Networks using Genetic Algorithm, Intelligent Systems for Demand Forecasting.	

Reference Books:

1. N. P. Padhy, “Artificial Intelligence and Intelligent Systems”, OXFORD University Press, New Delhi, 2005.
2. Stamations V. Kartalopoulos, “Understanding Neural Networks and Fuzzy Logic: Basic concepts and Applications”, Prentice Hall India Private Limited, New Delhi, 2002.
3. Abhisek Ukil, “Intelligent Systems and Signal Processing in Power Engineering, Springer Berlin Heidelberg”, New York, 2002.
4. Kevin Warwick, Arthur Ekwue and Raj Aggarwal, “Artificial Intelligence Techniques in Power Systems”, IEEE Power Engineering Series, UK, 1997.
5. Rajashekran, S. and VijaylaksmiPai, G.A., “Neural Networks, Fuzzy Logic and Genetic Algorithm Synthesis and Applications”, Prentice–Hall of India Private Limited, 2004.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply the fundamentals of Artificial Intelligence, neural networks, fuzzy logic, and evolutionary algorithms for power system applications.
2. Analyze the behavior of neural networks, fuzzy systems, and genetic algorithms for solving engineering problems.
3. Solve practical problems related to power system operation, control, and

optimization using AI-based tools and techniques.

4. Evaluate the suitability of various AI methods for specific power system applications like voltage control, demand forecasting, and preventive maintenance.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE746E.1	3	2	2	2	2							3	2	2
2	22UEE746E.2	3	3	3	3	2							3	3	2
3	22UEE746E.3	2	3	3	3	3				2	2	2	3	3	2
4	22UEE746E.4	2	3	3	3	3		2		2	2	2	3	3	3

Syllabus for B.E VII - Semester for academic year 2025 – 2026

(For students admitted to I year in 2022-23)

22UEE718P	Project Work	12 - Credits (0 : 0 : 24)
Hours/Week : 24		CIE Marks : 50
Total Hours :		SEE Marks : 50

Students have to take up literature survey, formulate the problem of the project, define the project objectives and prepare the project implementation schedule. Project work, based on the problem defined, should be completed and implemented. The implementation of the project work can be done either in a reputed industry/ research organization/ parent institute. A certified report with project demonstration and a seminar is to be presented by the students. The seminar should highlight – Broad project area of their project work carried out.

CIE of 50 marks will be conducted by the Committee consisting of HOD/Nominee + Project Coordinator + Guides as per the rubrics. For SEE, student has to make a presentation of the work carried out to Project Evaluation Committee (PEC- Project coordinator, Hod/Nominee, External Examiner). PEC will allot SEE marks for 50.

Course Outcomes

At the end of this course, students will be able to:

1. Identify, formulate & analyze the engineering problems associated with electrical & electronics engineering and interdisciplinary research.
2. Design & implement proposed solutions for complex engineering problems to meet specified objectives by analyzing / validating the design / solutions of engineering problems using contemporary tools & resources.
3. Prepare engineering documents and make effective presentation to communicate effectively and collaboratively with detailed analysis and interpretation of results to yield valid conclusions.
4. Demonstrate social, ethical cultural & engineering professional responsibilities.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE718P.1	3	3	2	2	1	1	1		2	2	2	3	2	1
2	22UEE718P.2	3	3	3	3	3				2	2	2	3	3	1
3	22UEE718P.3	2	2	2	2	2	2	1		2	3	2	2	3	1
4	22UEE718P.4								3	2	2	2	2	2	1

Syllabus for B.E VII - Semester for academic year 2025 – 2026

(For students admitted to I year in 2022-23)

22UHS711C/22UHS811C	Research Methodology and IPR	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction to Engineering Research **Fundamentals of Research**: Meaning, objectives, and motivation in engineering research. **Types of Engineering Research:** Basic, applied, and translational research; identifying and solving Worthwhile problems. **Research Ethics:** Ethics in engineering research and practice, types of research misconduct, and ethical issues in authorship.	
UNIT – II	**(10 Hours)**
Literature Review and Citations **Technical Reading & Analysis:** Methods for reviewing literature, analyzing prior art, and synthesizing new and existing knowledge. **Bibliographic Databases:** Web of Science, Google, Google Scholar, effective search strategies. **Conceptualizing Research:** Critical and creative reading, taking notes, reading mathematical models, algorithms, and datasheets. **Citations & Acknowledgments:** Attribution, citation styles, impact of keywords, citing datasets, and knowledge dissemination	
UNIT – III	**(10 Hours)**
Intellectual Property Rights (IPR) & Patents: **Introduction to Intellectual Property:** Concepts of property and rights, forms of IPR, role in research and economic development, IP governance, and global innovation indicators. **Patents:** Definition, objectives, criteria for patentability, software/business method patents, infringement, compulsory licensing, and government use of inventions. **Patent Process:** Prior art search strategies, patent databases (free and paid), drafting specifications and claims, filing requirements, jurisdiction, opposition procedures, and renewal. **Filing Requirement of patent:** Patent Application Forms. Work flow chart in obtaining Patents, Jurisdiction of Filing Patent Application. Pre-grant & Post-grant Opposition. Forms to be submitted, filing mechanism through Individual patent office and PCT route. Need for a Patent Attorney/Agent Revocation. Term of Patent, Patent renewal and Fee Structure National Bodies Dealing with Patent Affairs. Utility Models.	
UNIT – IV	**(10 Hours)**
Copyrights and Related Rights: Classes of Copyrights. Criteria for Copyright. Ownership of Copyright. Copyrights of the Author. Copyright Infringements. Copyright Infringement and remedies in case of infringement. Fair Use Doctrine. Copyrights and Internet. Non-Copyright Work. Copyright Registration. Judicial Powers of the Registrar of Copyrights. Fee Structure. Validity of Copyright. Copyright Profile of India. Copyright and the word 'Publish'. Transfer of Copyrights to a Publisher. Copyrights and the Word 'Adaptation'. Copyrights and the Word 'Indian Work'. Joint Authorship. Copyright Society. Copyright Board. Copyright Enforcement Advisory Council (CEAC). International Copyright	

Agreements, Conventions and Treaties. Interesting Copyrights Cases.

Trademarks: Eligibility Criteria. Who Can Apply for a Trademark. Acts and Laws. Classification of Trademarks. Registration of a Trademark. Process for Trademarks Registration. Prior Art Search. Validity of Trademark. Trademark Registry. Famous Case Law: Coca-Cola Company vs. Bisleri International Pvt. Ltd.

Industrial Designs: Eligibility Criteria. Acts and Laws to Govern Industrial Designs. Design Rights. Enforcement of Design Rights. Non-Protectable Industrial Designs India. Protection Term. Procedure for Registration of Industrial Designs. Prior Art Search. Application for Registration. Duration of the Registration of a Design. Importance of Design Registration. Cancellation of the Registered Design. Application Forms. Classification of Industrial Designs. Designs Registration Trend in India. International Treaties. Famous Case Law: Apple Inc. vs. Samsung Electronics Co.

Reference Books:

1. Dr. Santosh M Nejakar, Dr. Harish Bendigeri "Research Methodology and Intellectual Property Rights", ISBN 978-93-5987-928-4, Edition: 2023-24.
2. David V. Thiel "Research Methods for Engineers" Cambridge University Press, 978-1- 107-03488-4
3. Intellectual Property Rights by N.K.Acharya Asia Law House 6th Edition. ISBN: 978-93-81849-30-9
4. P. Naryan, "Intellectual Property Law", 3rd Ed, Eastern Law House, 2007.
5. Dr. S.R. Myneni, "Law of Intellectual Property", 9th edition, Asia law House, 2019.
6. Dr. G.B Reddy, "Intellectual Property Rights and Law", Gogia Law Agency, Hydrabad, Reprint edition 2020.
7. N.R. Subbaram. S. Viswanathan, "Hand book Indian Patent Law and, Practice" Printers and publishers Pvt. Ltd, 2008.
8. Cornish, "Intellectual Property Rights", Universal publications.
9. Dr. B. L. Wadehra, "Law Relating to Intellectual Property" 5th edition, Universal Law publishing Co, Dehli.

Course Outcomes:

After successful completion of this course the student should be able to:

1. Integrate research methodology in engineering sciences in relevant trades.
2. Exhibit reflective thinking in problem solving exercises.
3. Identify criteria to fit one's own intellectual work in particular form of IPRs and able to apply statutory provisions and procedure to protect different forms of IPRs at national and international level.
4. Develop skill of making search using modern tools and techniques and also student is able to become patent agent by cracking patent agent exam.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UHS711C.1		2	2	3	2	1	2	3		1	2			
2	22UHS711C.2		3	2	3		2	2	2			2			
3	22UHS711C.3					2	3	2	3		1	3			
4	22UHS711C.4				2	3	2		1		1				

Syllabus for B.E VII - Semester for academic year 2025 – 2026

(For students admitted to I year in 2022-23)

22UEE715I/815I	Internship	10 - Credits (0 : 0 : 30)
Hours/Week : 30		CIE Marks : 50
Total Hours : --		SEE Marks : 50

All the students have to undergo mandatory Research/Industrial internship in any one of the reputed industry/ research institute. The internship program has to be taken up during the entire semester. The duration of the training program should be for entire semester for 15 weeks. A report on the internship is to be submitted. The supervisor/ guide from industry shall allot 100 marks of the CIE and the other 100 by the internal evaluation committee. SEE evaluation will be made by a committee comprising of HoD as Chairman/his nominee, internship coordinator and a senior faculty. The SEE will be a Technical Seminar on the industrial training.

Course Outcomes

After undergoing the internship, students shall be able to:

1. Test the theoretical learning in practical situations by accomplishing the tasks assigned during the internship period.
2. Operate the systems/ devices independently and tabulate the experimental results in consultation with supervisor.
3. Apply various soft skills such as time management, positive attitude and communication skills during performance of the tasks assigned in internship organization.
4. Analyze the real time functioning of internship organization.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE815I.1	2	2	2	3	1			1	1		2	1	1	3
2	22UEE815I.2	2	2	1	3	3			1	1		2	1	1	3
3	22UEE815I.3						1	1	3	3	3	2			3
4	22UEE815I.4	2	2	3	3	3	1	1	1	2	2	1	2	2	2

Annexure 6

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Scheme of Teaching and Evaluation for B.E Electrical and Electronics Engineering

2023-24 (admitted batch), 2024-25 (sem 3&4), 2025-26 (sem 5&6), 2026-27 (sem 7&8).

Total Credits for BE=160 (as per VTU/AICTE)

Table-1: Breakdown of Credits suggested by the VTU Belagavi/AICTE New Delhi

Sl.	Category	VTU	AICTE	BEC
1.	HSMC: HSS (2 English, 1 Kannada, 1 UHV, 1 Constitution, 1 EV), 3 HRM (Offered by Dept) = 9 AEC (1 Scientific foundations of Health, 1 Innovation and design Thinking, 2 SS, 3 MOOCS, 3 Dept. specific) = 10	16	15	19 (20)
2.	BSC: Basic Science Courses (Physics, Chemistry and Mathematics)	22	23	22 (22)
3.	ESC/ETC: Engineering Science Courses (BasicElect./Electronics/Computer/Mechanics/Workshop/Drawing…)	24	17	18 (24)
4.	PCC: Professional Core Courses	59	61	56 (49)
5.	PEC: Professional Elective Courses relevant to the branch with at least one course either fully or partially supported by industry	12	12	12 (12)
6.	OEC: Open Electives Courses/ Subjects from other technical/Arts/ Commerce (3 MOOCS + 6)	09	12	09 (09)
7.	Mini (2) and Major projects (12)/ Industrial Internships (10)	20	20	24 (24)
8.	Mandatory Course: PE, Yoga, NSS, Bridge course Maths 1 and 2 (lateral Entry)	00	00	00
	Total	160		160

Table-2: Semester wise Breakdown of Credits

Sem.	BSC	ESC/ETC	HSSM	AEC	PCC	PEC	OEC	Proj.	Int.	Total
1.	(08)	(09)	(02)	(01)						20
2.	(08)	(09)	(02)	(01)						20
3.	(03)	(03)	(01)	(01)	(12)					20
4.	(03)	(03)	(01)	(01)	(12)					20
5.			(01)	(02)	(09)	(03)	(03)	(02)		20
6.			(01)		(13)	(03)	(03)			20
7.			(03)		(03)	(06)		(12)		24
8.				3 (MOOCS)			3 (MOOCS)		(10)	16
Tot.	22	24	11	09	49	12	09	14	10	160

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Semester-1 **CAY 2023-24 (160 Credits 2023-24 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	ASC (IC)	22UMA101C	Mathematics for Electrical Sciences-I	4	3	0	2	50	50	100
2.	ASC (IC)	22UPH105C	Physics for Electrical Sciences	4	3	0	2	50	50	100
3.	ESC	22UEE115C	Elements of Electrical Engineering	3	3	0	0	50	50	100
4.	ESC - I	22UxxxxxN	Engineering Science Course - I	3	3	0	0	50	50	100
5.	ETC - I	22UxxxxxB	Emerging Technology Course - I	3	3	0	0	50	50	100
6.	HSSC	22UHS124C	Communicative English	1	1	0	0	50	50	100
7.	HSSC	22UHS125C	Constitution of India	1	1	0	0	50	50	100
8.	AEC	22UHS128C	Scientific Foundations of Health	1	1	0	0	50	50	100
			Total	20						

Semester-2 **CAY 2023-24 (160 Credits 2023-24 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	ASC (IC)	22UMA201C	Mathematics for Electrical Sciences-II	4	3	0	2	50	50	100
2.	ASC (IC)	22UCH209C	Chemistry for Electrical Sciences	4	3	0	2	50	50	100
3.	ESC	22UME223C	CAED	3	2	0	2	50	50	100
4.	ESC - II	22UxxxxxN	Engineering Science Course - II	3	3	0	0	50	50	100
5.	PLC - I	22UxxxxxB	Programming Language Course-I	3	2	0	2	50	50	100
6.	HSSC	22UHS224C	Professional Writing Skills in English	1	1	0	0	50	50	100
7.	HSSC	22UHS226C 22UHS227C	Samskruthika Kannada* Balake Kannada**	1	1	0	0	50	50	100
8.	AEC	22UHS229C	Innovation and Design Thinking	1	1	0	0	50	50	100
			Total	20						

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

(ESC - I) Engineering Science Courses - I				
Code	Title	L	T	P
22UME122N/222N	Introduction to Mechanical Engineering	3	0	0
22UCV118N/218N	Introduction to Civil Engineering	3	0	0
22UEE116N/216N	Introduction to Electrical Engineering	3	0	0
22UEC114N/214N	Introduction to Electronics Engineering	3	0	0
22UCS120N/220N	Introduction to 'C' Programming	2	0	2

(ETC - I) Emerging Technology Courses - I				
Code	Title	L	T	P
22UEC134B/234B	Introduction to Embedded Systems	3	0	0
22UEC135B/235B	Introduction to Communication Technology	3	0	0
22UEE136B/236B	Renewable Energy Sources	3	0	0
22UCV138B/238B	Green Buildings	3	0	0
22UCV139B/239B	Waste Management	3	0	0
22UCS140B/240B	Introduction to Internet of Things (IOT)	3	0	0
22UCS141B/241B	Introduction to Cyber Security	3	0	0
22UME142B/242B	Composite Materials	3	0	0
22UME143B/243B	Introduction to Robotics	3	0	0
22UBT148B/248B	Biomass and Bio-energy	3	0	0

(PLC - I) Programming Language Courses - I				
Code	Title	L	T	P
22UCS130B/230B	Introduction to Web Programming	2	0	2
22UCS131B/231B	Introduction to Python Programming	2	0	2
22UCS132B/232B	Basics to JAVA programming	2	0	2
22UCS133B/233B	Introduction to C++ Programming	2	0	2

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Semester-3 **CAY 2024-25 (160 Credits 2023-24 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	ASC	22UMA313C	Mathematics –III for EE Engineering	3	3	0	0	50	50	100
2.	IPCC	22UEE325C	Electric Circuit Analysis	4	3	0	2	50	50	100
3.	IPCC	22UEE326C	Analog Electronic Circuits	4	3	0	2	50	50	100
4.	PCC	22UEE327C	Transformers and Generators	3	3	0	0	50	50	100
5.	PCCL	22UEE328L	Transformers and Generators Laboratory	1	0	0	2	50	50	100
6.	ESC	22UEE33XC	ESC/ETC/PLC	3	3	0	0	50	50	100
7.	UHV	22UHS317L	Social Connect and Responsibility	1	0	0	2	100	--	100
8.	AEC	22UEE34XL	Ability Enhancement Course - III	1	0	0	2	50	50	100
9.	ASC	22UMA300C	Bridge Course Mathematics - I	0	3	0	0	50	50	100
10.	MC	22UHS001M	Yoga	0	0	0	2	25	-	25
		22UHS002M	National Service Scheme	0	0	0	2	25	-	25
		22UHS003M	Physical Education and Sports	0	0	0	2	25	-	25
		22UHS004M	Music	0	0	0	2	25	-	25
			Total	20						

All students have to register for any one of the courses namely National Service Scheme, Physical Education (Sports and Athletics), and Yoga with the concerned coordinator of the course during the first week of III semester. The activities shall be carried out between III semesters to VI semester (for 4 semesters). The accumulated marks are considered for CIE. Successful completion of the registered course is mandatory for the award of the degree.

Semester-4 **CAY 2024-25 (160 Credits 2023-24 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	22UEE425C	Electric Motors	3	3	0	0	50	50	100
2.	PCC	22UEE426C	Transmission and Distribution	4	4	0	0	50	50	100
3.	IPCC	22UEE427C	Microcontrollers	4	3	0	2	50	50	100
4.	PCCL	22UEE428L	Electric Motors Laboratory	1	0	0	2	50	50	100
5.	ESC	22UEE43XC	ESC/ETC/PLC	3	3	0	0	50	50	100
6.	ESC	22UEE44XL	Ability Enhancement Course - IV	1	0	0	2	50	50	100
7.	BSC	22UBT441C	Biology For Engineers	3	3	0	0	50	50	100
8.	HSMC	22UHS424C	Universal Human Values - II	1	1	0	0	50	50	100
9.	ASC	22UMA400C	Bridge Course Mathematics - II	0	3	0	0	50	50	100
10	MC	22UHS001M	Yoga	0	0	0	2	25	-	25
		22UHS002M	National Service Scheme	0	0	0	2	25	-	25
		22UHS003M	Physical Education and Sports	0	0	0	2	25	-	25
		22UHS004M	Music	0	0	0	2	25	-	25
			Total	20						

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22UEE33XC: Codes started with 331C up to the number of courses offered in list of ESC/ETC/PLC.
22UEE34XL: Codes started with 341L up to the number of courses offered in the list of AEC. 'L' is mentioned in view that all listed courses are laboratory courses in AEC.

Engineering Science Course (ESC/ETC/PLC)			
22UEE331C	Digital Logic Circuits	22UEE333C	Electromagnetic Field Theory
22UEE332C	Electrical Measurements and Instrumentation	22UEE334C	Physics of Electronic Devices
Ability Enhancement Course – III			
22UEE341L	SCI LAB/MATLAB for Transformers and Generators	22UEE343L	555 IC Laboratory
22UEE342L	Circuit Laboratory using P Spice	22UEE344L	Electrical Hardware Laboratory

22UEE43XC: Codes started with 431C up to the number of courses offered in list of ESC/ETC/PLC.
22UEE44XL: Codes started with 441L up to the number of courses offered in the list of AEC. 'L' is mentioned in view that all listed courses are laboratory courses in AEC.

Engineering Science Course (ESC/ETC/PLC)			
22UEE431C	Electrical Power Generation and Economics	22UEE433C	Engineering Materials
22UEE432C	Op-Amp and LIC	22UEE434C	Object Oriented Programming
Ability Enhancement Course – III			
22UEE441L	Basics of VHDL Lab	22UEE443L	Sci Lab / MATLAB for Electrical and Electronic Measurements
22UEE442L	PCB Design Laboratory	22UEE444L	Aurdino & Rasberry PI based Projects

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Semester-5 **CAY 2025-26 (160 Credits 2023-24 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	22UEE525C	Power System – II	3	3	0	0	50	50	100
2.	PCC	22UEE526C	Power Electronics	3	3	0	0	50	50	100
3.	PCC	22UEE520L	Power Electronics Laboratory	1	0	0	2	50	50	100
4.	PCC	22UEE521L	AutoCAD Electrical Laboratory	1	0	0	2	50	50	100
5.	PCC	22UEE522L	Logic Design Laboratory	1	0	0	2	50	50	100
6.	PEC	22UEE5xxE	Professional Elective Course – I	3	3	0	0	50	50	100
7.	OEC	22Uxx5xxN	Open Elective Course – I	3	3	0	0	50	50	100
8.	Proj	22UEE528P	Mini Project	2	0	0	4	50	50	100
9.	AEC	22UHS522C	Quantitative Aptitude and Professional Skills	2	2	0	0	50	50	100
10.	HSMC	22UBT523C	Environmental Studies	1	1	0	0	50	50	100
11.	MC	22UHS001M	Yoga	0	0	0	2	25	-	25
		22UHS002M	National Service Scheme	0	0	0	2	25	-	25
		22UHS003M	Physical Education and Sports	0	0	0	2	25	-	25
		22UHS004M	Music	0	0	0	2	25	-	25
			Total	20						

Semester-6 **CAY 2025-26 (160 Credits 2023-24 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	22UEE625C	Power System – III	3	3	0	0	50	50	100
2.	PCC	22UEE626C	Control Systems	4	4	0	0	50	50	100
3.	PCC	22UEE627C	Digital Signal Processing	4	4	0	0	50	50	100
4.	PCC	22UEE620L	Power System – II Laboratory	1	0	0	2	50	50	100
5.	PCC	22UEE621L	Control Systems Laboratory	1	0	0	2	50	50	100
6.	PEC	22UEE6xxE	Professional Elective Course – II	3	3	0	0	50	50	100
7.	OEC	22Uxx6xxN	Open Elective Course – II	3	3	0	0	50	50	100
8.	HSMC	22UHS600C	Indian Knowledge Systems	1	1	0	0	50	50	100
9.	MC	22UHS001M	Yoga	0	0	0	2	25	-	25
		22UHS002M	National Service Scheme	0	0	0	2	25	-	25
		22UHS003M	Physical Education and Sports	0	0	0	2	25	-	25
		22UHS004M	Music	0	0	0	2	25	-	25
			Total	20						

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Semester-7[#] **CAY 2026-27 (160 Credits 2023-24 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	22UEE725C/825C	Power System – IV	3	3	0	0	50	50	100
2.	PEC	22UEE7xxE/8xxE	Professional Elective Course-III	3	3	0	0	50	50	100
3.	PEC	22UEE7xxE/8xxE	Professional Elective Course-IV	3	3	0	0	50	50	100
4.	Proj	22UEE728P /828P	Project Work	12	0	0	12	50	50	100
5.	HSMC	22UHS721C/821C	Research Methodology and IPR	3	3	0	0	50	50	100
			Total	24						

Semester-8[#] **CAY 2026-27 (160 Credits 2023-24 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	INT	22UEE825I/725I	Internship	10	0	0	--	50	50	100
2.	AEC	22UEE7xxO/8xxO	MOOCs*	3	--	--	--	--	--	--
3.	OEC	22UEE7xxO/8xxO	MOOCs*	3	--	--	--	--	--	--
			Total	16						

[#] Semester 7 & 8 are flippable (swapped)

Criteria for Bachelor Degree: A student has to earn a minimum of 160 credits for award of Bachelor of Engineering (B.E) at the end of fourth year.

Criteria for Bachelor Degree (Honors): A student has to earn a minimum of 178 [160 + 18 (online)] credits for award of Bachelor of Engineering (B.E honors) at the end of fourth year.

Criteria for Bachelor Degree (with minor degree): A student has to earn a minimum of 178 [160 + 18* (blended)] credits for award of Bachelor of Engineering (B.E) with major and minor streams at the end of fourth year.

Subject Code Indication for Elective Courses: 21UEE741E
21-Year of course introduction/ modification: UEE–UG in E&EE: 7–Semester in which course is being offered: 4-Electives group number: 1-Serial number of course in elective group: E-Elective course

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Semester-5

List of subjects for Professional Elective Course – I (Sem-V)		
1.	22UEE511E	Electrical Machine Design
2.	22UEE512E	Electrical Engineering Materials
3.	22UEE513E	Testing and Commissioning of Electrical Equipment
4.	22UEE514E	Data Base management Systems
5.	22UEE515E	Operation Research
6.	22UEE516E	Field Theory

List of subjects for Open Elective Course I		
1.		Electric Vehicle
2.		Fundamentals of Wind Energy Conversion System

Semester-6

List of subjects for Professional Elective Course – II (Sem-VI)		
1.	22UEE621E	Integration of Distributed Generation
2.	22UEE622E	Automotive Electronics
3.	22UEE623E	Intelligent Instrumentation
4.	22UEE624E	VLSI Design
5.	22UEE625E	Electric Machine Drives
6.	22UEE626E	Modern Control Theory

List of subjects for Open Elective Course II		
1.		Electrical Safety for Engineers
2.		Energy Storage Systems

Semester-7

List of subjects for Professional Elective Course – III (Sem-VII)		
1.	22UEE731E	Smart Grids
2.	22UEE732E	Electric Vehicles
3.	22UEE733E	Solar Photovoltaic System Design
4.	22UEE734E	Reactive Power Management
5.	22UEE735E	Power System Planning
6.	22UEE736E	HVDC Transmission

List of subjects for Professional Elective Course – IV (Sem-VII)		
1.	22UEE741E	Flexible AC Transmission Systems
2.	22UEE742E	Battery Management Systems
3.	22UEE743E	Energy Conservation, Audit and DSM
4.	22UEE744E	Energy Efficient Motors
5.	22UEE745E	Wind Energy Conversion Systems
6.	22UEE746E	AI Applications to Power Systems

Annexure 7

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE525C	Power System - II	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Power System Representation:

Standard symbols of power system components, Single line diagram, Per unit system, Per unit impedance of 3 phase components, Change of base, Per unit impedance diagram, Advantages of per unit system calculations.

Symmetrical Three Phase Faults:

3 - phase short circuit at the terminals of unloaded generator, Sub transient, Transient and Steady state reactance, Transients on a transmission line, Short circuit currents and Reactance of synchronous machines on load and no load, Short circuit MVA.

UNIT – II	(10 Hours)

Symmetrical Components:

Definition of sequence components for 3-Phase unbalanced power systems, Operator “a” and its properties, Expressions for sequence components, Phase shift of symmetrical components in star delta transformer bank.

Sequence Networks:

3- Ph power in terms of sequence components, voltage drop due to sequence currents, sequence impedance and sequence networks of power system elements (Alternator, Transformer and Transmission line), positive, negative and zero sequence networks of power system elements.

UNIT – III	(10 Hours)

Unsymmetrical Fault at the Terminals Unloaded Generator:

L-G, L-L, L-L-G fault with and without fault impedance at the terminals of unloaded generator- derivation for connection of sequence network and fault currents.

Unsymmetrical Faults on Power Systems:

L-G, L-L, L-L-G faults on unloaded power systems, Open conductor faults in power system.

UNIT – IV	(10 Hours)

Transient Stability Analysis:

Classification of Power System Stability, Steady Rotor dynamics, Swing equation, Solution of swing equation by numerical techniques (Point by point method and Runge Kutta Method), Power angle equation for salient and non-salient pole synchronous machines.

Equal Area Criterion:

Equal area criterion – Stability analysis for sudden change in mechanical input power, 3- ph fault on Generator terminals and on transmission line, Expression for critical clearing angle, Methods to improve stability of power system.

Reference Books:

1. K. Uma Rao, “Computer Techniques and Models in Power Systems”, 1st Edition, I. K. International publishing house, 2014.
2. Nagarath and Kothari, “Modern Power System Analysis”, 3rd Edition, TMH, 2009.
3. W.D. Stevenson, “Elements of Power Systems Analysis”, 4th Edition, Mc.Graw Hill Publishers, 2013.
4. Hadi Saadat, “Power System Analysis”, TMH, Publishers, 4th Edition 2015.
5. V Neelakantan, "Power System Analysis & Stability”, Shiva Publishers, 2017.

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Course Outcomes:

After completion of the course the students will be able to,

1. Represent power system networks as per unit reactance diagrams on the base of given MVA and KV values
2. Assess phase & line components of voltage/current and to draw the positive, negative & sequence networks using symmetrical components
3. Carry out analysis of unsymmetrical faults (LG,LL,LLG) to determine fault currents when fault occurs at generator terminals/in power systems networks
4. Assess stability of power system under different types of disturbances by applying equal area criterion/solving the swing equation

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE525C.1	1	2	1	1							1	3		1
2	22UEE525C.2	1	3	2	1							1	3		1
3	22UEE525C.3	1	3	2	2							1	3		1
4	22UEE525C.4	1	3	2	2							1	3		1

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE526C	Power Electronics	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
Introduction: Introduction to power electronics, block diagram of power electronic converter system, applications of power electronics. Types of power electronic circuits and their peripheral effects. **Power Transistors:** Introduction to Power BJT's and MOSFETs static characteristics, switching characteristics, switching limits, di**/**dt and dv**/**dt protection, cooling, heat sinks and snubber circuits. **Thyristors:** Introduction, static characteristics, two transistor model. Switching characteristics, di/dt and dv/dt protection.	
UNIT – II	**10 Hours**
Controlled Rectifiers: Introduction. Classification of rectifiers, principle of phase-controlled converter operation. Single- phase half wave, semi-converters and full converters and problems. Three-phase half-wave, semi-converters and full converters with R, R-L and RLE load. Performance evaluation of Rectifier.	
UNIT – III	**10 Hours**
Commutation Techniques: Introduction. Natural commutation, forced commutation: self-commutation, impulse commutation, resonant pulse commutation and complementary commutation. **DC–DC Converters:** Introduction. Principle Operation of dc-dc converter, Control Strategies: constant frequency, Variable Frequency, Four quadrant operation of dc-dc converter. Detailed analysis of Class-A chopper with numerical, Principle operations of Class-B, Class-C, Class-D and Class-E chopper. Flyback converters-Boost, Buck and Buck-Boost converters	
UNIT – IV	**10 Hours**
Inverters: Introduction. Types of inverters, performance parameters, principle of operation of half bridge and full bridge inverters with R and R-L load. Three phase inverter configurations to operate with 120^0- and 180^0-degree modes. Voltage control of single-phase inverters – single pulse width modulation, multiple pulse width modulation and sinusoidal pulse width modulation. **AC Voltage Controllers:** Introduction. Principle of ON-OFF control and phase control. Single-phase half wave and full-wave AC voltage controllers with resistive and inductive loads.	

Reference Books:

1. M. H. Rashid, "Power Electronics", 3rd Edition, P.H.I./Pearson, New Delhi, 2002.
2. Mohan, Undel and, Robbins, "Power Electronics" Wiley Edition, 2003
3. P. S. Bimbra, "Power Electronics", 4th Edition Khanna Publishers, 2009.
4. G. K. Dubey, S.R.Dorodla, A.Joshiand, R.M.K.Sinha, "Thyristorised Power Controllers",

New Age International Publishers, 2005.

5. M. D. Singh and Khanchandani K. B., "Power Electronics", 2nd Edition, Khanna Publisher, 2007

Course Outcomes:

After completion of the course the students will be able to,

1. Select suitable power switches, heat sinks and power converters for industrial applications.
2. Investigate performance of the power switches-based on switching characteristics, power converters based on performance indices
3. Compute power loss in power switches and power converters, average and rms voltage, average and rms currents, ripple factors and harmonic components of power converters
4. Design various components of power converters employed in industrial application

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE526C.1	3	3	2	1	1				1	1	2	3	2	1
2	22UEE526C.2	3	2	3	3	1				1	1	2	2	2	1
3	22UEE526C.3	3	3	3	2	1				1	1	2	2	3	1
4	22UEE526C.4	3	2	2	3	1				1	1	2	3	1	2

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE520L	Power Electronics Laboratory	01 - Credits (0 : 0 : 1)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. Static characteristic of SCR
2. Static and switching characteristic of IGBT and MOSFET
3. Static characteristic of TRIAC
4. Study of SCR firing circuit (R, RC, UJT)
5. Single phase half wave controlled rectifier with R and RL load
6. Single phase half controlled bridge rectifier with R and RL load
7. Single phase fully controlled bridge rectifier with R and RL load
8. Speed control of a separately excited D.C. motor using an IGBT an MOSFET chopper
9. Study of SCR commutation circuit
10. Half wave and Full wave bridge Inverter for R and RL load

Reference Books:

1. M. H. Rashid, “Power Electronics”, 3rd Edition, P.H.I./Pearson, New Delhi, 2002.
2. Mohan, Undel and, Robbins, “Power Electronics” Wiley Edition, 2003
3. P. S. Bimbra, “Power Electronics”, 4th Edition Khanna Publishers, 2009.
4. G. K. Dubey, S.R.Dorodla, A.Joshiand, R.M.K.Sinha, “Thyristorised Power Controllers”, New Age International Publishers, 2005.

Course Outcomes:

After completion of the course the students will be able to:

1. Select appropriate power equipment and instruments for realization of static and switching characteristics of MoSFET, SCR, IGBT and various power converter circuits
2. Conduct the experiments to evaluate performance characteristics of power devices and power electronics converter circuits
3. Interpret experiment results to investigate performance of various switching device and power converter

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE520L.1	3	1	2	2	1				2	2	2	3	2	1
2	22UEE520L.2	3	2	3	2	1				1	1	2	2	2	2
3	22UEE520L.3	3	1	2	2	1				1	2	2	2	2	1

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE521L	Auto CAD Electrical Laboratory	01 - Credits (0 : 0 : 1)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. Installation and Basic Commands of Auto CAD package
2. Drawing the basic diagrams for familiarization with Auto CAD
3. Drawing the cross sectional elevation of XLPE cable
4. Drawing the line diagram of DOL and Star – Delta starter
5. Drawing the half sectional elevation of pin insulator
6. Drawing the single line diagrams of a substations for the specified incoming and outgoing components
7. Drawing the layout of residential and workshop plans
8. Development and drawing of Simplex, Single layer Progressive Lap winding for DC machine with specified details
9. Development and drawing of Simplex, Single layer retrogressive Lap winding for DC machine with specified details
10. Development and drawing of Simplex, Double layer progressive Lap winding for DC machine with specified details
11. Development and drawing of Duplex, Single layer progressive Lap winding for DC machine with specified details
12. Development and drawing of Simplex, Single layer Progressive Wave winding for DC machine with specified details
13. Development and drawing of Simplex, Single layer retrogressive Wave winding for DC machine with specified details

Reference Books:

1. Devalapur, S F, "Textbook of Electrical Drafting", 7th Edition, Eastern Book Promoters, Belgaum, 2006
2. A.K. Sawhney, A Course in Electrical Machine Design, Dhanpat Rai & Co. (P) Limited (2017), ISBN-10: 8177001019, ISBN-13: 978-8177001013.
3. Mittle V.N., Arvind Mittal, Design of Electrical Machines, Standard Publishers Distributors (2009), ISBN-13: 978-81-8014-126-3, ISBN: 81-8014-126-8.

Course Outcomes:

After completion of the course the students will be able to:

1. Identify the tools and commands in the AutoCAD software
2. Draw and develop the engineering diagrams of the specified electrical components as per the proposed scale
3. Analyze the constructional details of electrical devices and components

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE521L.1	3	1	1		3	1				1	1	2	1	3
2	22UEE521L.2	3	2	2	1	3	1				1	2	2	1	3
3	22UEE521L.3	3	2	2	1	3	2				1	2	2		3

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE522L	Logic Design Laboratory	01 - Credits (0 : 0 : 1)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. Study and verify the truth table of logic gates
2. Simplify the given expression and to realize it using Basic gates and Universal gates Design and testing of diode clipping and clamping circuits.
3. Realization of
   i. Half Adder and Full Adder
   ii. Half Subtractor and Full Subtractor by using Basic gates and NAND gates
4. Design and set up the following circuit using IC 7483.
   i. A 4-bit binary parallel adder.
   ii. A 4-bit binary parallel subtractor
5. Design and realize the following using IC 7483.
   i. BCD to Excess- 3 Code
   ii. Excess-3 to BCD Code.
6. Realization of Binary to Gray code converter and vice versa
7. Design and set up the MUX & DEMUX circuits for following cases
   i. 4:1 Multiplexer (MUX) using only NAND gates.
   ii. 1:4 Demultiplexer(DE-MUX) using only NAND gates.
   iii. Verify the various functions of IC 74153(MUX) and IC 74139(DEMUX).
   iv. Half/Full Adder and Half/Full Subtractor using IC 74153.
8. Realization of One & Two Bit Comparator and study of 7485 magnitude comparator
9. Realization of decoder circuits using basic gates and to verify with IC 74LS139
10. Set up and test a 7-segment static display system to display numbers
11. Design Encoder circuits for following cases
    i. Decimal-to-BCD Encoder using IC 74147.
    ii. Hexadecimal-to-Binary Encoder using IC
    iii. 74148 Encoders and IC 74157 Multiplexer
12. Truth Table verification of following Flip-Flops
    i. RS Flip Flop
    ii. T type Flip Flop.
    iii. D type Flip Flop.
    iv. JK Flip Flop.
    v. JK Master Slave Flip Flop.
13. Realization and study of following types of Shift Registers.
    i. SISO (Serial in Serial out)
    ii. SIPO (Serial in Parallel out)
    iii. PIPO (Parallel in Parallel out)
    iv. PISO (Parallel in Serial out)
14. Design and set up of Sequence Generator using IC 7495
15. Realization and study of Ring and Johnson counters
16. Design and test 3-bit binary synchronous & asynchronous counters using flip-flop IC 7476 for the given sequence.

17. Design IC 74193 as a up/down counter
18. Design IC 7490 as a decade counter with BCD count sequence

Reference Books:

1. Morris Mano, Charles R. Kime, Logic and computer design fundamentals, Pearson Prentice Hall, 2004
2. Basavaraj,B., Digital fundamentals, New Delhi: Vikas Publishing House, 1999.
3. KandelLangholz, Digital Logic Design, Prentice Hall, 1988.
4. Rafiquzzaman& Chandra, Modern Computer Architecture, West Pub. Comp., 1988.
5. Zvi. Kohavi, Switching and Finite Automata Theory, Tata McGraw Hill, India, 2004.

Course Outcomes:

After completion of the course the students will be able to:

1. Draw the circuit, write the procedure and select the required components for a given experiment
2. Rig up the circuit, simplify the expressions using K-map and conduct experiments using the selected components to achieve desired results
3. Verify the results to write the inference and prepare a detailed report.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE522L.1	2	3									1	1	2	1
2	22UEE522L.2	3	1	2	1							1	1	3	1
3	22UEE522L.3	3	3	1	1	1			1			1	1	2	1

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Professional Elective Course – I

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE511E	Electrical Machine Design	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Principles of Electrical Machine Design: Introduction to design of electrical machines, limitations. Different types of materials and insulators used in electrical machines. **Design of DC Machines:** Output equation, choice of specific loadings and number of poles, design of main dimensions, armature slot dimensions and estimation of ampere turns.	
UNIT – II	**(10 Hours)**
Design of Transformers (Single phase and three phase): Output equation for single phase and three phase transformer, choice of specific loadings, expression tor volts/turn, determination of main dimensions of the core, types of windings and estimation of number of turns and cross sectional area of Primary and secondary coils and Design of tank and cooling tubes.	
UNIT – III	**(10 Hours)**
Design of Induction Motors: Output equation, choice of specific loadings, main dimensions of three phase induction motor, stator winding design, choice of length of the air gap, estimation of number of slots for the squirrel cage rotor, end ring current.	
UNIT – IV	**(10 Hours)**
Design of Synchronous Machines: Output equation, choice of specific loadings, short circuit ratio, design of main dimensions, armature slots and windings, slot details for the stator of salient and non salient pole synchronous machine. Design of rotor of salient pole synchronous machines, magnetic circuits and rotor of non salient pole machine.	

Reference Books:

1. A.K. Sawhney, A Course in Electrical Machine Design, Dhanpat Rai & Co. (P) Limited (2017), ISBN-10: 8177001019, ISBN-13: 978-8177001013.
2. Mittle V.N., Arvind Mittal, Design of Electrical Machines, Standard Publishers Distributors (2009), ISBN-13: 978-81-8014-126-3, ISBN: 81-8014-126-8.
3. V. Rajini, V. S. Nagarajan Electrical Machine Design Pearson Education (May 2018) ISBN-10: 9332585571, ISBN-13: 978-9332585577
4. K. G. Upadhyay Design of Electrical Machines (2010) Publisher: New Age International ISBN: 9788122422825, 8122422829.

Course Outcomes:

After completion of the course the students will be able to,

1. List and define different types of materials, parts, insulators, and the terms associated to electrical machines and its design terms.
2. Explain the specific loadings, design factors for electrical machines.
3. Calculate the design parameters of an electrical machine for a given set of specifications and necessary assumptions as per the Indian standards.
4. Derive the equations with respect to specific loadings, dimensions and other design aspects for electrical machines.

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE511E.1	3	2	2				1		1		1	3	1	1
2	22UEE511E.2	3	2	2				1		1		1	2	1	1
3	22UEE511E.3	3	3	3	3			1	2	1		1	1	1	1
4	22UEE511E.4	3	3	3	2			1		1		2	1	1	1

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE512E	Electrical Engineering Materials	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction to Electrical and Electronic Materials: Importance of materials, Classification of electrical and electronic materials, Scope of electrical and electronic materials, Requirement of Engineering materials, Operational requirements of electrical and electronic materials, Classification of solids on the basis of energy gap, Products – working principle and materials, Types of engineering materials, Levels of material structure. Spintronics and Spintronic materials, Ferromagnetic semiconductors, Left handed materials.	
UNIT – II	**(10 Hours)**
Conductors: Conductor materials, Factors affecting conductivity, Thermal conductivity, Heating effect of current, Thermoelectric effect, Seebeck effect, Thomson effect, Wiedemann – Franz law and Lorentz relation, Problems. **Conductive Materials and Applications:** Mechanically processed forms of electrical materials, Types of conducting materials, Low resistivity materials, High resistivity materials, Contact materials, Fusible materials, Filament materials, Carbon as filamentary and brush material, Material for conductors, cables, wires, solder, sheathing and sealing.	
UNIT – III	**(10 Hours)**
Dielectrics: Introduction to dielectric materials, classification of dielectric materials, Dielectric constant, Dielectric strength and Dielectric loss. Polarization, Mechanisms of polarization, Comparison of different polarization process, Factors affecting polarization, Spontaneous polarization, Behavior of polarization under impulse and frequency switching, Decay and build-up of polarization under ac field, Complex dielectric constant. **Insulating Materials:** Insulating materials and applications – Ceramic, Mica, Porcelain, Glass, Micanite and Glass bonded mica. Polymeric materials – Bakelite, Polyethylene. Natural and synthetic rubber. Paper. Choice of solid insulating material for different applications, Liquid insulating materials – Requirements, Transformer oil, Bubble theory, Aging of mineral insulating oils. Gaseous insulating Materials – Air, Nitrogen, Vacuum.	
UNIT – IV	**(10 Hours)**
Magnetic Materials: Origin of permanent magnetic dipole, Magnetic terminology, Relation between relative permeability and magnetic susceptibility. Classification of magnetic materials, Diamagnetic, Paramagnetism, Ferromagnetism, Antiferromagnetic and the corresponding materials. Ferrimagnetism and ferrites – properties and applications, Soft and hard ferrites. Curie temperature, Laws of magnetic materials. Magnetization curve, Initial, and maximum permeability. Hysteresis loop and loss, Eddy current loss. Types of magnetic materials, Soft and hard magnetic materials, High energy magnetic materials, Commercial grade soft and hard magnetic materials.	
Reference Books: 1. K.M. Gupta, Nishu Gupta, “Advanced Electrical and Electronics Materials; Processes and Applications”, 1st Edition, Scrivener Publishing, 2015 2. R.K. Shukla, Archana Singh, “Electronic Engineering Materials”, Tata McGraw Hill Education PVT Ltd, 2012.	

3. L Solymar, D. Walsh, R. R. A. Syms, “Electrical Properties of Materials”, 10th Edition, Oxford Publishing, 2018.
4. A.J. Dekker, “Electrical Engineering Materials”, 1st Edition, Pearson, 2015.

Course Outcomes:

After completion of the course the students will be able to,

1. Classify solids on the basis of energy gap, Products – working principle and materials,
2. Select Material for conductors, cables, wires, solder, sheathing and sealing.
3. Choose solid and liquid insulating materials for different applications.
4. Select magnetic materials: Soft and hard magnetic materials, High energy magnetic materials, Commercial grade soft and hard magnetic materials.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE512E.1	3						1		1		1		1	1
2	22UEE512E.2	3	1					1		1		1	2		1
3	22UEE512E.3	3		2		1		1	1	1		1	1	1	1
4	22UEE512E.4	3	3	2	2	1		1		1		2	1	1	1

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE513E	Testing and Commissioning of Electrical Equipment	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Electrical Tools, accessories: Tools, Accessories and Instruments required for Installation, Maintenance and Repair Work, India Electricity Rules, Safely Codes Causes and Prevention of Accidents, Artificial Respiration, Workmen's Safety Devices.

Transformers: Installation, Location Site Selection, Foundation Details, Code of Practice for Terminal Plates, Polarity and Phase Sequence, Oil Tanks, Drying of Winding sand General Inspection. Commissioning Tests As Per National and International Standards - Volts Ratio Earth Resistance, Oil Strength, Insulation Tests, Impulse Tests Polarizing Index, Load Temperature Rise Tests. Specific Tests for Determination of Performance Curves like Efficiencies, Regulation Etc., Determination Mechanical Stress Under Normal and Abnormal Conditions.

UNIT – II	(10 Hours)

Synchronous Machines: Specifications as per BIS Standards. Installation - Physical Inspection, Foundation Details, Alignments, Excitation Systems, Cooling and Control Gear, Drying Out. Commissioning Tests - Insulation, Resistance Measurement of Armature and Field Windings, Wave Form and Telephone Interference Tests, Line Charging Capacitance. Performance Tests -Various Tests to Estimate the Performance of Generator Operations, Slip Test, Maximum Lagging Current, Maximum Reluctance Power Tests, Sudden Short Circuit Tests, Transient Sub Transient Parameters, Measurement of Sequence Impedances, Capacitive Reactance, and Separation Of Losses, Temperature Rise Test, and Retardation Tests. Factory Tests -Gap Length, Magnetic Eccentricity, Balancing Vibrations, Bearing Performance

UNIT – III	(10 Hours)

Induction Motor: Specifications. Installation- Location of Motors and its Control Apparatus, Shaft Alignment for Various Coupling, Fitting of Pulleys and Coupling, Drying of Windings. Commissioning Tests -Mechanical Tests For Alignment, Air Gap Symmetry, Tests for Bearings, Vibrations and Balancing. Specific Tests -Performance and Temperature Raise Tests, Stray Load Losses, Shaft Alignment, Re-Writing and Special Duty Capability, Site Tes

UNIT – IV	(10 Hours)

Laying of Underground Cables: Inspection, Storage, Transportation and Handling of Cables, Cable Handing Equipment, Cable Laying Depths and Clearances from other Services such as Water Sewerage, Gas, Heating and other Mains, Series of Power and Telecommunication Cables and Coordination with these Services, Excavation of Trenches, Cable Jointing and Terminations Testing and Commissioning. Location of Faults using Megger, Effect of Open or Loose Neutral Connections, Provision of Proper Fuses on Service Lines and Their Effect on System, Causes and Dim, and Flickering Lights

Reference Books:

1. Testing, Commissioning, Operation and Maintenance of Electrical Equipment S. Rao Khanna Publishers 6th Edition, 19th Reprint, 2015
2. Testing and Commissioning of Electrical Equipment R.L.Chakrasali Prism Books Pvt Ltd 1st Edition,2014

3. Preventive Maintenance of Electrical Apparatus S.K.Sharotri Katson Publishing House 1st Edition, 1980
4. Handbook of Switchgears BHEL McGraw Hill 1st Edition, 2005
5. Transformers BHEL McGraw Hill 1st Edition, 2003
6. The J&P Transformer Book Martin J. Heathcote Newnes, 12th Edition, 1998

Course Outcomes:

After completion of the course the students will be able to,

1. Describe the process to plan, control and implement commissioning of electrical equipment's.
2. Differentiate the performance specifications of transformer and induction motor Synchronous machines and switchgear.
3. Demonstrate the routine tests for synchronous machine, induction motor, transformer & switchgears.
4. Describe corrective and preventive maintenance of electrical equipment's. Such as isolators, circuit breakers, induction motor and synchronous machines.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE513E.1	3						1		1		1		1	1
2	22UEE513E.2	3	1					1		1		1	2		1
3	22UEE513E.3	3		2		1		1	1	1		1	1	1	1
4	22UEE513E.4	3	3	2	2	1		1		1		2	1	1	1

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE514E	Data Base Management Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Introduction to Data Base Systems:

Managing data, a historical perspective, File systems versus DBMS, Advantages of DBMS, Describing and Storing Data in DBMS, Queries in DBMS, Transaction management, Structure of DBMS, People who work with databases.

Entity – Relationship Model:

Using high-Level Conceptual Data Models for Database Design, An example of Database Application, Entity types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Refining the ER Design for the COMPANY database, ER Diagrams, Naming Conventions and Design Issues.

UNIT – II	(10 Hours)

Relational Model and Relational Algebra:

Relational model concepts, relational model constraints and relational database schemes, update operations and dealing with Constraint Violations, Unary relational Operations, SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations, JOIN and DIVISION, Additional Relational Operations, examples of Queries in Relational algebra, relational database design using ER – to-Relational mapping.

SQL-The Relational Database Standard:

SQL Data definition and data types, specifying basic constraints in SQL, Schemes, Change statements in SQL, basic Queries in SQL, more complex SQL queries, Insert, Delete and Update statements in SQL, additional features of SQL, specifying general constraints as assertion, views (virtual tables) in SQL,

UNIT – III	(10 Hours)

Data Base Design:

Informal Design Guidelines for Relation Schemes, Functional Dependencies, Normal Forms based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Properties of Relational Decompositions, Algorithms for Relational Database Scheme Design, Multivalued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Inclusion Dependencies, Other Dependencies and Normal Forms.

UNIT – IV	(10 Hours)

Transaction Management:

The ACID properties, Transactions and Schedules, Concurrent Execution of transactions, Lock-based Concurrency control, performance of locking, Transaction support In SQL, Introduction to crash recovery; 2PL, ss for 4rializability and recoverability, Introduction to lock management, Lock Conversions, Dealing with Deadlocks, Specialized locking Techniques, Concurrency control without locking, Introduction to ARIES

Reference Books:

1. Silberschatz, Korth and Sudharahan, “Data Base System Concepts”, 5th Edition, Mc- Graw Hill, 2007
2. C.J. Date, A.Kannan, S.Swamynatham, “An Introduction to Database Systems”, 8th

Edition, Pearson Education, 2006.
3. Raghu Ramakrishnan and JohannesGehrke, “Database Management Systems”, 3rd Edition, McGraw Hill, 2004.
4. Elmasri and Navathe, “Fundamentals of Database Systems”, 4th Edition, Pearson Publication.

Course Outcomes:

After completion of the course the students will be able to,

1. Construct, manipulate and share data base, for various applications and Draw ER diagram.
2. Construct relational database schemes, perform relational algebra operations and ER- to Relational Mapping and queues from database using SQL.
3. Describe different normal forms and properties of relational decomposition.
4. Perform operations about Transaction Management and Crash recovery.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE514E.1	1						1		1		1	1	1	1
2	22UEE514E.2	1	1					1		1		1	1	1	1
3	22UEE514E.3	1		2		1		1	1	1		1	1	1	1
4	22UEE514E.4	1	1	2	2	1		1		1		2	1	1	1

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE515E	Operation Research	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction: Definition, OR models characteristics and phase of OR. Modeling with linear Programming: Two variable LP model, Graphical LP solution, model in equation from graphical to algebraic solution. **Simplex Method:** Special cases in Simplex method Big M method.	
UNIT – II	**(10 Hours)**
Duality: Definition of the dual problem primal to dual relationships, economic interpretation of duality, additional simplex algorithms. **Transportation Model:** Definition of transportation model basic feasible solution by different methods, finding optimal solutions, stepping stone method, MODI method, the assignment model, traveling salesman problem.	
UNIT – III	**(10 Hours)**
Advanced Linear Programming: Revised simplex method, dual simplex method, Bounded variable algorithm, parametric linear programming. **Game Theory:** Formulation of two – person, zero sum games, solving simple games, Max–Min, Min–Max principles, graphical solution procedure, solving by linear programming.	
UNIT – IV	**(10 Hours)**
Pert and CPM Techniques: Network representation, critical path computation, construction of the time schedule, variation under probabilistic models, crossing of simple networks, PERT calculation.	

Reference Books:

1. Hamdy A Thoha, "Operation Research an Introduction", 8th Edition, Pearson Education, 2008.
2. Fredrick S.Hillier and Lieverman "Operation Research Concept and Cases", 8th Edition, TMH, 2009.
3. S.D. Sharma, "Operation Research" 16th revised Edition, KNRN New Delhi 2009.
4. S. S. Rao, "Optimization Techniques", 3rd Edition, New age International Publishers, 2010.

Course Outcomes:

After completion of the course the students will be able to,

1. Identify and develop operational research models from the algebraic linear equations for the real world problems.
2. Illustrate the mathematical tools that are needed to solve different optimization problems.
3. Find the feasible solution for real time algebraic equations.
4. Design the PERT network and obtain solution by CPM methods.

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE515E.1	3						1		1		1	3	1	1
2	22UEE515E.2	3	1					1		1		1	2	3	1
3	22UEE515E.3	3	3	2	2	1		1		1		1	1	1	1
4	22UEE515E.4	3	3	3	3	1		1	1	1		2	1	1	1

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE516E	Field Theory	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Coulomb's Law and Electric Field Intensity:
Experimental law of Coulomb, electric field intensity, field due to continuous volume charge distribution, field of a line charge, field of a sheet charge.
Electric Flux Density, Gauss' Law and Divergence:
Electric Flux Density, Gauss' law, divergence. Maxwell's first equation (Electrostatics), vector operator V and the divergence theorem.

UNIT – II	(10 Hours)

Energy and Potential: Energy expended in moving a point charge in an electric filed, the line integral, definition of potential difference and potential. The potential field of a point charge and system of charges, potential gradient, the dipole. Current and current density, Continuity of current.

UNIT – III	(10 Hours)

The Steady Magnetic Field: Biot-Savart law, Ampere's circuital law, Curl, Stokes' theorem, magnetic flux and flux density.
Magnetic Forces:
Force on a moving charge and differential current element, force between differential current elements.

UNIT – IV	(10 Hours)

Materials and Inductance:
The nature of magnetic materials, Magnetization and permeability.
Time Varying Fields and Maxwell's Equations:
Faraday's law, displacement current, Maxwell's equation in point and Integral form.

Reference Books:

1. William H. Hayt Jr. and John A Buck, "Engineering Electromagnetics", 17th - Edition, Tata McGraw Hill, 2012.
2. John Karuss, Daniel A Fleisch, "Electromagnetics with Applications", 5th Edition McGraw-Hill,1999.
3. Edward C. Jordan and Keith G Balmain, "Electromagnetic Waves and Radiating Systems," II- Edition, Prentice Hall of India / Pearson Education, 1968. Reprint 2002.
4. Dr. D. Ganesh Rao, "Field Theory" Sanguine Technical Publishers, 1st Edition, 2014.

Course Outcomes:
After completion of the course the students will be able to,

1. Identify differential coordinate elements for the various electric and magnetic field applications
2. Estimate the flux density, field intensity of electric and magnetic fields for various charges
3. Analyze the time varying and static electric and magnetic fields for various charges
4. Select the suitable time varying maxwells equation for real-time application of electromagnetism.

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE516E.1	3	3	2	2	1							3		
2	22UEE516E.2	3	3	3	2	2							3		
3	22UEE516E.3	3	3	3	3	2							3		
4	22UEE516E.4	3	3	3	2	2							3	2	

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Open Elective Course-I

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

	Electric Vehicles	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hours**
Introduction to EV: Historical Background, Benefits of Using Evs, Overview of types of Evs and its Challenges, EV Motor Drive Technologies, EV Energy Source Technologies, EV Battery Charging Technologies, EV Vehicle to Grid **EV Subsystem**: EV Subsystems and Configurations, HEV Subsystems and Configurations. HEV Subsystems and Configurations, Motion and dynamic equations for vehicles	
UNIT – II	**10 Hours**
Energy Storage: Batteries-Overview of Batteries, Battery Parameters, Lead Acid Batteries, Lithium Batteries, Metal Air Batteries. Alternative and Novel Energy Sources-Solar Photovoltaics, Flywheels, Super Capacitors. Fuel Cells-Main issues in the fuel cell, Hydrogen Fuel Cells: Basic Principles, Fuel Cell Thermodynamics (Introduction)	
UNIT – III	**10 Hours**
Architecture of EV and HEV: Vehicle Power Plant and Transmission Characteristics- Introduction, Drive train Configuration, Vehicle power plant, Internal combustion engine, Electric Motor, The need for gearbox, Drive train tractive effort and vehicle speed, Vehicle performance. Basic Architecture of Hybrid Drive Trains and Analysis of Series Drive Train- The Hybrid Electric Vehicle (HEV), Energy Use in Conventional Vehicles, Energy Savings Potential ofHybrid Drivetrains, HEV Configurations, Series and parallel Hybrid System.	
UNIT – IV	**10 Hours**
Power Flow in HEVs: Introduction, Power Flow Control, Power Flow Control in Series Hybrid, Power Flow Control in Parallel Hybrid, Power Flow Control in series-Parallel Hybrid, Power Flow Control Complex HybridControl	

Reference Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

Course Outcomes:

After completion of the course the students will be able to,

1. list and define all the terms associated with electric and hybrid electric vehicles
2. Explain the types of EVs, power flow topologies, Motors, EV & HEV Sub systems
3. solve simple numerical problems on battery cell voltage fuel cells and flywheels
4. Compare and contrast the types of EVs based on applications, battery requirements and HEV configurations.

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE516N.1	3	1	1	1					1		1			
2	22UEE516N.2	3	2	1	1					1		1			
3	22UEE516N.3	3	3				1	1		1		1			
4	22UEE516N.4	3	3	3	2	1		1	1	1	1	2			

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

	Fundamentals of Wind Energy Conversion Systems	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hours**
Introduction: Historical Development (BC – 20th Century); Historical Development (20th Century – 1980s); Recent Developments (1980s – present); The Nature of the Wind, origin of wind; Wind Energy Potential; Offshore Wind Energy; Modern Wind Turbines; Wind Vs Conventional power generation.	
UNIT – II	**10 Hours**
Wind Resource Assessment: Introduction – Spatial variation, Time variation; Characteristics of steady wind; Weibull wind speed distribution function; Vertical profiles of steady wind; Wind rose; Energy content of wind; Resource assessment.	
UNIT – III	**10 Hours**
Aerodynamics: Introduction; Aerofoil – Two dimensional theory, Relative wind velocity, Stall control; Wind flow models – Wind flow pattern; Axial momentum theory; Momentum theory for rotating wake; Blade element theory, Strip theory; Tip losses and correction; Wind Machine Characteristics.	
UNIT – IV	**10 Hours**
Wind Turbines: Introduction; Classification of Wind Turbines; Wind Turbine Components; Basic principles of wind energy extraction; Extraction of wind turbine power (Numerical problems) - Weibull distribution-Wind power generation curve-Betz's Law-Modes of wind power generation.	

Reference Books:

1. Siraj Ahmed, "Wind Energy- Theory and Practice", Prentice Hall of India, New Delhi, 2010.
2. D. P. Kothari, S. Umashankar, Wind Energy Systems and Applications, Narosa publishers, 2017.
3. Khan B. H., Non-Conventional Energy Resources, Tata McGraw Hill, 2009.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply various parameters and features of wind energy conversion systems.
2. Analyse various concepts and theory related to wind energy conversion systems.
3. Evaluate/calculate various parameters related to wind energy conversion systems.
4. Relate/articulate the concepts and theories related to wind energy conversion systems.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE517N.1	3	2	2	2	1					1				
2	22UEE517N.2	3	3	3	2	2									
3	22UEE517N.3	3	2	3	3	2					1	1			
4	22UEE517N.4	3	3	3	2	2					1	1			

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE528P	**Mini Project**	**02- Credits (0 : 0 : 4)**
Hours/Week : 0L+4P		CIE Marks : 50
Total Hours : 48		SEE Marks : 50

The Mini Project is a laboratory-oriented course designed to provide students with a platform to enhance their practical knowledge and technical skills through the development of small-scale systems or applications. It serves as a foundation for larger project work in the final year and beyond, encouraging creativity, collaboration, and hands-on learning.

Students will undertake a mini project either individually or in teams of up to four members, based on their abilities and the recommendations of the faculty mentor. Projects may be single-disciplinary or multidisciplinary, depending on the nature of the problem and the interests of the students.

The evaluation of the Mini Project will be carried out in two stages: Continuous Internal Evaluation (CIE) and Semester End Evaluation (SEE), each carrying 50 marks. The CIE will be conducted by a committee comprising the Head of the Department (HOD) or nominee, the Mini Project Coordinator, and the assigned faculty guide. Students will be assessed based on predefined rubrics that consider the relevance and clarity of the problem identified, technical depth, innovation, quality of implementation, teamwork, and effectiveness of presentation and communication. For the SEE, students are required to present their completed mini project to the Mini Project Evaluation Committee (MPEC), which includes the Mini Project Coordinator, HOD or nominee, and an External Examiner. The committee will evaluate the students based on the demonstration of the project, technical content, report quality, and overall presentation. This dual-stage evaluation ensures a comprehensive assessment of both the process and the outcome of the mini project work.

Course Outcomes

After undergoing the internship, students will be able to:

1. Identify engineering problems associated with electrical & electronics engineering and interdisciplinary research.
2. Analyze Data and interpret contemporary tools & resources to analyze / validate the solutions for engineering problems.
3. Communicate effectively and present the work to technical audience.
4. Prepare quality technical report with detailed analysis and representation of the executed work.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	**22UEE528P.1**	3	3	2	1	2	1	1	2	2	2	1	2	2	3
2	**22UEE528P.2**	2	3	3	2	3	1	1	1	1	1	1	2	2	3
3	**22UEE528P.3**							1	1	3	1	1	2	2	3
4	**22UEE528P.4**				1	2	1	1	1	2	1	1	2	2	3

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE625C	Power System-III	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
Network Topology: Introduction, Elementary Graph Theory, connected graph, sub graph Loop, Cut-set, Tree, Co- tree, Basic loops, Basic cut-set. Incidence Matrices: Element-node incidence matrix A (Bus-incidence matrix), Branch path incidence matrix K, Basic (Fundamental) cut-set incidence matrix B, Augmented cut-set matrix, Basic loop incidence matrix C, Augmented loop incidence matrix. Algorithm for formation of Bus Impedance Matrix, formation of Ybus by inspection method and singular transformation method.	
UNIT – II	**10 Hours**
Load Flow Studies: Introduction, Power Flow Equation, Classification of Buses **Gauss-Seidel Method:** Algorithm for GS method, Modification of algorithm to include PV buses, Q- limit violations, Acceleration of convergence and examples. **Newton-Raphson Method:** Introduction, Algorithm for NR method in polar coordinates and rectangular coordinates. Fast Decoupled Load Flow and examples.	
UNIT – III	**10 Hours**
Economic Operations of Power System: Introduction, Performance curves, Economic generation scheduling neglecting losses and generator limits, Economic generation including generator limits and neglecting losses, Iterative technique, Economic Dispatch Including Transmission Losses: Approximation penalty factor, Derivation of transmission loss formula. Introduction to optimal scheduling for hydrothermal plants. Problem formulation, solution procedure and algorithm	
UNIT – IV	**10 Hours**
Excitation Systems: Introduction, DC Excitation system, AC Excitation, static Excitation, Dynamic performance measures of Excitation system, control and protective functions: AC and DC regulators, excitation system stabilizing circuits, power system stabilizer, load compensation, under excitation limiter, over excitation limiter. Modeling of AVR, steady state and dynamic performance analysis of AVR.	

References:

1. Stag. G. W, EI-Abaid, A. H., “Computer Methods in Power System Analysis”, MED TECH, A Division of Scientific International 2019.
2. Olle I. Elgerd, “Electric Energy Systems Theory-An Introduction”, 2nd Edition McGraw-Hill Book Company.
3. Pai M.A., “Computer Techniques in Power System Analysis”, 2nd Edition, TMH, 2006.
4. K. Uma Rao, “Computer Techniques and Model in Power Systems”, 2nd Edition, I.K. International, 2014.
5. Singh L. P., “Advanced Power System Analysis and Dynamics”, 6th Edition, New Age International(P) Ltd, New Delhi, 2014.
6. Nagrath, I .J., and Kothari, D.P., “Modern Power System Analysis”, 4th Edition, TMH, 2011

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Course Outcomes:

After completion of the course the students will be able to,

1. Apply suitable network topology, primitive network, types of power system buses for load flow studies and economic scheduling algorithms and excitation systems for power system operation.
2. Investigate performance of the power systems using load flow analysis, optimum scheduling of thermal generators and excitation systems.
3. Calculate Y_{BUS} matrix, real power, reactive power and power flow for a given power systems using load flow studies and optimum cost of generation of thermal power plants using economic scheduling study and components of excitation systems.
4. Formulate the load flow models, economic scheduling of thermal generators.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE625C.1	3						1		1		1	2	1	
2	22UEE625C.2	3	1					1		1		1	1	2	1
3	22UEE625C.3	3	3	2	2	1		1		1		1	3	1	1
4	22UEE625C.4	3	3	3	3	1		1	1	1		2	3	1	

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE626C	Control Systems	04 - Credits (4 : 0 : 0)
Hours/Week : 04		CIE Marks : 50
Total Hours : 52		SEE Marks : 50

UNIT – I	(13 Hours)
Introduction: Objective of control system, Importance of control system, Examples of control system, Types of control systems, Open-loop and closed loop control systems, Feed-back and its effects on system performance characteristics. **Modeling of Physical Systems:** Models of mechanical systems, Electrical systems, and Electromechanical systems, Analogous systems: Force-voltage analogy, Force- current analogy. Usage of MATLAB command-line functions to verify the solution.	
UNIT – II	**(13 Hours)**
Block Diagrams and Signal Flow Graphs: Transfer function; Block diagram reduction, Signal flow graphs, Mason's gain formula, and Application of Mason's gain formula to block diagrams. **Time Response of Feedback Control Systems:** Standard test signals, Type and order of system, Steady state error and error constants, Unit-step response of first and second order systems, Time domain specifications. Usage of MATLAB command-line functions to verify the solution.	
UNIT – III	**(13 Hours)**
Stability Analysis: The concept of stability, BIBO stability, Zero-input and asymptotic stability, Routh- Hurwitz (R-H) stability criterion, Application. **Root-Locus Analysis:** The concept of root locus and Complementary root locus, Basic properties of root locus, Construction of root locus. Usage of MATLAB command-line functions to verify the solution.	
UNIT – IV	**(13 Hours)**
Frequency Domain Analysis: The concept of frequency response, Bode plots, procedure for constructing Bode plots, Gain margin, Phase margin, Frequency domain specifications, Nyquist stability criterion and examples. **Control system analysis in state-space:** State variable representation, conversion of state variable models to transfer functions and vice versa. Usage of MATLABcommand-line functions to verify the solution.	

Reference Books:

1. Benjamin C. Kuo, “Automatic Control System”, 7th Edition, PHI, 2010.
2. Richard C. Dorf Robert H. Bishop “Modern Control Systems”, 8th Edition, Addison-Wesley,1999
3. I.J. Nagarath and M Gopal, “Control Systems Engineering”, New Age International (P) Ltd.,1999
4. Norman S. Nise “Control System Engineering”, McGraw Hill, 2010.
5. R. S. Allurkar, “Control Systems”, EBPB, 2004

Course Outcomes:

After completion of the course the students will be able to,

1. Classify control systems based on a number of ways and select them for particular applications.
2. Develop mathematical modeling of LTI control systems via differential equation

formation, transfer function, and state space analysis.

3. Employ time domain analysis to predict and diagnose transient performance parameters of LTI control systems for standard input function step.
4. Formulate different types of analysis in frequency domain to obtain the stability of the LTI control systems.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE626C.1	3	3	2	2	2							2	1	2	1
2	22UEE626C.2	3	3	3	2	3							2	1	3	1
3	22UEE626C.3	3	3	3	3	3							2	1	3	1
4	22UEE626C.4	3	3	3	3	3							2	1	2	1

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE627C	Digital Signal Processing	04 - Credits (4 : 0 : 0)
Hours/Week : 04		CIE Marks : 50
Total Hours : 52		SEE Marks : 50

UNIT – I	13 Hours
Introduction: Definition of signal and system, classification of signals, elementary signals, basic operations on signals, sampling and aliasing, sampling theorem, basic system properties: stability, memory, causality, time invariance and linearity. **Time-domain Analysis of Discrete-Time LTI Systems:** The convolution sum, convolution sum evaluation procedure, convolution properties. **Time domain Analysis of Continuous-Time LTI Systems:** The convolution integral, convolution integral evaluation procedure.	
UNIT – II	**13 Hours**
Fourier Series Representations: Continuous-time periodic signals: Fourier Series (FS), properties of FS, Discrete-Time Fourier Series (DTFS). **Fourier Transforms Representations:** Continuous-time aperiodic signals: Fourier Transform (FT), properties of FT.	
UNIT – III	**13 Hours**
The Discrete Fourier Transform (DFT): DFT, IDFT, DFT as a linear transformation, properties of DFT, circular convolution. Efficient Computation of the DFT: Radix-2 FFT algorithm, Radix-2 inverse FFT, decimation-in-time FFT algorithm, decimation-in-frequency FFT algorithm.	
UNIT – IV	**13 Hours**
Design of FIR filters: Design of FIR filters using windows(Rectangular, Hamming). **Design of IIR filter:** Design of IIR filter from analog Butterworth filter, Impulse -invariance and bilinear transformation method. **Realization of IIR systems:** Structure for IIR systems: Direct-form, cascade form and parallel form.	

Text Books:

1. Simon Haykin, Barry van Veen, “Signals and Systems,” John Wiley &Sons (Asia) Pvt. Ltd, 2nd Edition, 2004.
2. B. P. Lathi, “Principles of Linear Systems and Signals,” Oxford University Press, 2nd Edition,
3. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", 4th Edition, Pearson Education, 2007.

Reference Books:

4. A.V. Oppenheim, A.S. Willsky, S.H. Nawab, “Signals and Systems,” 2nd Edition, 2006.
5. R.E. Ziemer, W.H. Tranter, D.R. Fannin, “Signals and Systems,” Pearson Education, 2nd Edition, 2002.
6. S.K. Mitra, “Digital Signal Processing: A Computer - Based Approach”, McGraw Hill Higher Education, 4th Edition, 2013.

Course Outcomes:

After completion of the course the students will be able to,

1. Classify signals and systems.
2. Determine the response of LTI systems..
3. Represent the signals in the frequency domain.
4. Design and realize filters.

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO 1	3	2	2	1	1					3	2		3	1
2	CO 2	3	3	3	2	2					3	2		3	1
3	CO 3	3	2	3	2	3					2	2		3	1
4	CO 4	3	2	3	2	3					2	2		3	1

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE620L	Power System-II Laboratory	01 - Credits (0 : 0 : 2)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. Determination of regulation, efficiency, symmetry and reciprocity of transmission lines by assessment of ABCD parameters
2. Determination of fault currents and voltages in a power systems at a specified location for LG, LL & LLG faults and to check boundary conditions
3. Formation of Y_{Bus} of power systems by singular transformation and inspection method.
4. Determination of power angle diagrams for salient and non-salient pole synchronous machines.
5. Determination of power system stability using swing equation
6. Determination of critical clearing time for SMIB system by varying inertia constant, line parameters/fault location.
7. Load flow study of power systems using Gauss-Seidel method (only pq Bus not exceeding 4-buses).
8. Load flow study of power systems using Jacobian matrix for a given power system not exceeding 4 buses in polar Coordinates (no PV buses).
9. Load flow study of power systems using fast-decoupled method.
10. Optimal generator scheduling for thermal power plants connected to load dispatch center.

Reference Books:

1. K. Uma Rao, "Computer Techniques and Model in Power Systems", 2nd Edition, I.K. International, 2014.
2. Singh L. P., "Advanced Power System Analysis and Dynamics", 6th Edition, New Age International(P) Ltd, New Delhi, 2014.
3. Nagrath, I .J., and Kothari, D.P., "Modern Power System Analysis", 4th Edition, TMH, 2011

Course Outcomes:

After completion of the course the students will be able to:

1. Apply MATLAB and Mi Power software tools to model, simulate, and analyze various power system components and networks.
2. Conduct experiments related to transmission line parameters, fault analysis, stability studies, load flow methods, and optimal scheduling in power systems using laboratory setups and software tools.
3. Interpret experimental results, analyze system performance, and formulate conclusions to evaluate and improve the efficiency, stability, and reliability of power systems.

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE620L.1		1	1	3	3						1	3		2
2	22UEE620L.2	1	2	2	3	3						1	3		2
3	22UEE620L.3	1	2	3	3	3						1	3		2

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE621L	Microcontrollers Laboratory	01 - Credits (0 : 0 : 2)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

Part A - Assembly Language Programming

1. Addition of two 8 bit numbers, 16 bit numbers, array of 8 bit numbers, average of an array
2. Subtraction of two 8 bit numbers, 16 bit numbers
3. BCD Addition- two digit numbers, 4 digit numbers
4. Multiplication, Division
5. Arranging an array of number in ascending/descending order
6. To find maximum/minimum number of an array
7. Block of data transfer- Internal RAM, Internal RAM to external RAM
8. To find number of positive and negative numbers in an array
9. Code Conversion-BCD to Hex, Hex to BCD
10. Counters-Binary, BCD

Part B-IOT Programming

1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2. To interface LED/Buzzer with Arduino Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds
3. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
4. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
5. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
6. To interface DISPLAY with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
7. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smart phone using Bluetooth
8. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when I'/'O' is received from smartphone using Bluetooth.
9. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to Thingspeak cloud
10. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from Thingspeak cloud
11. To install MySQL database on Raspberry Pi and perform basic SQL queries.
12. Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker
13. Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.
14. Write a program to create TCP server on Arduino Raspberry Pi and respond with humidity data to TCP client when requested.
15. Write a program to create UDP server on Arduino Raspberry Pi and respond with humidity data to UDP client when requested.

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Reference Books:

1. Kenneth J. Ayala, "The 8051 Microcontroller Architecture, Programming and Applications" 3rd Edition, Cengage, 2007.
2. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; "The 8051 Microcontroller and Embedded Systems using assembly and C", 2nd Edition, Pearson, 2012.
3. David Calcutt Fred Cowan, Hasan Parchizadeh Elsecier, "8051 Microcontrollers an application based introduction", 2004.

Course Outcomes:

After completion of the course the students will be able to:

1. Develop and verify Assembly Language Programes for the specified applications
2. Analyze and execute the Assembly Language Programes in Microcontroller kit
3. Interface and analyze the functioning of peripheral devices with microcontroller

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE621L.1	3	1	1		1	1				1	1		1	1
2	22UEE621L.2	3	1	1	1	2					1	1		2	2
3	22UEE621L.3	3	1	1	1	2					1	1		2	2

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(For students admitted to I year in 2023-24)

Professional Elective Course – II

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE621E	Integration of Distributed Generation	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Distributed Generation: Introduction, Sources of Energy - Wind Power, Solar Power, Combined Heat-and-Power, Hydropower, Tidal Power, Wave Power, Geothermal Power, Thermal Power Plants	
UNIT – II	**(10 Hours)**
Distributed Generation (continued): Interface with the Grid. Power System Performance: Impact of Distributed Generation on the Power System, Aims of the Power System, Hosting Capacity Approach, Power Quality, Voltage Quality and Design of Distributed Generation, Hosting Capacity Approach for Events, Increasing the Hosting Capacity.	
UNIT – III	**(10 Hours)**
Overloading and Losses: Impact of Distributed Generation, Overloading: Radial Distribution Networks, Overloading: Redundancy and Meshed Operation, Losses Overloading and Losses (continued): Increasing the Hosting Capacity. Voltage Magnitude Variations: Impact of Distributed Generation, Voltage Margin and Hosting Capacity, Design of Distribution Feeders, A Numerical Approach to Voltage Variations, Tap Changers with Line-Drop Compensation, Probabilistic Methods for Design of Distribution Feeders	
UNIT – IV	**(10 Hours)**
Voltage Magnitude Variations (continued): Statistical Approach to Hosting Capacity, Increasing the Hosting Capacity. Power Quality Disturbances: Impact of Distributed Generation, Fast Voltage Fluctuations, Voltage Unbalance.	

Reference Books:

1. Math Bollen, “Integration of Distributed Generation in the Power System”, Wiley publications, 2011.
2. Amirnaser Yezdani, and Reza Iravani, “Voltage Source Converters in Power Systems: Modeling, Control and Applications”, IEEE John Wiley Publications, 2009.
3. Dorin Neacsu, “Power Switching Converters: Medium and High Power”, CRC Press, Taylor & Francis, 2006.
4. Chetan Singh Solanki, “Solar Photo Voltaics”, PHI learning Pvt. Ltd., New Delhi, 2009
5. J.F. Manwell, J.G “Wind Energy Explained, Theory Design and Applications,” McGowan Wiley publication, 2nd Edition, 2009.
6. John Twidell and Tony Weir, “Renewable Energy Resources”, Taylor and Francis Publications, Second Edition, 2006.

Course Outcomes:

After completion of the course the students will be able to,

1. Determine the variation in production capacity at different timescales, the size of individual units, and the flexibility in choosing locations with respect to of wind and solar systems.

2. Evaluate performance of the power system with distributed generation is integrated to the system.
3. Analyze effects of the integration of DG in terms of increased risk of overload, losses, over voltages and power quality disturbances
4. Assess the impact the integration of DG on power system stability and operation

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE621E.1	3					1	1					2	1	1
2	22UEE621E.2	3	3	2	1		1						2	1	1
3	22UEE621E.3	3	3	2	1	1	1						2	1	1
4	22UEE621E.4	3	3	2	1	1	1				1		2	1	1

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(For students admitted to I year in 2023-24)

22UEE622E	Automotive Electronics	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction: Need For Electronics In Automotive Control Systems, Structure Of Vehicle Electronics Systems, Common Features Of Vehicle Systems, Measurement System, Sensors And Actuators. Introduction To Electronics: Electronic Components, Diodes, Transistors, Electronic Circuits, Analog Circuits, Digital Circuits, Integrated Circuits, Microprocessor Systems, Systems Approach To Control And Instrumentation.	
UNIT – II	**(10 Hours)**
Electronic Ignition Systems: Types Of Ignition Systems, Conventional Ignition System, Cdi, Programmed Ignition System, Distributor-Less Ignition System, Direct Ignition. Electronic Fuel Control: Electronic Control Of Carburetion, Petrol Injection System, Single And Multi-Point Injection System, Components, Flow Diagram, Diesel Fuel Injection.	
UNIT – III	**(10 Hours)**
Engine Management System: Combined Ignition And Fuel Management System, Exhaust Emission Control, Digital Control Techniques, Complete Vehicle Control Systems, Artificial Intelligence And Engine Management Chassis Electrical Systems: Anti-Lock Brakes, Active Suspension, Traction Control, Electronic Control Of Automatic Transmission.	
UNIT – IV	**(10 Hours)**
Electronics For Comfort, Safety And Security: Electric Seats, Mirrors And Sun-Roof Operation, Central Looking And Electric Windows, Cruise Control, In Car Entertainment (Ice) And Communications, Adaptive Noise Control, Airbags And Seatbelt Tensioners, Obstacle Avoidance Radar, Security Systems - Engine Immobilizer, Icat.	

Reference Books:

1. Tom Denton, “Automotive electrical and electronic systems”, 3rd Edition, SAE International, 2015.
2. Eric Chowanietz, “Automotive Electronics”, 1st Edition Newnes publishers, 1995.
3. William B Ribbens, “Understanding Automotive Electronics”, 7th Edition, Butterworth-Heinemann –Elsevier, 2012.
4. Bernhard Mencher, et. al., “Bosch Professional Automotive Information”, 5th Edition, Springer Vieweg, 2014.

Course Outcomes:

After completion of the course the students will be able to,

1. Explain the need for electronics in modern automobiles and describe the structure and function of key electronic components, sensors, actuators, and control systems used in vehicles.
2. Analyze various electronic ignition and fuel control systems including CDI, programmed ignition, and petrol/diesel injection systems.
3. Examine the role of electronics in engine management systems and advanced chassis control systems such as ABS, traction control, and electronic suspension.
4. Evaluate comfort, safety, and security features in automobiles enabled by

electronics such as airbags, cruise control, infotainment systems, and electronic locking mechanisms.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE622E.1	3	2			1							2	2	1
2	22UEE622E.2	2	3			2								3	2
3	22UEE622E.3	3	2	2		3								3	3
4	22UEE622E.4	2	3		2	2								3	3

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE623E	Intelligent Instrumentation	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction: Intelligent instrumentation, Definition, Historical Perspective, Current status, software based instruments. **Intelligent Sensors**: Classification, Smart sensors, Monolithic Integrated Smart Sensors, Hybrid Integrated Smart Sensors, Cogent Sensors, Soft or Virtual sensors, Self-adaptive, Self- validating sensors, Soft Sensor Secondary Variable Selection, Rough Set Theory, Model Structures. Self-Adaptive Sensors, Self-Validating Sensors, VLSI Sensors, Temperature Compensating Intelligent Sensors, Pressure Sensor.	
UNIT – II	**(10 Hours)**
Sensor Characterization and Linearization: Analog Linearization of Positive and Negative Coefficient Resistive Sensors. Higher-Order Linearization, Quadratic Linearization, Third-Order Linearization Circuit, Nonlinear ADC- and Amplifier-Based Linearization, Interpolation, Piecewise Linearization, Microcontroller-Based Linearization, Lookup Table Method, Artificial Neural Network– Based Linearization, Nonlinear Adaptive Filter–Based Linearization.	
UNIT – III	**(10 Hours)**
Sensor Calibration and Compensation: Sensor Calibration, Conventional Calibration Circuits, Offset Compensation, Error and Drift Compensation, Lead Wire Compensation. **Sensors with Artificial Intelligence:** Artificial Intelligence, Sensors with Artificial Intelligence, Multidimensional Intelligent Sensors, AI for Prognostic Instrumentation, ANN-Based Intelligent Sensors, Fuzzy Logic–Based Intelligent Sensors.	
UNIT – IV	**(10 Hours)**
Intelligent Sensor Standards and Protocols: IEEE 1451 Standard: STIM, TEDS, NCAP. Network Technologies, LonTalk, CEBUS, J1850 Bus: Signal Logic and Format, MI Bus, Plug-n-Play Smart Sensor Protocol.	

Reference Books:

1. Manabendra Bhuyan, “Intelligent Instrumentation: Principles and Applications,” CRC Press, Taylor and Francis Group, 2011.
2. G. C. Barney, “Intelligent Instrumentation,” Prentice Hall, 1995.
3. J.B Dixit, Amit Yadav, “Intelligent Instrumentation for Engineers,” Laxmi Publications Ltd., 2011

Course Outcomes:

After completion of the course the students will be able to,

1. Explain intelligent instrumentation and analyze the structure and types of smart and self-adaptive sensors.
2. Apply and compare analog and digital linearization techniques for accurate sensor characterization.
3. Apply sensor calibration and compensation techniques and analyze the role of AI in intelligent sensors.
4. Describe IEEE 1451 standards and evaluate protocols used for smart sensor communication and integration.

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(For students admitted to I year in 2023-24)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE623E.1	3	2	1		2						1	3	2	
2	22UEE623E.2	3	3	2		3							3	3	
3	22UEE623E.3	3	3	2		3						1	3	3	
4	22UEE623E.4	3	2	2		3						2	3	3	

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE624E	VLSI Design	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction: Overview of VLSI design methodology, VLSI design flow, Design hierarchy, Concept of regularity, Modularity, and Locality, VLSI design style, Design quality, package technology, introduction to FPGA and CPLD, computer aided design technology. Fabrication of MOSFET: Introduction, Fabrication Process flow: Basic steps, C-MOS nWellProcess, Layout Design rules, full custom mask layout design.	
UNIT – II	**(10 Hours)**
MOS Transistor: The Metal Oxide Semiconductor (MOS) structure, The MOS System under external bias, Structure and Operation of MOS transistor, MOSFET Current-Voltage characteristics, MOSFET scaling and small-geometry effects, MOSFET capacitances MOS Inverters - Static Characteristics: Introduction, Resistive load Inverter, Inverter with n-type MOSFET load(Enhancement and Depletion type MOSFET load), CMOS Inverter	
UNIT – III	**(10 Hours)**
MOS Inverters Switching characteristics and Interconnect Effects: Introduction, Delay-time definitions, Calculation of Delay times, Inverter design with delay constraints, Estimation of Interconnect Parasitic, Calculation of interconnect delay, Switching Power Dissipation of CMOS Inverters	
UNIT – IV	**(10 Hours)**
Combinational MOS Logic Circuits: Introduction, MOS logic circuits with Depletion nMOS Loads, CMOS logic circuits, Complex logic circuits, CMOS Transmission Gates (TGs) Sequential MOS Logic Circuits: Introduction, Behavior of Bistable elements, The SR latch circuit, Clocked latch and Flip-flop circuit, CMOS D-latch and Edge-triggered flip-flop Dynamic Logic Circuits: Introduction, Basic Principles of pass transistor circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, CMOS Dynamic Circuit Techniques, High-performance Dynamic CMOS circuits	
Reference Books: 1. Sung – Mo Kang, Yusuf Leblebici, “CMOS Digital Integrated circuits – Analysis and Design”, TATA McGraw-Hill Pub. Company Ltd. 2. Pucknell, Eshraghian, “Basic VLSI Design”, PHI publications, 3rd Edition, 2018. 3. Mead C and Conway, “Introduction to VLSI Systems”, Addison Wesley publications, 2nd Edition, 1990. 4. John P. Uyemura, “Introduction to VLSI Circuits & Systems”, Wiley Publications, 2006. 5. Brown and Vranesic, “Fundamentals of Digital Logic Design with VHDL”, McGraw Hill Education, 3rd Edition, 2017.	
Course Outcomes: After completion of the course the students will be able to, 1. Apply VLSI design flow, hierarchy, and layout rules to illustrate MOSFET fabrication and design methodologies. 2. Analyze MOS transistor characteristics, scaling effects, and evaluate static performance of CMOS inverters.	

3. Compute delay parameters, interconnect parasitics, and power dissipation to assess switching behavior of CMOS inverters.
4. Design and evaluate combinational, sequential, and dynamic MOS logic circuits using CMOS and transmission gate techniques.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE624E.1	3	2	2	2	1					1		3	2	
2	22UEE624E.2	3	3	2	2	2					1		3	2	
3	22UEE624E.3	3	3	3	2	2					2		3	2	1
4	22UEE624E.4	3	3	3	2	3					2		3	3	2

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE625E	Electric Machine Drives	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Fundamentals of Electric Drives

Electric drive – Concept, classification, parts and advantages of electrical dives, Types of Loads, Components of load toques Fundamental torque equation – Load torque components – Nature and classification of load torques – Steady state stability – Transient stability -Load equalization– Four quadrant operation of drive (hoist control) – Braking methods: Dynamic – Plugging – Regenerative methods

UNIT – II	(10 Hours)

Converter Controlled DC Motor Drives

Modeling of DC motors, State space modeling, block diagram & Transfer function, Single phase, three phases fully controlled and half controlled DC drives. Dual converter control of DC drives. Power factor, supply harmonics and ripple in motor current

DC–DC Converters Controlled DC Motor Drives

Single quadrant – Two quadrant and four quadrant DC-DC converter fed separately excited and self-excited DC motors – Continuous current operation – Output voltage and current waveforms – Speed–torque expressions – Speed–torque characteristics – Four quadrant operation – Closed loop operation (qualitative treatment only).

UNIT – III	(10 Hours)

Induction motor Drive

Stator voltage variation by three phase controllers, Speed control using chopper resistance in the rotor circuit, slip power recovery scheme. Pulse width modulated inverter fed and current source inverter fed induction motor drive. Volts/Hertz Control, Vector or Field oriented control

UNIT – IV	(10 Hours)

Synchronous motor drives

Variable frequency control, Self-Control, Voltage source inverter fed synchronous motor drive, Vector control

Solar and Battery Powered Drive

Introduction, Stepper motor, Switched Reluctance motor drive

Industrial application

Drive consideration for Textile mills, Steel rolling mills, Cement mills, Paper mills, Machine tools. Cranes & hoist drives

Reference Books:

1. G K Dubey, “Fundamentals of Electric Drives”, Narosa Publications, 2nd Edition, 2011.
2. S.B. Dewan, G.R. Slemon, A. Straughen, “Power Semiconductor Drives”, Wiley-India Publications, 2nd Edition, 2009.
3. Vedam Subrahmanyam, “Electric Drives”, Tata McGraw Hill, 2nd Edition, 2011.
4. R. Krishnan, “Electric Motor Drives- Modelling, Analysis and Control”, Prentice Hall Inc., 2008.
5. Bimal K. Bose, “Modern Power Electronics & AC drives”, Prentice Hall Inc., 2001

6. Austin Hughes, “Electric Motor & Drives” Newnes-Elsevier, 3rd Edition, 2006.
7. S.K. Pillai, “A first course on Electrical Drives”, New Age International Publication, 2nd Edition, 1982.

Course Outcomes:

After completion of the course the students will be able to,

1. Identify and classify suitable drive system for industrial application
2. Analyze the operation of three phase converter and DC-DC converter fed dc motors for four quadrant operation
3. Design suitable drives system based on the performance of motor for various industrial application
4. Model and analyze the DC motor, induction motor and synchronous motor for converter-controlled drive system

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE625E.1	3	2	2	2	1				1	2	1	3	1	3
2	22UEE625E.2	3	3	3	2	3				1	2	1	3	2	2
3	22UEE625E.3	3	2	3	3	3				1	2	1	3	2	1
4	22UEE625E.4	3	2	2	2	3				1	2	1	3	3	2

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE626E	Modern Control Theory	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
State Variable Analysis and Design:-Introduction, concept of state, state variables and state model, state modeling of linear systems, linearization of state equations. State space representation using physical variables, phase variables & canonical variables. Usage of MATLAB command-line functions to verify the solution.	
UNIT – II	**(10 Hours)**
Derivation of transfer function from state model:-Derivation of transfer function from state model, diagolization, Eigen values, Eigen vectors, generalized Eigen vectors. **Solution of state equation:-** Solution of state equation, state transition matrix and its properties, computation using Laplace transformation, power series method, Cayley-Hamilton method, concept of controllability & observability, methods of determining the same. Usage of MATLAB command-line functions to verify the solution.	
UNIT – III	**(10 Hours)**
Control system design in state-space: State variable feedback structure, pole-placement design using feedback, state feedback with integral control, critique of pole-placement state feedback control, observer-based state feedback control. **Pole Placement Techniques and Controllers:-** Stability improvements by state feedback, necessary & sufficient conditions for arbitrary pole placement, state regulator design, and design of state observer, Controllers- P,PI, PID. Usage of MATLAB command-line functions to verify the solution.	
UNIT – IV	**(10 Hours)**
Nonlinear system analysis: Introduction, behavior of non-linear system, common physical non linearity-saturation, friction, backlash, dead zone, relay, multi variable non-linearity. **Phase plane method:-**Phase plane method, singular points, stability of nonlinear system, limit cycles **Liapunov stability criteria:-**Liapunov stability criteria, Liapunov functions, direct method of Liapunov& the linear system, construction of Liapunov functions for nonlinear system by Krasvskii's method.	
Reference Books: 1. M.Gopal, "Control Systems Principles and Design", 3rd Edition, Tata McGraw Hill, 2011. 2. Katsuhiko Ogata, "Modern Control Engineering", 4th Edition, Pearson Education, 2002. 3. A Nagoor Kani, "Advanced Control Theory", CBS Publishers, 3rd Edition, 2020	
Course Outcomes: After completion of the course the students will be able to, 1. Apply state-space representation techniques to model linear and nonlinear control systems. 2. Analyze system properties such as controllability, observability, and stability using mathematical tools and system matrices. 3. Design state feedback controllers and observers for modern control systems based on pole placement and canonical forms.	

4. Evaluate nonlinear control system behavior using phase-plane methods and Liapunov's stability criteria for system performance analysis.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE626E.1	3	2	2	2	2						1	3	2	2
2	22UEE626E.2	3	3	2	2	2						2	3	3	2
3	22UEE626E.3	3	2	3	3	2						2	3	3	2
4	22UEE626E.4	3	3	2	3	2						3	3	2	2

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Open Elective Course – II

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

	Electrical Safety for Engineers	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hours**
Introduction to Electrical Safety, Electric Shocks and their Prevention: OSHA standards on electrical safety, objectives of safety and security measures, hazards associated with electric current and voltage, principles of electrical safety, approaches to prevent accidents, review of IE rules & acts. Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns	
UNIT – II	**10 Hours**
First Aid in Case of Electric Shock: First principles of actions after electric shock, first aid-artificial respiration methods, Cardiac Pulmonary Resuscitation, accident management and safety management. **Equipment Earthing and System Neutral Earthing:** Earthing, need for earthing, types of earthing, distinction between system grounding and equipment grounding, functional requirement of earthing system, technical consideration of station earthing system, step and touch potential, neutral grounding and its advantages	
UNIT – III	**10 Hours**
Safety in Residential, Commercial and Agricultural Installations: Domestic wiring methods and installations, safety requirements, shocks from domestic equipment-water taps- wet walls-agricultural pumps, types of cables and specifications, underground cables, best practices with use of electricity. **Accident Investigation:** Why and how to investigate, investigation report writing. Case studies of accidents in HESCOM/GESCOM region	
UNIT – IV	**10 Hours**
Electrical System Safety: Safety devices and their characteristics, safety clearances and creepage distances in electrical plants, line supports, insulators Circuit Breakers: Arc phenomenon, principles of arc extinction, oil & air blast breakers Protective Relays: Fundamental requirements of relaying, classification of relays Protection of Alternators, Transformers, Bus bars and Lines, protection against over voltages	
Reference Books: 1. S. Rao., R. K. Jain., H.L. Saluja., "Electrical safety, fire safety Engineering and safety management", Khanna Publishers New Delhi, 2nd Edition, 2021 2. Pradeep Chaturvedi, "Energy management policy, planning and utilization", Concept Publishing company, New Delhi, 1997. 3. V. K.Mehta, Rohit Mehta, "Principles of Power Systems", S Chand Publications, 4th Edition, 2008. 4. The Electricity Act, 2003, https://cercind.gov.in/Act-with-amendment.pdf	

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Course Outcomes:

After successful completion of this course the student will be able to:

1. Identify the type of the electric shock and suggest probable electric safety & security measures in the given electric system
2. Analyze the safety & grounding requirements in Residential, Commercial, Agricultural installations and suggest best practices with use of electricity
3. Carry out detailed fault investigation and suggest the methods to rescue & first aid approaches in case of electrical accidents
4. Analyze the need for safety devices and requirements in the electric systems

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1			1	1	1				1						
2		1	2	1	2		1					1			
3		1	2	1	2		1		1			1			
4		1	2	1	2		1					1			

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE617N	Energy Storage Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
Energy storage systems overview - Scope of energy storage, needs and opportunities in energy storage, Technology overview and key disciplines, comparison of time scale of storages and applications, Energy storage in the power and transportation sectors. Importance of energy storage systems in electric vehicles, Current electric vehicle market. **Thermal storage system**-heat pumps, hot water storage tank, solar thermal collector, application of phase change materials for heat storage-organic and inorganic materials, efficiencies, and economic evaluation of thermal energy storage systems.	
UNIT – II	**10 Hours**
Chemical storage system- hydrogen, methane etc., concept of chemical storage of solar energy, application of chemical energy storage system, advantages and limitations of chemical energy storage, challenges, and future prospects of chemical storage systems **Electromagnetic storage systems** - double layer capacitors with electrostatically charge storage, superconducting magnetic energy storage (SMES), concepts, advantages and limitations of electromagnetic energy storage systems, and future prospects of electrochemical storage systems.	
UNIT – III	**10 Hours**
Electrochemical storage system **Batteries-**Working principle of battery, primary and secondary (flow) batteries, battery performance evaluation methods, major battery chemistries and their voltages- Li-ion battery& Metal hydride battery vs lead-acid battery. **Super capacitors-** Working principle of super capacitor, types of super capacitors, cycling and performance characteristics, difference between battery and super capacitors, Introduction to Hybrid electrochemical super capacitors **Fuel cell:** Operational principle of a fuel cell, types of fuel cells, hybrid fuel cell-battery systems, hybrid fuel cell-super capacitor systems.	
UNIT – IV	**10 Hours**
Battery design:- Battery design for transportation, Mechanical Design and Packaging of Battery Packs for Electric Vehicles, Advanced Battery-Assisted Quick Charger for Electric Vehicles, Charging Optimization Methods for Lithium-Ion Batteries, Thermal run-away for battery systems, Thermal management of battery systems, State of Charge and State of Health Estimation Over the Battery Lifespan, Recycling of Batteries from Electric Vehicles	
Reference Books: 1. Frank S. Barnes and Jonah G. Levine, Large Energy Storage Systems Handbook (Mechanical and Aerospace Engineering Series), CRC press (2011) 2. Ralph Zito, Energy storage: A new approach, Wiley (2010) 3. Pistoia, Gianfranco, and Boryann Liaw. Behaviour of Lithium-Ion Batteries in Electric Vehicles: Battery Health, Performance, Safety, and Cost. Springer International Publishing AG, 2018. 4. Robert A. Huggins, Energy storage, Springer Science & Business Media (2010) 5. Ibrahim Dincer and Mark A. Rosen, Thermal Energy Storage Systems and	

Applications, John Wiley & Sons, 3rd Edition, 2021.

6. Ru-shi Liu, Lei Zhang and Xueliang sun, electrochemical technologies for energy storage and conversion, Wiley publications, 2nd Volume set, 2012.
7. James Larminie and Andrew Dicks, Fuel cell systems Explained, Wiley publications, 3rd Edition, 2018.

Course Outcomes:

After completion of the course the students will be able to,

1. Identify the requirement, current status and future prospectus of energy storage.
2. Describe and compare various thermal, chemical energy storage technologies on the basis of technical characteristics.
3. Verify various types of energy losses and the associated energy efficient technologies for the routinely used thermal, chemical and electrical energy systems.
4. Design and Model the battery storage system and its applications

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1		1	1	1	1										
2		1	1	2	2										
3		1	1	2	2										
4		1	1	1	1										

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE725C	Power System - IV	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Automatic Load Frequency Control: Introduction, Control loops of power systems modeling of Automatic Load Frequency Control (ALFC) of single area systems, performance of ALFC. ALFC of two area systems, expression for tie-line flow and frequency deviation, parallel operation. Generation Control: Supplementary Control Action, Tie line Control, Generation Allocation. **Control of Voltage and Reactive Power:** Introduction, generation and absorption of reactive power, methods of voltage control: Shunt reactor, shunt capacitor, series capacitor, tap changing transformer and booster transformer Compensating Devices-Characteristics of SVC, TCR, TSC and STATCOM. voltage stability, PV and QV curves, voltage collapse, prevention of voltage collapse**.**	
UNIT – II	**(10 Hours)**
Unit Commitment: Statement of the problem, need and importance of unit, constraints in unit commitment, spinning reserve, Thermal Unit Constraints, Other constraints, Hydro constraints, Must Run, Fuel constraints, Unit commitment Solution methods: Priority-List methods, Dynamic Programming solution. Reliability Considerations, Patton's Security Function, Security constrained Optimal Unit Commitment **Interchange of Power and Energy:** Introduction, Economy Interchange between Interconnected Utilities, Infertility Economy Energy Evaluation, Multiple-Utility Interchange Transaction, Power pools, Transmissions Effects and Issues	
UNIT – III	**(10 Hours)**
Power System Security: Introduction, factors affecting power system security, power system contingency analysis, detection of network problems, network sensitivity methods, calculation of network sensitivity factor, contingency ranking **Power System State Estimation:** Introduction, power system state estimation, maximum likeli-hood weighted least-square estimation, maximum likeli- hood concept with example, matrix formulations, Detection and Identification of bad measurements	
UNIT – IV	**(10 Hours)**
Power System SCADA: Introduction, building blocks of SCADA, Remote Terminal Unit (RTU)-Evolution and Components of RTU, Communication Subsystem, Logic subsystem, Termination subsystem, HMI subsystem, Advanced RTU functionalities. **Intelligent Electronic Device (IED)-**IED functional block diagram, hardware and software architecture of IED, IED communication systems. Data concentrator and merging units, SCADA communication system, Master station, Human Machine Interface (HMI), Building SCADA system, Classification of SCADA,SCADA implementation and Case studies in SCADA	

Reference Books:

1. Allaen J Wood Bruce F. Wollenberg, “Power Generation, Operation and Control”, 2nd Edition, John Wiley and Sons, Reprint 2014.
2. G.L. Kusic, “Computer Aided Power System Analysis”, 2nd Edition, PHI, 1992.
3. T.J.E Miler, “Reactive Power Control in Electric Power Systems”, John Wiely and Sons NY, 1982.

4. Mini S Thomas, Jhon D. McDonald. "Power System SCADA and Smart Grid", CRC press Taylor and Francis groups, 2015.
5. Nagrath,I.J., Kothari,D.P, "Modern Power SystemAnalysis", 4th Edition, TMH, 2014.
6. Prabha Kundur, "Power System Stability and Control", 9th reprint, TMH, 2009.

Course Outcomes:

After completion of the course the students will be able to,

1. Analyze and design automatic load frequency control (ALFC) and voltage control strategies in power systems, including modeling of single and two-area systems, reactive power management, and the application of compensating devices to enhance system stability and prevent voltage collapse.
2. Evaluate and apply unit commitment strategies and economic interchange methods in interconnected power systems, considering system constraints, reliability, and transmission effects to ensure optimal and secure operation.
3. Assess and improve power system security through contingency analysis, sensitivity methods, and state estimation techniques, using tools like maximum likelihood estimation and matrix formulations to detect network issues and ensure system reliability.
4. Describe the concepts behind the design and operation of SCADA systems, including the roles of Remote Terminal Units (RTUs), Intelligent Electronic Devices (IEDs), communication subsystems, and Human-Machine Interfaces (HMIs) for effective power system monitoring and control.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE705C.1	1	3	2	1							1	3		1
2	22UEE705C.2	1	3	2	1							1	3		1
3	22UEE705C.3	1	3	2	1							1	3		1
4	22UEE705C.4	1	1	1	1							1	3		1

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

Professional Elective Course – III

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE731E	Smart Grids	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Smart Grid Architectural Designs: Introduction, Today's Grid versus the Smart Grid, Energy Independence and Security Act of 2007: Rationale for the Smart Grid, Computational Intelligence, Power System Enhancement, Communication and Standards, Environment and Economics, General View of the Smart Grid Market Drivers, Stakeholder Roles and Function, Working Definition of the Smart Grid Based on Performance Measures, Representative Architecture, Functions of Smart Grid Components. **Smart Grid Communications and Measurement Technology:** Communication and Measurement, Monitoring, PMU, Smart Meters, and Measurements Technologies, GIS and Google Mapping Tools, Multiagent Systems (MAS) Technology, Microgrid and Smart Grid Comparison. **Performance Analysis Tools for Smart Grid Design:** Introduction to Load Flow Studies, Challenges to Load Flow in Smart Grid and Weaknesses of the Present Load Flow Methods, Load, Flow State of the Art: Classical, Extended Formulations, and Algorithms, Congestion Management, Effect, Load Flow for Smart Grid Design.	
UNIT – II	**(10 Hours)**
Stability Analysis: Introduction to Stability, Strengths and Weaknesses of Existing Voltage Stability Analysis Tools, Voltage Stability Assessment, Voltage Stability Assessment Techniques, Voltage Stability Indexing, Analysis Techniques for Steady-State Voltage Stability Studies, Optimizing Stability Constraint through Preventive Control of Voltage Stability, Angle Stability Assessment. **Computation Tools for Smart Grid:** Introduction to Computational Tools, Decision Support Tools, Optimization Techniques, Classical Optimization Method, Heuristic Optimization, Evolutionary Computational Techniques.	
UNIT – III	**(10 Hours)**
Pathway for Designing Smart Grid: : Introduction to Smart Grid Pathway Design, Barriers and Solutions to Smart Grid Development, Solution Pathways for Designing Smart Grid Using Advanced Optimization and Control Techniques for Selection Functions, General Level Automation, Bulk Power Systems Automation of the Smart Grid at Transmission Level, Distribution System Automation Requirement of the Power Grid, End User/Appliance Level of the Smart Grid, Applications for Adaptive Control and Optimization. **Renewable Energy and Storage:** Renewable Energy Resources, Sustainable Energy Options for the Smart Grid, Penetration and Variability Issues Associated with Sustainable Energy Technology, Demand Response Issues, Electric Vehicles and Plug-in Hybrids, PHEV Technology, Environmental Implications, Storage Technologies, Tax Credits.	
UNIT – IV	**(10 Hours)**
Interoperability, Standards, and Cyber Security: Introduction, Interoperability, Standards, Smart Grid Cyber Security, Cyber Security and Possible Operation for Improving Methodology for Other Users. **Research, Education, and Training for the Smart Grid:** Introduction, Research Areas for Smart Grid Development, Research Activities in the Smart Grid, Multidisciplinary Research	

Activities, Smart Grid Education, Training and Professional Development.

Case Studies and Test beds for the Smart Grid:

Introduction, Demonstration Projects, Advanced Metering, Microgrid with Renewable Energy, Power System Unit Commitment (UC) Problem, ADP for Optimal Network Reconfiguration in Distribution Automation, Case Study of RER Integration, Testbeds and Benchmark Systems, Challenges of Smart Transmission, Benefits of Smart Transmission.

Reference Books:

1. James Momoh., "Smart Grid, Fundamentals of Design and Analysis", 1st Edition, Wiley, 2012.
2. Clark W Gellings, "The Smart Grid, Enabling Energy Efficiency and Demand Side Response"- CRC Press, 2009.
3. Yokoyama, Nick Jenkins, "Smart Grid: Technology and Applications"- Wiley, 2012.

Course Outcomes:

After completion of the course the students will be able to,

1. Identify the smart measuring instruments for two way communication of each components in grid.
2. Apply the suitable load flow analysis technique for exiting distribution system.
3. Evaluate the optimal value for distribution system including renewable energy and storage systems.
4. Formulate the existing distribution for the conversion to smartgrid using standards as for the case studies.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE731E.1	3	2	2	2	3					1		3	2	2
2	22UEE731E.2	3	3	2	3	2					1		3	3	2
3	22UEE731E.3	3	3	3	3	3		2		1	2	2	3	3	3
4	22UEE731E.4	3	3	3	3	2	2	2	2	2	3	2	3	3	3

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE732E	Electric Vehicles	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
Introduction to EV: Historical Background, Benefits of Using Evs, Overview of types of Evs and its Challenges, EV Motor Drive Technologies, EV Energy Source Technologies, EV Battery Charging Technologies, EV Vehicle to Grid **EV Subsystem**: EV Subsystems and Configurations, HEV Subsystems and Configurations. HEV Subsystems and Configurations, Motion and dynamic equations for vehicles	
UNIT – II	**10 Hours**
Energy Storage: Batteries-Overview of Batteries, Battery Parameters, Lead Acid Batteries, Lithium Batteries, Metal Air Batteries. Alternative and Novel Energy Sources-Solar Photovoltaics, Flywheels, Super Capacitors. Fuel Cells-Main issues in the fuel cell, Hydrogen Fuel Cells: Basic Principles, Fuel Cell Thermodynamics (Introduction)	
UNIT – III	**10 Hours**
Architecture of EV and HEV: Vehicle Power Plant and Transmission Characteristics- Introduction, Drive train Configuration, Vehicle power plant, Internal combustion engine, Electric Motor, The need for gearbox, Drive train tractive effort and vehicle speed, Vehicle performance. Basic Architecture of Hybrid Drive Trains and Analysis of Series Drive Train- The Hybrid Electric Vehicle (HEV), Energy Use in Conventional Vehicles, Energy Savings Potential of Hybrid Drivetrains, HEV Configurations, Series and parallel Hybrid System.	
UNIT – IV	**10 Hours**
Power Flow in HEVs: Introduction, Power Flow Control, Power Flow Control in Series Hybrid, Power Flow Control in Parallel Hybrid, Power Flow Control in series-Parallel Hybrid, Power Flow Control Complex Hybrid Control	

Reference Books:

1. Iqbal Hussein, “Electric and Hybrid Vehicles: Design Fundamentals”, CRC Press, 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 2004.
3. James Larminie, John Lowry, “Electric Vehicle Technology Explained”, Wiley publications, 2003.

Course Outcomes:

After completion of the course the students will be able to,

1. Illustrate the evolution, classification, and components of electric and hybrid vehicles.
2. Analyze different energy storage and alternative energy sources used in EV applications.
3. Interpret the drive-train architecture and vehicle dynamics of electric and hybrid vehicles.
4. Evaluate the power flow control strategies in various hybrid electric vehicle configurations.

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE732E.1	3	2					2					3		
2	22UEE732E.2	3	3	2									2	3	
3	22UEE732E.3	3	2	3	2								3	3	2
4	22UEE732E.4	2	2	3	3	2							2	3	3

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE733E	Solar Photovoltaic Systems Design	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Chapter-01: Solar Energy – Introduction and its scenario of India and global; Solar Radiation – solar radiation spectrum, diffuse & beam radiation and solar radiation measurement.

Chapter-02: Solar Cells – I-V & P-V characteristics; Technologies; Parameters; Factors affecting electricity generated; series, parallel and series & parallel connections; Numerical problems.

UNIT – II	(10 Hours)

Chapter-03: SPV module – Ratings, standard parameters; factors affecting electricity generated; I-V & P-V Characteristics; connection of modules in series, parallel and series & parallel; Mismatch in series and parallel connections, Introduction to arrays.

Chapter-04: Balance of System (BoS) - Batteries; Charge Controllers; MPPT; Inverters. (BoS to cover functions, working, types, features, typical specifications and cost). Numerical problems.

UNIT – III	(10 Hours)

Chapter-05: Wires – Introduction, basics of current conduction, types of wires, measurement of wire dimensions, wire sizing; junction box;

Chapter-06: Installation, troubleshooting of stand-alone and grid connected solar PV power systems; Safety of SPV power plants; Solar PV plant installation check list – Electrical testing of PV array, inverter; islanding protection; commissioning and system functioning. Field visits within campus to study installations.

UNIT – IV	(10 Hours)

Chapter-07: SPV system design and integration – Types of SPV systems; Design Methodology for Stand-alone SPV systems.

Chapter-08: Grid connected Solar PV Power Systems (GCSPVPS) – Introduction, Configurations & Components of GCSPVPS, GCSPVPS Design for small applications and for power plants.

Reference Books:

1. Chetan Singh Solanki, "Solar Photovoltaics – Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi, 3rd Edition, 2015.
2. Chetan Singh Solanki, "Solar Photovoltaic Technology and Systems – A Manual for Technicians, Trainers and Engineers", PHI Learning Private Limited, New Delhi, 2014
3. Tiwari, G. N and Ghosal, M. K., "Fundamentals of Renewable Energy Sources", Alpha Science International Ltd, New Delhi, 2007.

Course Outcomes:

After completion of the course the students will be able to,

1. Analyze the performance of solar photovoltaic systems under varying load and environmental conditions using numerical and analytical methods.
2. Apply knowledge of solar PV system components and configurations to select appropriate systems for specific applications.
3. Evaluate the operation, testing, and troubleshooting of solar PV systems and their

components ensuring safe and effective performance.

4. Design stand-alone and grid-connected solar photovoltaic systems based on specific load requirements and integration methodologies.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE733E.1	3	3	2	2	2		2			2		3	2	2
2	22UEE733E.2	3	2	2	2	3		2			2		3	3	2
3	22UEE733E.3	3	3	3	3	3	2	2			2	2	3	3	3
4	22UEE733E.4	3	3	3	3	3	2	2		2	3	2	3	3	3

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE734E	Reactive Power Management	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction Importance of reactive power control in electrical power system, objectives of load compensation, ideal compensator, load compensation specific of a compensator, power factor correction and voltage regulation in single phase system, reactive power bias.	
UNIT – II	**(10 Hours)**
Basic requirement in AC power transmission Factor affecting stability and voltage, uncompensated Transmission line: performance equations and performance requirement of lines, voltage profile, voltage-power characteristics, load ability characteristics. Transmission line compensation: types passive/active compensators, series/shunt compensation and compensation by sectioning.	
UNIT – III	**(10 Hours)**
Harmonics Characteristics and un characteristics harmonics, sources, troubles caused by harmonics on electrical equipment, means of reducing harmonics, types of harmonic filters, DC filters IEEE 519-1992 guidelines telephone interferences.	
UNIT – IV	**(10 Hours)**
Reactive power co-ordination Reactive power management and planning, utility objectives, practices, transmission benefits, reactive power dispatch & equipment impact, reactive power forecasting, reactive power control by DSM, power pooling.	

Reference Books:

1. T. J. E. Miller, “Reactive Power Control in Electric Power Systems”, John Wiley & Sons NY 2009
2. D. Tagare, “Reactive Power Management”, TMH, 1st Edition, 2004.
3. Prabha Kundur, “Power System Stability and Control”, TMH 9th reprint, 2007.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply suitable compensation scheme for load and power factor correction
2. Investigate performance of the transmission lines through voltage-power and loadability characteristics
3. Identify type of harmonics in transmission line by calculating magnitude of harmonics
4. Develop reactive power management scheme for utilities

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE734E.1	3	2	1	3	2				1	2	2	3	2	2
2	22UEE734E.2	3	3	3	1	3				1	1	2	3	2	1
3	22UEE734E.3	3	2	2	2	2				1	1	2	3	3	2
4	22UEE734E.4	3	2	3	2	3				1	2	2	3	3	2

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE735E	Power System Planning	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction of Power Planning: National and regional planning, structure of power system, planning tools, electricity regulation, Load forecasting, forecasting techniques, modeling. **Generation Planning:** Integrated power generation, co-generation / captive power, power pooling and power trading, transmission and distribution planning.	
UNIT – II	**(10 Hours)**
Power System Economics: Power system economics, power sector finance, financial planning, private participation, rural electrification investment, concept of rational tariffs. **Computer Aided Planning:** Wheeling, environmental effects, greenhouse effect, technological impacts, insulation co-ordination, reactive compensation.	
UNIT – III	**(10 Hours)**
Power System Reliability: Reliability definition, system reliability, system adequacy and security, reliability planning, reliability evaluation, functional zones, generation, transmission, reliability target, quality of supply.	
UNIT – IV	**(10 Hours)**
System Operation Planning: Operations, Maintenance, Load management, Load prediction, Reactive power balance, Power grid, Online power flow studies, State estimation, Computerized management, Power system simulator.	

Reference Books:

1. A.S.Pabla, Macmillan “Electrical Power System Planning”, (1st Edition), India Ltd, 2016.
2. M. E. Van Valkenburg, "Network analysis", 3rd Edition, PHI Learning, 2014.
3. Charles E Ebeling by “Reliability and Maintainability Engineering”, 1st Edition, Tata McGraw Hill, 2004.

Course Outcomes:

After completion of the course the students will be able to,

1. **Analyze** the structure of national and regional power systems, and apply forecasting techniques and planning tools for effective generation, transmission, and distribution planning.
2. **Evaluate** the economic aspects of power system planning, including tariff structuring, investment strategies, financial modeling, and the role of private participation in the power sector.
3. **Assess** the reliability of power systems by evaluating generation, transmission, and distribution adequacy using system reliability models and performance indicators.
4. **Develop** strategies for power system operation through load management, state estimation, reactive power balancing, and the application of simulation and computerized planning tools.

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE735E.1	3	2	2		2						1	2	3	1
2	22UEE735E.2	2	3	2		2	1					1	2	3	2
3	22UEE735E.3	3	3	2	2	2						1	2	3	1
4	22UEE735E.4	3	2	3	2	3						1	2	3	2

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE736E	HVDC Transmission	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
General Aspects of DC Transmission: Historical sketch, constitution of EHVAC and DC links, Limitations and Advantages of AC and DC Transmission and comparison of DC with AC transmission **Analysis of the Bridge Converter:** Analysis with grid control but no overlap, Analysis with grid control and with overlap less than 60 deg, Analysis with overlap greater than 60 deg, complete characteristics of rectifier, Inversion.	
UNIT – II	**(10 Hours)**
Control of HVDC Converters and Systems: Grid control, basic means of control, power reversal, limitations of manual control, constant current versus constant voltage, desired feature of control, actual control characteristics, constant -minimum -Ignition –angle control, constant –current control, constant –extinction –angle control, stability of control. Grid control, basic means of control, power reversal, limitations of manual control, constant current versus constant voltage, desired feature of control, actual control characteristics, constant -minimum -Ignition –angle control, constant –current control, constant –extinction –angle control, stability of control.	
UNIT – III	**(10 Hours)**
Smoothing Reactor and DC Line: Smoothing reactor, voltage oscillations and valve dampers, current oscillations and anode dampers, DC line oscillations and line dampers, clear line faults and reenergizing the line, DC Breakers, Effects of proximity of AC and DC Transmission Lines **Harmonics, Filters and Torsional Interaction:** Generation of Harmonics, design of AC filters, DC filters, harmonic interactions and torsional interaction. Torsional interactions with HVDC systems, counter measures to torsional interaction with DC systems	
UNIT – IV	**(10 Hours)**
Multiterminal DC Systems: Potential Applications of MTDC Systems, Types of MTDC Systems, Control and protection of MTDC systems, study of MTDC systems **Power Flow Analysis in AC/DC Systems:** Modeling of DC Links, solution of DC load flow, per unit system for DC quantities, solution of SC-AC power flow. An example: Five terminal DC system.	
Reference Books: 1. Prabha Kundur, “Power System Stability and Control”, TMH, 5th reprint 2008. 2. EW Kimbark, “Direct current Transmission”,Vol.No1, John Wiley, New York, 1971 3. K R Padiyar, “HVDC Power Transmission Systems Technology and System Interation”, (3rd Edition), New Age International Publishers, Reprint 2017.	
Course Outcomes: After completion of the course the students will be able to, 1. Explain the principles of HVDC transmission and analyze converter characteristics. 2. Evaluate control strategies for HVDC systems and their impact on system performance	

3. Analyze filtering, harmonic effects, line protection, and system stability in HVDC systems
4. Examine MTDC system configurations and perform power flow analysis in AC/DC systems

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE736E.1	3	3	2	2			2					3	2	
2	22UEE736E.2	3	3	3	3	2							2	3	2
3	22UEE736E.3	3	2	3	2	2							2	3	3
4	22UEE736E.4	3	3	3	3	3							3	3	3

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

Professional Elective Course – IV

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE741E	Flexible AC Transmission Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Review of AC transmission lines: Electrical characteristics, performance equations, natural or surge impedance loading, equivalent circuit of a transmission line, performance requirements of power transmission lines, voltage and current profile under no load.

Power transfer and stability considerations, Principles of transmission system compensation - series and shunt, Compensation by line sectioning, Concept of flexible AC transmission, FACTS-Benefits, Types and Brief descriptions.

UNIT – II	(10 Hours)

Static Shunt Compensators: Objective of shunt compensation, Methods of controllable VAR Generation. SVC and STATCOM: Operating principle, Regulation slope, Transfer function and Dynamic performance, Transient stability enhanced and power oscillation damping, VAR Reserve Control.

Comparison between STATCOM and SVC: V-I and V-Q Characteristics, Transient Stability, Response Time, Capability to Exchange real power, operating with unbalanced AC system, Physical size and Installation, Merit of hybrid compensator, Static Var Systems.

UNIT – III	(10 Hours)

Static Series Compensators GCSC, TSSC, TCSC: Objectives of series compensation, Voltage stability, Improvement of transient stability, power oscillation damping, sub synchronous oscillation damping, approaches to controlled series compensation.

Variable Impedance Type series compensators: GTO Thyristor- controlled series capacitor (GCSC), Thyristor-Switched Series Capacitor (TSSC), Thyristor Controlled Series Capacitor (TCSC), Thyristor- Controlled Voltage and Phase Angle Regulators (TCVRs and TCPARs).

UNIT – IV	(10 Hours)

Unified Power Flow Controller (UPFC): Basic operating principle, control capabilities, implementation, comparison to series compensators and Phase Angle Regulators, Control structure, Dynamic performance. Interline Power Flow Controller (IPFC): operating Principle, control structure and Applications.

Dynamic Voltage Restorer (DVR) – Introduction to DVR, overview of voltage sag and swells.

Reference Books:

1. Narain G. Hingorani and Lazlo Gyugyi, Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, IEEE Press and John Wiley & Sons, Inc, 2000.
2. Prabha Kundur, Power System Stability and Control Tata McGraw Hill Publishers, New Delhi, 2006.
3. R. Mohan Mathur, Static Controllers for Electrical Transmission Systems, IEEE Press and John Wiley & Sons, Inc. 2008.
4. R. Mohan Mathur, Rajiv K Varma, Thyristor-Based FACTS Controllers for Electrical Transmission Systems, IEEE Press and John Wiley & Sons, Inc. 2008.

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

Course Outcomes:

After completion of the course the students will be able to,

1. Analyze the operations of different FACTS devices on a given transmission line and assess the impact of FACTS controller
2. Choose proper controller for the specific application based on system requirements
3. Interpret the control circuits of Shunt Controllers SVC & STATCOM for various functions viz. Transient stability Enhancement, voltage instability prevention and power oscillation damping
4. Detect the Power and control circuits of Series Controllers GCSC, TSSC and TCSC

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE741E.1	3	2	1	3	2				1	2	2	3	2	2
2	22UEE741E.2	3	2	2	1	3				1	2	2	2	2	1
3	22UEE741E.3	3	2	2	2	2				1	1	2	2	3	2
4	22UEE741E.4	3	2	3	2	3				1	2	2	3	3	2

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE742E	Battery Management Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Battery-Management-System Requirements: Introduction and BMS functionality. Requirements: Sensing, High-voltage contactor control, Isolation sensing and thermal control, Protection and interface, State-of-charge estimation and Energy & power estimation.	
UNIT – II	**(10 Hours)**
Battery State Estimation: Preliminary definitions, approaches to estimate state of charge, Review of probability, Overview of vector random (stochastic) processes, Sequential-probabilistic-inference solution, The six-step process, Deriving the linear Kalman filter, Visualizing the Kalman filter, MATLAB code for the Kalman filter steps, Practical considerations, The extended Kalman filter (EKF)	
UNIT – III	**(10 Hours)**
Battery Health Estimation: Introduction, Lithium-ion aging: Negative electrode, Lithium-ion aging: Positive electrode, Sensitivity of voltage to ESR and total capacity, A Kalman filter framework for estimating parameters, EKF for parameter estimation, Simultaneous state and parameter estimation, Robustness and speed, The problem with least-squares capacity estimates, Derivation of weighted ordinary least squares, Derivation of weighted total least squares, Goodness of the model fit and confidence intervals, Simplified method with proportional confidence on xi and yi.	
UNIT – IV	**(10 Hours)**
Cell Balancing: Causes (and not causes) of imbalance, Design choices when implementing balancing, Circuits for balancing (1): Passive, Circuits for balancing (2): Active, capacitive, Circuits for balancing (3): Active, inductive and dc-dc, How quickly must I balance a pack? And results of balancing simulations. Voltage-Based Power-Limit Estimation: Problem definition, Voltage-based rate limits, using simple cell model, Voltage-based rate limits, using comprehensive cell model, Bisection search and Power-limits estimation example.	
Reference Books: 1. A.R. JHA, Next-Generation Batteries and Fuel Cells for Commercial, Military, and Space Applications, CRC Press, 2012. 2. Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric, Springer, 2013. 3. Gregory L. Plett, Battery Management Systems, Volume 1: Battery Modeling , Artech House September 2015	
Course Outcomes: After completion of the course the students will be able to, 1. Explain the functional requirements and critical roles of a Battery Management System (BMS) in electric energy systems. 2. Apply probabilistic and filtering techniques for battery state estimation using Kalman and Extended Kalman Filters. 3. Evaluate battery health and degradation mechanisms using statistical and estimation	

models.

4. Analyze balancing circuits and estimate voltage-based power limits for optimal battery pack performance

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE742E.1	3	2	2									3	2	
2	22UEE742E.2	3	3	3	3	3							2	3	3
3	22UEE742E.3	3	3	3	3	2							2	3	3
4	22UEE742E.4	2	3	3	2	2							2	3	3

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE743E	Energy Conservation, Audit and DSM	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Energy Scenario: Introduction to Energy; Units and Conversions; GDP, GNP and Per Capita Energy Consumption; Renewable Energy Act, International Energy Agency, OECD and Kyoto Protocol (only overview)

Economic Analysis of Energy: Economic analysis of investment, Cash Flows and CF diagrams, Economic analysis technique – Simple payback period method, Discounted cash flow method or Time adjustment technique, Net present value method, Present value index method or Profitability index method, Internal rate of return method, Accounting on average rate of return method; Interest Factors – Single Payment Compound Amount (SPCA), Single Payment Present Worth (SPPW), Uniform Series Compound Amount (USCA), Sinking Fund Payment (SFP), Uniform Series Present Worth (USPW), Capital Recovery (CR). (Simple Numerical problems).

UNIT – II	(10 Hours)

Motors: Introduction, Motor Efficiency, Motor Selection; Determination of energy saving, Energy saving options in oversized motors, Effect of variation of voltage on performance of motor, Effect on efficiency due to variation in load; Energy Efficient Motors, Choice of energy efficient motor, Factors Affecting Energy Efficiency, Rewinding Effects on Energy Efficiency, Standards and Star Labeling of Energy Efficient Induction Motors.

Lighting: Introduction, Terms and definitions – Lumen, Lux, Load efficacy, Lamp circuit efficacy, Colour rendering index (CRI); Characteristic of different types of lamps, Aspects of lighting system designing, Installed load efficacy ratio, Various means of energy savings – Use of natural day light, Reduction in light fixture, High efficiency lamps and luminaries, Effect of reduction in supply voltage on energy consumption, Timers and occupancy sensors.

UNIT – III	(10 Hours)

Energy Management and Audit: Energy management; Developing energy use profiles; Sankey Diagram; Process flow diagrams; Material and energy balance; Energy auditing instruments. Energy audit – Need for energy audit, Scope of energy audit, Types of energy audit – Preliminary energy audit, Detailed energy audit.

UNIT – IV	(10 Hours)

Energy Conservation: Introduction, Results of energy conservation, Principles of energy conservation, Energy conservation planning, Energy conservation Act,; Energy conservation in residential and commercial sectors, Energy conservation in transportation, considerations for Energy conservation in industry, Energy conservation in electricity generation, transmission and distribution, Energy conservation in agricultural sector.

Demand Side Management: Introduction to DSM – Definition, Evolution, Benefits and Scope; Role of Energy Companies, Load Management, Application of Load Control, DSM Implementation Issues, Strategies to implement and Promote DSM, Customer acceptance of DSM, Environment & DSM, International experience with DSM, DSM in India.

Reference Books:

1. Suresh Kumar Soni and Manoj Nair, “Energy Conservation and Audit”, Satya Prakashan, New Delhi, 2010.

2. Rajiv Shankar, “Energy Auditing in Electrical Utilities”, Viva Books, New Delhi, 2010.
3. Larry C. White, Philip S. Schmidt, David R. Brown, “Industrial Energy Management Systems”, Hemisphere Publishing Corp, New York.
4. Albert Thumann, “Fundamentals of Energy Engineering”, Prentice Hall Inc, Englewood Cliffs, New Jersey.
5. Gupta, B. R., “Generation of Electrical Energy”, Eurasia Publishing House Pvt. Ltd., New Delhi, 6th, 2006

Course Outcomes:

After completion of the course the students will be able to,

1. Solve issues & interpret outcomes related to energy economics and energy efficient motors
2. Compare & contrast on selection of energy economic techniques, lighting criterion, energy efficient motors and energy alternative from DSM techniques
3. Evaluate various methods of energy conservation and DSM in different sectors like agriculture, commercial, transpiration and domestic
4. Design and develop methods/techniques for energy conservation, audit & management

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE743E.1	1	2	2	3								3		1
2	22UEE743E.2	1	2	3	3			1		1	1		3		1
3	22UEE743E.3	1	2	3	3			1		1	1		3		1
4	22UEE743E.4	1	2	3	3						1		3		1

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE744E	Energy Efficient Motors	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction: Need for energy efficient machines, energy cost and two part tariff, energy conservation in industries and farms -a necessity, introduction to energy management and energy audit system. Review of induction motor characteristics.	
UNIT – II	**(10 Hours)**
Power Factor: The power factor in sinusoidal systems, power factor improvement, power factor with nonlinear loads, Harmonics and the power factor.	
UNIT – III	**(10 Hours)**
Energy Efficient Motors: Standard motor efficiency, why more efficient motors? An energy efficient motor, efficiency determination methods, Direct Measurement method, Loss segregation method, Comparison, motor efficiency labelling, energy efficient motor standards. Motor life cycle.	
UNIT – IV	**(10 Hours)**
Induction Motors and Adjustable Drive Systems: Energy Conservation, adjustable speed systems, Application of adjustable speed systems to fans, pumps and constant torque loads.	

Reference Books:

1. Witte. L.C., P.S. Schmidt, D.R. Brown, “Industrial Energy Management and Utilisation”, Hemisphere Publishers, Washington, 1988.
2. Callaghn, P.W. “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.
3. Dryden. I.G.C., “The Efficient Use of Energy”, Butterworths, London, 1982
4. Turner. W.C., “Energy Management Hand book”, Wiley, New York, 1982.
5. Murphy. W.R. and G. Mc KAY, “Energy Management”, Butterworths, London 1987.

Course Outcomes:

After completion of the course the students will be able to,

1. Examine the need for energy efficiency in machines and industries, and analyze the role of energy audits and management systems in reducing energy costs.
2. Analyze the concept of power factor under linear and nonlinear loads and evaluate its significance in energy conservation.
3. Evaluate the performance of energy efficient motors using efficiency determination methods and compare with conventional motors.
4. Apply energy conservation techniques in induction motor drive systems and analyze the suitability of adjustable speed drives for various industrial loads.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE744E.1	3	2		2		1	2					2		1
2	22UEE744E.2	3	3		2	2		2					3	2	
3	22UEE744E.3	3	2	3	2								3	3	
4	22UEE744E.4	3	2	3	2	2							3	2	2

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE745E	Wind Energy Conversion Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction: Introduction: Nature of wind, historical uses of wind, history of wind electric generation, working principle of wind turbines (lift and drag mechanism), components of horizontal and vertical axis wind turbines, classification, applications, advantages and disadvantages.	
UNIT – II	**(10 Hours)**
Wind Resource Assessment: Wind Data Analysis: Wind velocity – measurement and representation, wind speed statistics, probability distribution functions – Weibull and Raleigh. **Performance of Wind Turbine Generators:** Basics of fluid mechanics (simple terms & definitions), elementary fluid flow concepts,	
UNIT – III	**(10 Hours)**
Power in the wind: maximum power output of wind turbine (Betz limit), axial force and thrust on blades, torque developed by turbine, dynamic matching for maximum power extraction - tip speed ratio & blade pitch angle, power vs wind speed characteristics, electrical power output from wind energy conversion system, capacity factor, energy production.	
UNIT – IV	**(10 Hours)**
Electric Generators for WECS: Classification, basic working principle, advantages and disadvantages. **Grid-connected and Self-excited Induction Generator Operation:** Constant-voltage, constant-frequency generation, reactive power compensation, variable-voltage, variable-frequency generation, effect of wind generator on the network. **Wind Energy Conversion Systems (WECS):** Stand-alone and grid connected wind farms, simulation model of WECS. Site matching of wind turbine generators. Economics of wind systems: Reliability consideration, estimation of O&M costs, capital costs, cost of energy, estimation of payback period	

Reference Books:

1. Bhadra, S. N., Kashta, D., and Bannerjee, S., Wind Electrical Systems, Oxford University Press, New Delhi, 2009.
2. Gary L. Johnson, Wind Energy Systems, Prentice hall Publication, 1985.
3. G. D. Rai, Non-Conventional Energy Sources, Khanna Publishers New Delhi, 2007.
4. B. H. Khan, Non-Conventional Energy Resources, 2nd Edition, Tata McGraw Hill Publishing Ltd. New Delhi, 2009
5. D. Mukhaerjee and S. Chakrabarti, Fundamentals of Renewable Energy Systems, New Age International Publishers New Delhi, 2007.
6. D. P. Kothari, S. Umashankar, “Wind Energy Systems and Applications”, Narosa publishers, 2017.
7. Khan B. H., Non-Conventional Energy Resources, Tata McGraw Hill, 2009.

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

Course Outcomes:

After completion of the course the students will be able to,

1. Apply the principles of wind energy conversion and turbine operation in analyzing different types of wind turbines and their components.
2. Analyze wind resource data, turbine characteristics, and fluid flow behavior for performance assessment of wind energy systems.
3. Calculate the power output, capacity factor, and economic parameters of wind energy systems using appropriate performance equations and site data.
4. Design wind energy systems for standalone and grid-connected applications considering technical constraints, environmental impact, and economic viability.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE745E.1	3	2	2			2	3					2	1	1
2	22UEE745E.2	3	2	2	2			2					3	1	1
3	22UEE745E.3	3	3	3	3	3		2			2		2	1	1
4	22UEE745E.4	3	3	3	3	3	2	2		2	2		3	1	1

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE746E	AI Applications to Power Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Artificial Intelligence: History and Applications Introduction, Intelligence, Communication, Learning, Artificial Intelligence, History, Early Works, Importance, Definitions, Programming Methods, Techniques, Progress of Artificial Intelligence, Growth of AI, AI and Industry, AI and the world, Current Trends in Applied AI, Modeling, Simulation and AI, Intelligent Systems, Role of IS, Comparisons with conventional programs.	
UNIT – II	**(10 Hours)**
Artificial Neural Network: difference between human machine and intelligence, biological neural network, artificial neuron model, Concept of Perceptron, ADALINE, Feedback in Neural Network, Neural Network Architectures: Neural Learning, Application of Neural Network in Power System **Fuzzy Logic:** Introduction, Foundation of Fuzzy Systems, Representing Fuzzy Elements, Basic Terms and Operations, Properties of Fuzzy Sets, Fuzzification, Arithmetic Operations of Fuzzy Numbers.	
UNIT – III	**(10 Hours)**
Genetic Algorithms and Evolutionary Programming: Introduction, Genetic Algorithms, Procedure of Genetic Algorithms, Genetic Representations, Initialization and Selection, Genetic Operators, Mutation, The Working of Genetic Algorithms, Evolutionary Programming, The Working of Evolutionary Programming.	
UNIT – IV	**(10 Hours)**
Application of AI in Power Systems: Application of Neural Network and Expert Systems in Voltage Control, Application of ANN for security assessment, Schedule Maintenance of Electrical Power Transmission Networks using Genetic Algorithm, Intelligent Systems for Demand Forecasting.	

Reference Books:

1. N. P. Padhy, “Artificial Intelligence and Intelligent Systems”, OXFORD University Press, New Delhi, 2005.
2. Stamations V. Kartalopoulos, “Understanding Neural Networks and Fuzzy Logic: Basic concepts and Applications”, Prentice Hall India Private Limited, New Delhi, 2002.
3. Abhisek Ukil, “Intelligent Systems and Signal Processing in Power Engineering, Springer Berlin Heidelberg”, New York, 2002.
4. Kevin Warwick, Arthur Ekwue and Raj Aggarwal, “Artificial Intelligence Techniques in Power Systems”, IEEE Power Engineering Series, UK, 1997.
5. Rajashekran, S. and VijaylaksmiPai, G.A., “Neural Networks, Fuzzy Logic and Genetic Algorithm Synthesis and Applications”, Prentice–Hall of India Private Limited, 2004.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply the fundamentals of Artificial Intelligence, neural networks, fuzzy logic, and evolutionary algorithms for power system applications.
2. Analyze the behavior of neural networks, fuzzy systems, and genetic algorithms for solving engineering problems.
3. Solve practical problems related to power system operation, control, and

optimization using AI-based tools and techniques.

4. Evaluate the suitability of various AI methods for specific power system applications like voltage control, demand forecasting, and preventive maintenance.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE746E.1	3	2	2	2	2							3	2	2
2	22UEE746E.2	3	3	3	3	2							3	3	2
3	22UEE746E.3	2	3	3	3	3				2	2	2	3	3	2
4	22UEE746E.4	2	3	3	3	3		2		2	2	2	3	3	3

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE728P	**Project Work**	**12 - Credits (0 : 0 : 24)**
Hours/Week : 24		CIE Marks : 50
Total Hours :		SEE Marks : 50

Students have to take up literature survey, formulate the problem of the project, define the project objectives and prepare the project implementation schedule. Project work, based on the problem defined, should be completed and implemented. The implementation of the project work can be done either in a reputed industry/ research organization/ parent institute. A certified report with project demonstration and a seminar is to be presented by the students. The seminar should highlight – Broad project area of their project work carried out.

CIE of 50 marks will be conducted by the Committee consisting of HOD/Nominee + Project Coordinator + Guides as per the rubrics. For SEE, student has to make a presentation of the work carried out to Project Evaluation Committee (PEC- Project coordinator, Hod/Nominee, External Examiner). PEC will allot SEE marks for 50.

Course Outcomes

At the end of this course, students will be able to:

1. Identify, formulate & analyze the engineering problems associated with electrical & electronics engineering and interdisciplinary research.
2. Design & implement proposed solutions for complex engineering problems to meet specified objectives by analyzing / validating the design / solutions of engineering problems using contemporary tools & resources.
3. Prepare engineering documents and make effective presentation to communicate effectively and collaboratively with detailed analysis and interpretation of results to yield valid conclusions.
4. Demonstrate social, ethical cultural & engineering professional responsibilities.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE728P.1	3	3	2	2	1	1	1		2	2	2	3	2	1
2	22UEE728P.2	3	3	3	3	3				2	2	2	3	3	1
3	22UEE728P.3	2	2	2	2	2	2	1		2	3	2	2	3	1
4	22UEE728P.4								3	2	2	2	2	2	1

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UHS721C/22UHS821C	Research Methodology and IPR	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction to Engineering Research **Fundamentals of Research**: Meaning, objectives, and motivation in engineering research. **Types of Engineering Research:** Basic, applied, and translational research; identifying and solving Worthwhile problems. **Research Ethics:** Ethics in engineering research and practice, types of research misconduct, and ethical issues in authorship.	
UNIT – II	**(10 Hours)**
Literature Review and Citations **Technical Reading & Analysis:** Methods for reviewing literature, analyzing prior art, and synthesizing new and existing knowledge. **Bibliographic Databases:** Web of Science, Google, Google Scholar, effective search strategies. **Conceptualizing Research:** Critical and creative reading, taking notes, reading mathematical models, algorithms, and datasheets. **Citations & Acknowledgments:** Attribution, citation styles, impact of keywords, citing datasets, and knowledge dissemination	
UNIT – III	**(10 Hours)**
Intellectual Property Rights (IPR) & Patents: **Introduction to Intellectual Property:** Concepts of property and rights, forms of IPR, role in research and economic development, IP governance, and global innovation indicators. **Patents:** Definition, objectives, criteria for patentability, software/business method patents, infringement, compulsory licensing, and government use of inventions. **Patent Process:** Prior art search strategies, patent databases (free and paid), drafting specifications and claims, filing requirements, jurisdiction, opposition procedures, and renewal. **Filing Requirement of patent:** Patent Application Forms. Work flow chart in obtaining Patents, Jurisdiction of Filing Patent Application. Pre-grant & Post-grant Opposition. Forms to be submitted, filing mechanism through Individual patent office and PCT route. Need for a Patent Attorney/Agent Revocation. Term of Patent, Patent renewal and Fee Structure National Bodies Dealing with Patent Affairs. Utility Models.	
UNIT – IV	**(10 Hours)**
Copyrights and Related Rights: Classes of Copyrights. Criteria for Copyright. Ownership of Copyright. Copyrights of the Author. Copyright Infringements. Copyright Infringement and remedies in case of infringement. Fair Use Doctrine. Copyrights and Internet. Non-Copyright Work. Copyright Registration. Judicial Powers of the Registrar of Copyrights. Fee Structure. Validity of Copyright. Copyright Profile of India. Copyright and the word 'Publish'. Transfer of Copyrights to a Publisher. Copyrights and the Word 'Adaptation'. Copyrights and the Word 'Indian Work'. Joint Authorship. Copyright Society. Copyright Board. Copyright Enforcement Advisory Council (CEAC). International Copyright	

Agreements, Conventions and Treaties. Interesting Copyrights Cases.

Trademarks: Eligibility Criteria. Who Can Apply for a Trademark. Acts and Laws. Classification of Trademarks. Registration of a Trademark. Process for Trademarks Registration. Prior Art Search. Validity of Trademark. Trademark Registry. Famous Case Law: Coca-Cola Company vs. Bisleri International Pvt. Ltd.

Industrial Designs: Eligibility Criteria. Acts and Laws to Govern Industrial Designs. Design Rights. Enforcement of Design Rights. Non-Protectable Industrial Designs India. Protection Term. Procedure for Registration of Industrial Designs. Prior Art Search. Application for Registration. Duration of the Registration of a Design. Importance of Design Registration. Cancellation of the Registered Design. Application Forms. Classification of Industrial Designs. Designs Registration Trend in India. International Treaties. Famous Case Law: Apple Inc. vs. Samsung Electronics Co.

Reference Books:

1. Dr. Santosh M Nejakar, Dr. Harish Bendigeri "Research Methodology and Intellectual Property Rights", ISBN 978-93-5987-928-4, Edition: 2023-24.
2. David V. Thiel "Research Methods for Engineers" Cambridge University Press, 978-1- 107-03488-4
3. Intellectual Property Rights by N.K.Acharya Asia Law House 6th Edition. ISBN: 978-93-81849-30-9
4. P. Naryan, "Intellectual Property Law", 3rd Ed, Eastern Law House, 2007.
5. Dr. S.R. Myneni, "Law of Intellectual Property", 9th edition, Asia law House, 2019.
6. Dr. G.B Reddy, "Intellectual Property Rights and Law", Gogia Law Agency, Hydrabad, Reprint edition 2020.
7. N.R. Subbaram. S. Viswanathan, "Hand book Indian Patent Law and, Practice" Printers and publishers Pvt. Ltd, 2008.
8. Cornish, "Intellectual Property Rights", Universal publications.
9. Dr. B. L. Wadehra, "Law Relating to Intellectual Property" 5th edition, Universal Law publishing Co, Dehli.

Course Outcomes:

After successful completion of this course the student should be able to:

1. Integrate research methodology in engineering sciences in relevant trades.
2. Exhibit reflective thinking in problem solving exercises.
3. Identify criteria to fit one's own intellectual work in particular form of IPRs and able to apply statutory provisions and procedure to protect different forms of IPRs at national and international level.
4. Develop skill of making search using modern tools and techniques and also student is able to become patent agent by cracking patent agent exam.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UHS721C.1		2	2	3	2	1	2	3		1	2			
2	22UHS721C.2		3	2	3		2	2	2			2			
3	22UHS721C.3					2	3	2	3		1	3			
4	22UHS721C.4				2	3	2		1		1				

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE715I/815I	Internship	10 - Credits (0 : 0 : 30)
Hours/Week : 30		CIE Marks : 50
Total Hours : --		SEE Marks : 50

All the students have to undergo mandatory Research/Industrial internship in any one of the reputed industry/ research institute. The internship program has to be taken up during the entire semester. The duration of the training program should be for entire semester for 15 weeks. A report on the internship is to be submitted. The supervisor/ guide from industry shall allot 100 marks of the CIE and the other 100 by the internal evaluation committee. SEE evaluation will be made by a committee comprising of HoD as Chairman/his nominee, internship coordinator and a senior faculty. The SEE will be a Technical Seminar on the industrial training.

Course Outcomes

After undergoing the internship, students shall be able to:

1. Test the theoretical learning in practical situations by accomplishing the tasks assigned during the internship period.
2. Operate the systems/ devices independently and tabulate the experimental results in consultation with supervisor.
3. Apply various soft skills such as time management, positive attitude and communication skills during performance of the tasks assigned in internship organization.
4. Analyze the real time functioning of internship organization.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE815I.1	2	2	2	3	1			1	1		2	1	1	3
2	22UEE815I.2	2	2	1	3	3			1	1		2	1	1	3
3	22UEE815I.3						1	1	3	3	3	2			3
4	22UEE815I.4	2	2	3	3	3	1	1	1	2	2	1	2	2	2

Annexure 8

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Scheme of Teaching and Evaluation for B.E Electrical and Electronics Engineering

2024-25 (admitted batch), 2025-26 (sem 3&4), 2026-27 (sem 5&6), 2027-28 (sem 7&8).

Total Credits for BE=160 (as per VTU/AICTE)

Table-1: Breakdown of Credits suggested by the VTU Belagavi/AICTE New Delhi

Sl.	Category	VTU	AICTE	BEC Present	BEC Revised
1.	HSMC: HSS (English:2, Kannada:1, UHV:1, Constitution:1, EV:1), HRM:3 (Offered by Dept) = 9 AEC (Scientific foundations of Health: 1, Innovation and design Thinking: 1, SS:2, IKS: 1, MOOCS: 3)= 8	14+8=22	15	9+10=19	9+8=17
2.	BSC: Basic Science Courses (Physics, Chemistry and Mathematics)	22	23	22	22
3.	ESC/ETC: Engineering Science Courses (Basic Elect/ Electronics/ Computer/ Mechanics/ Workshop/ Drawing etc.)	18	17	18	18
4.	PCC: Professional Core Courses	57	61	56	61
5.	PEC: Professional Elective Courses relevant to the branch with at least one course either fully or partially supported by industry	12	12	12	12
6.	OEC: Open Electives Courses/ Subjects from other technical/Arts/Commerce (3 MOOCS + 6)	9	12	09	09
7.	Mini (2) and Major projects (9)/Industrial Internships (10)	20	20	24	21
8.	Mandatory Course: PE, Yoga, NSS, Bridge course Maths 1 and 2 (lateral Entry)	00	00	00	00
	Total	160	160	160	160

Table-2: Semester wise Breakdown of Credits

Sem.	BSC	ESC ETC PLC	HSMC	AEC	PCC	PEC	OEC	Proj.	Int.	Total
I	8	9	2	1						20
II	8	9	2	1						20
III	3				17					20
IV	3		1		16					20
V			1	2	9	3	3	2		20
VI				1	13	3	3			20
VII			3		6	6		9		24
VIII				3			3		10	16
Tot.	22	18	9	8	61	12	9	11	10	160

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Semester-I (C Group) CAY 2024-25 (160 Credits 2024-25 admitted batch)

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	BSC (IC)	BMAE101C	Mathematics-I for EEE Stream	4	3	0	2	50	50	100
2.	BSC (IC)	BCHE102C	Applied Chemistry for EEE Stream	4	3	0	2	50	50	100
3.	ESC	BMEB103C	Computer Aided Engineering Drawing	3	2	0	2	50	50	100
4.	ESC - I	BxxA104N	Engineering Science Course-I	3	3	0	0	50	50	100
5.	PLC - I	Bxxx105D	Programming Language Course-I	3	2	0	2	50	50	100
6.	AEC	BHSB106C	Professional Writing Skills in English	1	1	0	0	50	50	100
7.	HSMC	BHSB107C / BHSC107C	Samskrutika Kannada/ Balake Kannada	1	1	0	0	50	50	100
8.	HSMC	BHSB108C	Innovation and Design Thinking	1	1	0	0	50	50	100
			Total	20						

Semester-II (P Group) CAY 2024-25 (160 Credits 2024-25 admitted batch)

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	BSC (IC)	BMAE201C	Mathematics-II for EEE Stream	4	3	0	2	50	50	100
2.	BSC (IC)	BPHE202C	Applied Physics for EEE Stream	4	3	0	2	50	50	100
3.	ESC	BEEA203C	Elements of Electrical Engineering	3	3	0	0	50	50	100
4.	ESC - II	BxxA204N	Engineering Science Course-II	3	3	0	0	50	50	100
5.	ETC – II	Bxxx205B	Emerging Technology Course-II	3	3	0	0	50	50	100
6.	AEC	BHSA206C	Communicative English	1	1	0	0	50	50	100
7.	HSMC	BHSA207C	Indian Constitution	1	1	0	0	50	50	100
8.	HSMC	BHSA208C	Scientific Foundations of Health	1	1	0	0	50	50	100
			Total	20						

Basaveshwar Engineering College, Bagalkote

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Course Category	Course Code	Course Title (L:T:P)
Engineering Science Courses ESC-I/ESC-II	BCVA104N/ BCVA204N BCSA104N/ BCSA204N BEEA104N/ BEEA204N BECA104N/ BECA204N BMEA104N / BMEA204N	Introduction to Civil Engineering (3:0:0) Introduction to C Programming (2:0:2) Introduction to Electrical Engineering (3:0:0) Introduction to Electronics and Communication (3:0:0) Introduction to Mechanical Engineering (3:0:0)
Emerging Technology Courses ETC-I/ ETC-II	BAIA105B/ BAIA205B BCVA105B/ BCVA205B BCVB105B/ BCVB205B BECA105B/ BECA205B BECB105B/ BECB205B BEEA105B/ BEEA205B BISA105B/ BISA205B BMEA105B/ BMEA205B BMEB105B/ BMEB205B BUEA105B/ BUEA205B	Introduction to Cyber Security (3:0:0) Green Building (3:0:0) Waste Management (3:0:0) Introduction to Nano Technology (3:0:0) Introduction to Embedded System (3:0:0) Renewable Energy Sources (3:0:0) Introduction to Internet of Things (IOT) (3:0:0) Smart Materials and Systems (3:0:0) Introduction to Sustainable Engineering (3:0:0) Emerging Applications of Biosensors (3:0:0)
Programming Language Courses PLC-I/PLC-II	BCSA105D/ BCSA205D BCSB105D/ BCSB205D BCSC105D/ BCSC205D BCSD105D/ BCSD205D	Introduction to Web programming (2:0:2) Introduction to Python programming (2:0:2) Introduction to JAVA programming (2:0:2) Introduction to C++ programming (2:0:2)

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Semester-III **CAY 2025-26 (160 Credits 2024-25 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	BSC	BMA301C	Mathematics – III for Electrical Science Stream	3	3	0	0	50	50	100
2.	PCC	BEEA302C	Network Analysis	3	2	2	0	50	50	100
3.	PCC	BEEA303C	Power Systems – I	3	3	0	0	50	50	100
4.	PCC	BEEA304C	Electronic Circuits	3	3	0	0	50	50	100
5.	PCC	BEEA305C	Electrical Machines – I	3	3	0	0	50	50	100
6.	IPCC	BEEA306C	Electrical and Electronic Measurements	3	2	0	2	50	50	100
7.	PCC	BEEA307L	Electronic Circuits Laboratory	1	0	0	2	50	50	100
8.	PCC	BEEA308L	Electrical Machines – I Laboratory	1	0	0	2	50	50	100
9.	BSC	BMA	Bridge Course Mathematics-I	0	3	0	0	50	50	100
10.	MC	BHSA360M	Yoga-I	0	0	0	2	100	-	100
		BHSB360M	National Service Scheme-I	0	0	0	2	100	-	100
		BHSC360M	Physical Education-I	0	0	0	2	100	-	100
		BHSD360M	Music-I	0	0	0	2	100	-	100
			Total	20						

All students have to register for any one of the courses namely National Service Scheme, Physical Education (Sports and Athletics), Yoga and Music with the concerned coordinator of the course during the first week of III semester. The activities shall be carried out between III semesters to VI semester (for 4 semesters).

Semester-IV **CAY 2025-26 (160 Credits 2024-25 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	BEEA401C	Signals and Systems	3	3	0	0	50	50	100
2.	PCC	BEEA402C	Logic Design	3	3	0	0	50	50	100
3.	PCC	BEEA403C	Electrical Machines – II	3	3	0	0	50	50	100
4.	PCC	BEEA404C	Control Systems	4	4	0	0	50	50	100
5.	BSC	BBTA405C	Biology for Engineers	3	3	0	0	50	50	100
6.	PCC	BEEA406L	PCB Design Laboratory	1	0	0	2	50	50	100
7.	PCC	BEEA407L	Logic Design Laboratory	1	0	0	2	50	50	100
8.	PCC	BEEA408L	Electrical Machines – II Laboratory	1	0	0	2	50	50	100
9.	UHV	BHSA424C	Universal Human Values-II	1	1	0	0	50	50	100
10.	MC	BHSA460M	Yoga-II	0	0	0	2	100	-	100
		BHSB460M	National Service Scheme-II	0	0	0	2	100	-	100
		BHSC460M	Physical Education-II	0	0	0	2	100	-	100
		BHSD460M	Music-II	0	0	0	2	100	-	100
			Total	20						

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Semester-V **CAY 2026-27 (160 Credits 2024-25 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	BEEA5XXX	Power System – II	3	3	0	0	50	50	100
2.	PCC	BEEA5XXX	Power Electronics	3	3	0	0	50	50	100
3.	PEC	BEEA5XXX	Professional Elective Course – I	3	3	0	0	50	50	100
4.	OEC	BEEA5XXX	Open Elective Course – I	3	3	0	0	50	50	100
5.	PCC	BEEA5XXX	Power Electronics Laboratory	1	0	0	2	50	50	100
6.	PCC	BEEA5XXX	Power System – I Laboratory	1	0	0	2	50	50	100
7.	PCC	BEEA5XXX	Control System Laboratory	1	0	0	2	50	50	100
8.	Proj	BEEA5XXX	Mini Project	2	0	0	4	50	50	100
9.	HSMC	BEEA5XXX	Environmental Studies	1	1	0	0	50	50	100
10.	AEC	BEEA5XXX	Quantitative Aptitude and Professional Skills	2	2	0	0	50	50	100
11.	MC	BHSA460M	Yoga-III	0	0	0	2	100	-	100
		BHSB460M	National Service Scheme-III	0	0	0	2	100	-	100
		BHSC460M	Physical Education-III	0	0	0	2	100	-	100
		BHSD460M	Music-III	0	0	0	2	100	-	100
			Total	20						

Semester-VI **CAY 2026-27 (160 Credits 2024-25 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	BEEA6XXX	Power System – III	4	4	0	0	50	50	100
2.	PCC	BEEA6XXX	Microcontrollers	3	3	0	0	50	50	100
3.	PCC	BEEA6XXX	Digital Signal Processing	4	4	0	0	50	50	100
4.	PEC	BEEA6XXX	Professional Elective Course – II	3	3	0	0	50	50	100
5.	OEC	BEEA6XXX	Open Elective Course – II	3	3	0	0	50	50	100
6.	PCC	BEEA6XXX	Power System – II Laboratory	1	0	0	2	50	50	100
7.	PCC	BEEA6XXX	Microcontrollers Laboratory	1	0	0	2	50	50	100
8.	AEC	BEEA6XXX	Indian Knowledge Systems	1	1	0	0	50	50	100
9.	MC	BHSA460M	Yoga-IV	0	0	0	2	100	-	100
		BHSB460M	National Service Scheme-IV	0	0	0	2	100	-	100
		BHSC460M	Physical Education-IV	0	0	0	2	100	-	100
		BHSD460M	Music-IV	0	0	0	2	100	-	100
			Total	20						

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Semester-VII/VIII **CAY 2027-28 (160 Credits 2024-25 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	BEEA701C/801C	Power System – IV	3	3	0	0	50	50	100
2.	PCC	BEEA702C/802C	High Voltage Engineering	3	3	0	0	50	50	100
3.	PEC	BEEX703C/803C	Professional Elective Course-III	3	3	0	0	50	50	100
4.	PEC	BEEX704C/804C	Professional Elective Course-IV	3	3	0	0	50	50	100
5.	HSMC	BEEA705C/805C	Research Methodology and IPR	3	3	0	0	50	50	100
6.	Proj	BEEA706P/806P	Project Work	9	0	0	--	50	50	100
			Total	24						

Semester-VIII/VII **CAY 2027-28 (160 Credits 2024-25 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	INT	BEEA801I/701I	Internship	10	0	0	--	50	50	100
2.	AEC	--	MOOCs*	3	--	--	--	--	--	--
3.	OEC	--	MOOCs*	3	--	--	--	--	--	--
			Total	16						

Semester 7 & 8 are flippable (swapped)

Criteria for Bachelor Degree: A student has to earn a minimum of 160 credits for award of Bachelor of Engineering (B.E) at the end of fourth year.

Criteria for Bachelor Degree (Honors): A student has to earn a minimum of 178 [160 + 18 (online)] credits for award of Bachelor of Engineering (B.E honors) at the end of fourth year.

Criteria for Bachelor Degree (with minor degree): A student has to earn a minimum of 178 [160 + 18* (blended)] credits for award of Bachelor of Engineering (B.E) with major and minor streams at the end of fourth year.

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Semester-5

List of subjects for Professional Elective Course – I (Sem-V)		
1.		Electrical Machine Design
2.		Electrical Engineering Materials
3.		Testing and Commissioning of Electrical Equipment
4.		Data Base management Systems
5.		Operation Research
6.		Field Theory

List of subjects for Open Elective Course I		
1.		Electric Vehicle
2.		Fundamentals of Wind Energy Conversion System

Semester-6

List of subjects for Professional Elective Course – II (Sem-VI)		
1.		Integration of Distributed Generation
2.		Automotive Electronics
3.		Intelligent Instrumentation
4.		VLSI Design
5.		Electric Machine Drives
6.		Modern Control Theory

List of subjects for Open Elective Course II		
1.		Electrical Safety for Engineers
2.		Energy Storage Systems

Semester-7

List of subjects for Professional Elective Course – III (Sem-VII)		
1.		Smart Grids
2.		Electric Vehicles
3.		Solar Photovoltaic System Design
4.		Reactive Power Management
5.		Power System Planning
6.		HVDC Transmission

List of subjects for Professional Elective Course – IV (Sem-VII)		
1.		Flexible AC Transmission Systems
2.		Battery Management Systems
3.		Energy Conservation, Audit and DSM
4.		Energy Efficient Motors
5.		Wind Energy Conversion Systems
6.		AI Applications to Power Systems

Annexure 9

Syllabus for B.E III - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

BMAE301C	Mathematics – III for Electrical Science Stream	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
Curve fitting, Correlation and Regressions: Principles of least squares, Curve fitting by the method of least squares in the form y = a + bx, y= a+ bx + cx^2, y = ab^x. Correlation, Regression and rank correlation. **(RBT Levels: L1, L2 and L3)**	
UNIT – II	**10 Hours**
Fourier series and practical harmonic analysis: Periodic functions, Dirichlet's condition. Fourier series expansion of functions with period 2π and with arbitrary period: periodic rectangular wave, Half-wave rectifier, rectangular pulse, Saw tooth wave. Half-range Fourier series. Half range expansions, Practical harmonic analysis, and variation of periodic current. **(RBT Levels: L1, L2 and L3)**	
UNIT – III	**10 Hours**
Infinite Fourier Transforms: Infinite Fourier transforms, Fourier cosine and sine transforms, Inverse Fourier transforms, Inverse Fourier cosine and sine transforms, discrete Fourier transform (DFT). Z-transforms **(RBT Levels: L1, L2 and L3)**	
UNIT – IV	**10Hours**
Ordinary Differential Equations of Higher Order: Higher-order linear ODEs with constant coefficients - Inverse differential operator, problems. Linear differential equations with variable Coefficients-Cauchy's and Legendre's differential equations – Problems. Application of linear differential equations to L-C circuit and L-C-R circuit. **(RBT Levels: L1, L2 and L3)**	

References:

Textbooks:

1. **Ronald E. Walpole, Raymond H Myers, Sharon L Myers & Keying Ye** "Probability & Statistics for Engineers & Scientists", Pearson Education, 9th edition, 2017.
2. **Peter Bruce, Andrew Bruce & Peter Gedeck** "Practical Statistics for Data Scientists" O' Reilly Media, Inc., 2nd edition **2020**.

Reference Books :

1. **Erwin Kreyszig**, "Advanced Engineering Mathematics", John Wiley & Sons,9th Edition , 2006.
2. **B. S. Grewal** "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
3. **G Haribaskaran** " Probability, Queuing Theory & Reliability Engineering", Laxmi Publication , Latest Edition, 2006
4. **Irwin Miller & Marylees Miller,** John E. Freund's "Mathematical Statistics with Applications" Pearson. Dorling Kindersley Pvt. Ltd. India, 8th edition, 2014.
5. **S C Gupta and V K Kapoor** , "Fundamentals of Mathematical Statistics", S Chand and Company , Latest edition.
6. **Robert V. Hogg, Joseph W. McKean & Allen T. Craig**. "Introduction to Mathematical Statistics", Pearson Education 7thedition, 2013.
7. **Jim Pitman**. Probability, Springer-Verlag , 1993.
8. **Sheldon M. Ross,** "Introduction to Probability Models"11th edition. Elsevier, 2014.

9. **A.M. Yaglomand I. M. Yaglom**, "Probability and Information" D. Reidel Publishing Company. Distributed by Hindustan Publishing Corporation (India) Delhi,1983.
10. **P.G. Hoel , S.C. Portand C. J. Stone**, "Introduction to Probability Theory", Universal Book Stall, (Reprint), 2003.
11. **S. Ross**, "A First Course in Probability", Pearson Education India, 6th Ed.,2002.
12. **W. Feller**, "An Introduction to Probability Theory and its Applications", Vol. 1,Wiley, 3rdEd., 1968.
13. **N. P. Bali and Manish Goyal** , A Text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
14. **Veerarajan T**, Engineering Mathematics(for semester III),Tata McGraw-Hill, New Delhi

Course Outcomes:

After completion of the course the students will be able to,

1. Make use of correlation and regression analysis to fit a suitable mathematical model for Statistical data
2. Demonstrate the Fourier series to study the behavior of periodic functions and their applications in system communications, digital signal processing, and field theory.
3. To use Fourier transforms and Z-Transform to analyze problems involving continuous-time signals and solve difference equations
4. Understand that physical systems can be described by differential equations and solve such equations

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2												
2	CO-2	3	2												
3	CO-3	3	2												
4	CO-4	3	2												

Syllabus for B.E III - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

BEEA302C	Network Analysis	03 - Credits (2 : 2 : 0)
Hours/Week : 04		CIE Marks : 50
Total Hours :52		SEE Marks : 50

UNIT – I	(7L-8T Hours)

Mesh and Node Analysis: Practical source transformation, network reduction using star delta transformation, Loop and node analysis with linearly dependent and independent source for DC and AC networks. Concept of super node and super mesh- Numerical Problems

Network Topology: Graph of network, concept of tree and co-tree, incidence matrix, Tie-set & cut-set schedules, Formulation of equilibrium equations in matrix form, solution of resistive network, Principles of duality- Numerical Problems

UNIT – II	(6L-6T Hours)

Network Theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's theorem, Compensation theorem, Tellegan's theorem - Numerical Problems

UNIT – III	(7L-6T Hours)

Transient Behavior and Initial Conditions: Behavior of circuit element under switching condition and their representation, evaluation of initial and final conditions in RL, RC, and RLC circuits for AC and DC excitation- Numerical Problems

Laplace Transformations and Applications:

Step, Ramp and Impulse functions and their Laplace transformation, Waveform synthesis and Laplace transformation, Initial value theorem and final value theorem, transformed network and their solution- Numerical Problems

UNIT – IV	(6L-6T Hours)

Resonant Circuits: Series and parallel resonance, frequency-response of series and parallel circuits, Q-factor, Bandwidth-Numerical Problems

Two Port Network Parameters: Short Circuit admittance parameters, open circuit impedance parameters, transmission parameters, hybrid parameters, relationship between parameters sets- Numerical Problems

Reference Books:

1. William H, Jack E Kemmerly and Steve Durbin, "Engineering Circuit Analysis", 8th Edition, Tata McGraw Higher Education, 2014.
2. M. E. Van Valkenburg, "Network analysis", 3rd Edition, PHI Learning, 2014.
3. Roy Chowdhary, "Network and Systems", 2nd Edition, New age International Publications, 2010.
4. Charles K. Alexander, Matthew N. O. Sadiku "Fundamentals of Electric Circuits", 5th Edition, Tata McGraw Higher Education, 2013.
5. AbhijitChakrabarti, "Circuit Theory-Analysis and Synthesis", 7thEdition, DhanpatRai Technical Publishers, 2016.

Syllabus for B.E III - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

Course Outcomes:

After completion of the course the students will be able to,

1. Calculate current, voltage and power dissipated in various branches of the complex electric circuit having three or more meshes/nodes by applying electric circuit theorems
2. Solve and analyze the electrical circuits under transient conditions with the given initial conditions using Laplace transforms
3. Analyze series and parallel resonance circuits to determine the circuit parameters (L&C) for which the circuit will resonate at given frequency
4. Evaluate Admittance, Impedance, Hybrid and Transmission parameters for a given two port network by deriving the relation between different set of parameters.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	3	1	1							1	3	1	1
2	CO-2	3	3	2	1							1	3	1	1
3	CO-3	3	3	2	1							1	3	1	1
4	CO-4	3	3	1	1							1	3	1	1

Syllabus for B.E III - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

BEEA303C	Power System - I	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours

AC Transmission Systems: Typical AC transmission system, Advantages of high voltage transmission. Components of overhead transmission line: Conductors, Line supports, Insulators – Types, Potential distribution over suspension insulator string, String efficiency, Methods of improving string efficiency. Corona – Factors affecting corona, Imp terms, Methods of reducing corona. Sag in overhead lines- Calculation of sag for equal and unequal supports, Effect of wind and ice loading on sag.

UNIT – II	10 Hours

Electrical Parameters of Overhead Transmission Lines: Constants of Transmission line. Inductance of single phase two wire line, Capacitance of single phase two wire line.

Performance of Transmission Lines: Classification of overhead Transmission line. Short Transmission line, Medium Transmission line – End condenser method, Nominal T method, Nominal π method, Long Transmission line. Generalized circuit constants (ABCD) of a transmission line.

UNIT – III	10 Hours

Underground Cables: Construction of underground cables, Insulating materials for underground cables, Laying of underground cables. Insulation resistance of single core cable, Capacitance of single core cable, Dielectric stress in a single core cable.

Distribution Systems: Classification of distribution systems. Overhead Vs Underground distribution system. Connection schemes of distribution system. Requirements of a distribution system. Types of DC distributors, DC distributor fed at one end- Concentrated loading, Uniform loading.

UNIT – IV	10 Hours

Circuit Breakers: Operating Principle of circuit breaking, Arc Phenomenon, Principle of Arc extinction, Methods of Arc extinction, Types of circuit breakers: Air blast circuit breaker, SF6 circuit breaker.

Protective Relaying and Protective Schemes: Relay definition, Required qualities of Protective Relaying, Primary and Back up protection, Classification of protective Relaying, Induction type Non-directional over current relay, Directional relay. Differential relay-Principle of operation, Distance relays: Impedance Relay, Buchholz Relay.

Reference Books:

1. Mehta V K and Rohit Mehta, “Principals of Power Systems”, 4th Edition, S Chand and Company Ltd, Publishers, New Delhi, 2015.
2. Soni, Gupta and Bhatnagar, “Power System Engineering”, 5th Edition, DhanapatRai and Co.(P) Ltd. Publishers, New Delhi, 2016.
3. Sunil Rao, “Switchgear and Protection and Power Systems”, 13th Edition, Khanna Publishers,2008.
4. J.B.Gupta, “Switchgear and Protection”, (2nd Edition), Katson Publisher,2013.
5. Ravindarnath B, “Power System Protection and Switchgear”, 2nd Edition, New age International, 2008.

Syllabus for B.E III - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

Course Outcomes:

After completion of the course the students will be able to,

1. Describe AC transmission system components and assess the effects of corona, insulator performance, and sag in overhead lines.
2. Calculate transmission line parameters and evaluate the performance of short, medium, and long transmission lines.
3. Illustrate the structure and characteristics of underground cables and evaluate different types and layouts of electrical distribution systems.
4. Explain circuit breaker operation and classify protective relays based on their principles and applications.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	2	2	1					1	2	3	2	
2	CO-2	3	3	3	3	2					1	2	3	2	
3	CO-3	3	2	2	2	1					1	2	3	2	
4	CO-4	3	2	2	2	2					1	2	3	2	

Syllabus for B.E III - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

BEEA304C	Electronic Circuits	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours

Diode Circuits:

Introduction to the PN Junction diodes, diode clipping and clamping circuits.

Transistor Biasing and Stabilization:

Introduction, operating point, DC load line, DC analysis and design of fixed bias circuit, emitter stabilized bias circuit, collector to base bias circuit, voltage divider bias circuit, modified DC bias with voltage feedback, derivation of stability factor, Bias compensation.

UNIT – II	10 Hours

Transistor at Low Frequencies:

Hybrid model, h-parameters for CE, CC and CB modes, mid-band analysis of single stage amplifier, simplified hybrid model, analysis for CE, CB and CC (emitter voltage follower circuit) modes, Millers Theorem and its dual, analysis for collector to base bias circuit and CE with un bypassed emitter resistance.

Transistor frequency response:

General frequency considerations, effect of various capacitors on frequency response, Miller effect capacitance, high frequency response, hybrid – pi model, CE short circuit current gain using hybrid pi model, multistage frequency effects.

UNIT – III	10 Hours

Multistage amplifiers:

Cascade connection, analysis for CE-CC mode, CE-CE mode, CASCODE stage-unbypassed and bypassed emitter resistance modes, Darlington connection using h-parameter model.

Feedback Amplifiers:

Classification of feedback amplifiers, concept of feedback, general characteristics of negative feedback amplifiers, Input and output resistance with feedback of various feedback amplifiers, analysis of different practical feedback amplifier circuits.

UNIT – IV	10 Hours

Power Amplifiers:

Classification of power amplifiers, Analysis of class A, Class B, Class C and Class AB amplifiers, Distortion in power amplifiers, second harmonic distortion, harmonic distortion in Class B amplifiers, cross over distortion and elimination of cross over distortion.

Oscillators:

Concept of positive feedback, frequency of oscillation for RC phase oscillator, Wein Bridge oscillator, Tuned oscillator circuits, Hartley oscillator, Colpitt's oscillator, crystal oscillator and its types.

FET: Construction, working and characteristics of JFET and biasing of JFET.

References:

1. Jacob Milliman, Christos C. Halkias, Chetan D. Parikh, Integrated Electronics-Analog and Digital Circuits and Systems, 2nd Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2015.
2. G. K. Mithall, Electronic Devices and Circuits, Khanna Publishers, New Delhi, 1998.
3. Electronic Devices and Circuit Theory, Robert L Boylestadand Louis Nashelsky, Pearson, 11th Edition, 2015

4. Electronic Devices and Circuits, Millman and Halkias, Mc Graw Hill, 4th Edition, 2015
5. Electronic Devices & Circuits, David A Bell, Oxford University Press, 5th Edition, 2008.

Course Outcomes:

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

1. Analyse diode circuits and design the stabilized transistor biasing circuits for various applications.
2. Apply transistor models and analyse frequency response techniques to solve circuit problems.
3. Evaluate the performance of multistage and feedback amplifier circuits for desired specifications.
4. Design power amplifiers and oscillator circuits and analyze the working and biasing of JFETs for amplification and oscillation applications.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	3	3	1		1					1		2	2
2	CO-2	3	3	2	2		1					1		2	2
3	CO-3	3	3	3	2		1					1		2	2
4	CO-4	3	3	3	2		1					1		2	2

Syllabus for B.E III - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

BEEA305C	Electrical Machines-I	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours

Single Phase Transformer:
Principle of operation, Types and construction details and EMF equation, Phasor diagrams, Calculation of equivalent circuit parameters by OC and SC tests, Transformer ratings and per unit (p.u.) scaling, Losses & efficiency, all day efficiency, voltage regulation, polarity test and Sumpner's test.

UNIT – II	10 Hours

Three Phase Transformers:
Construction of three phase transformer and types, bank of single-phase transformers for three phase operations and their connections: star-star, star-delta, delta-star, delta-delta, open delta, Labeling of terminals and vector groups, Single unit three phase transformer, Choice of connections, Harmonics in transformer, Suppression of harmonics by tertiary winding, Scott connection and Phase conversion. (Note: No analysis of Scott connection)

Parallel operation of Transformer
Need for parallel operation, conditions to be satisfied for parallel operation and load sharing.

Auto Transformer: Construction, working principle, saving of copper and applications.

UNIT – III	10 Hours

Three Phase Induction Motor:
Construction and types of motors, Principle of operation, production of rotating magnetic field, slip, rotor induced emf and its frequency, power losses in an induction motor, equivalent circuit, torque equation, torque-slip characteristics-motoring, generating and braking modes, starting torque, maximum torque, effect of rotor resistances on torque slip - characteristics, power output, no load and blocked rotor test- evaluation of equivalent circuit parameters, Cogging and crawling, Introduction of circle diagram.
(Note: Drawing of circle diagram would be done from NL and BR test in the laboratory. No problems on circle diagram in theory papers)

UNIT – IV	10 Hours

Starting and Speed Control of Three Phase Induction Motors:
Need for starter, DOL, star delta, autotransformer and rotor resistance starters, Calculation of starting torque, double cage and deep bar motors, speed control by rotor resistance, voltage control, V/f control, NEMA classifications. Introduction of Linear induction motor

Single Phase Induction Motors:
Construction, double field revolving theory, equivalent circuit, starting of single-phase motors: Resistance split phase, capacitor start and capacitor run motors, shaded pole motors.

References:

Text Books:

1. I J Nagarath and DP Kothari, “Electrical machines”, 5th - Edition, TMH, New Delhi, 2020
2. Ashfaq Hussain, “Electrical Machines”, Dhanpat Rai & Co. Publications, 3rd Edition, 2017

3. P.S. Bhimbhra, "Electrical Machinery", Khanna publishers, 7th Edition 2018
4. G D Rai, Non-conventional Energy sources, Khanna Publishers, 2014.

Reference Books:

5. Mulukuntla S. Sarma, "Electric Machines", Cengage, 1st Edition, 2009.
6. Theodore Wildi, "Electrical Machines, Drives and Power systems", Pearson, 6th Edition, 2014.
7. P.S. Bhimbhra, "Generalized Theory of Electrical Machines", Khanna publishers, 2014
8. V.K Mehta, Rohit Mehta, "Principles of Electrical Machines", S Chand, 2nd Edition, 2009.
9. Web links and Video Lectures (e-Resources):
   https://nptel.ac.in/courses/108102146
   https://nptel.ac.in/courses/108105131
   https://nptel.ac.in/courses/108105155
   https://nptel.ac.in/courses/10810607

Course Outcomes:

After completion of the course the students will be able to,

1. Analyze the construction, operation, and performance characteristics of single-phase and three-phase transformers, including phasor diagrams, voltage regulation, losses, and efficiency.
2. Apply standard testing methods such as Open Circuit, Short Circuit, Sumpner's, and polarity tests to determine transformer parameters and evaluate equivalent circuits.
3. Examine the construction, principle of operation, torque characteristics, and performance evaluation of three-phase and single-phase induction motors.
4. Evaluate various starting and speed control methods of induction motors and identify suitable motor types and configurations for practical applications.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	2	1	1	1	1				1	3	1	2
2	CO-2	3	2	3	2	2	1	1				2	3	1	3
3	CO-3	3	2	3	2	1	1	1				1	3	1	2
4	CO-4	3	2	3	1	1	1	1				1	3	2	2

Syllabus for B.E III - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

BEEA306I	Electrical & Electronic Measurement	03 - Credits (2 : 0 : 2)
Hours/Week : 2L + 2P		CIE Marks : 50
Total Hours(T+L) : 40		SEE Marks : 50

UNIT – I	7 Hours
Measurement of Resistance Inductance and Capacitance: Measurement of medium resistance: Wheatstone bridge, Limitations; Measurement of low resistance: Kelvin's Double bridge; AC Bridges: General equilibrium equations of AC bridges; Measurement of Self Inductance – Types of bridges for measurement of self inductance, Maxwell's Inductance Capacitance Bridge, Measurement of Capacitance: Types of bridges for measurement of capacitance, De Sauty's bridge. Sources of errors in bridge circuits. Sources and Detectors	
UNIT – II	**6 Hours**
Measurement of Power and Related Parameters: Dynamometer Type Wattmeter; Induction Type Single Phase Energy meter – Construction, Theory; Dynamometer Type Single Phase Power Factor meter – Construction and Operation; Weston Frequency meter.	
UNIT – III	**7Hours**
Extension of Instrument ranges: Introduction; Shunts and Multipliers; Instrument Transformers: Advantages of Instrument Transformers, Ratios of Instrument Transformers, ratio Correction Factor, Burden on Instrument Transformer; Current Transformer(CT) – Theory of CT; Potential Transformer(PT) – Differences between CT and PT, Theory of PT.	
UNIT – IV	**6 Hours**
Sensors and transducers: Definition and meaning of sensors and transducers, Difference between sensors and transducers, Classification (Types) of transducers: Mechanical/Electrical, Active/Passive, Analog/Digital, Modulating/Self balancing. Advantages and Disadvantages of Electrical transducers. Principle, construction, working and application of: Resistive transducers - Resistance Temperature Detector(RTD), Light Dependent Resistor(LDR); Capacitive transducers; Inductive transducers: Linear variable differential transformer (LVDT). LM 35 sensor.	

List of Experiments

1. Measurement of low resistance using Kelvin's double bridge.
2. Measurements of inductance using Maxwell's L-C bridge.
3. Measurements of capacitance using De-sauty's bridge
4. Adjustment and calibration of l-Φ Energy meter.
5. Measurement of power in a balanced 3-phase circuit using two wattmeters for star and delta connected loads.
6. Evaluation of transfer characteristics of Resistance Temperature Detector (RTD) using RTD
   Module.
7. Evaluation of transfer characteristics of Light Dependent Resistor (LDR) using LDR module.
8. Evaluation of transfer characteristics of Semiconductor Temperature Sensor using LM35 sensor module/unit.

Syllabus for B.E III - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

Reference Books:

1. A. K. Sawhney, "Electrical & Electronic Measurements and Instrumentation", 19th Edition, Dhanpat Rai& Son's, New Delhi, 2011.
2. Golding &Widdies, Pitman, "Electrical Measurements and Measuring Instruments", 5th Edition, D.R & Son's, New Delhi.
3. Ramon P. Areny, John G. Webster, "Sensors and Signal Conditioning", 2nd Edition, Wiley India Private Ltd.
4. Ian R. Sinclair, "Sensors and Transducers", 3rd Edition, Newgen Publication.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply bridge circuits to measure electrical parameters and evaluate the influence of errors, sources, and detectors on measurement accuracy.
2. Demonstrate and interpret the operation of instruments used for electrical power and energy measurement.
3. Evaluate range extension methods and differentiate between CTs and PTs based on their operation and performance.
4. Classify transducers and justify the selection of suitable types for specific applications based on their working and characteristics.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2		1	2							3	2	
2	CO-2	3	2		1	2							3	2	
3	CO-3	3	2		1	2							3	2	
4	CO-4	3	2	1		2							3	2	

Syllabus for B.E III - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

BEEA307L	Electronic Circuits Laboratory	01 - Credits (0 : 0 : 2)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. Design and testing of diode clipping and clamping circuits.
2. Design of fixed bias and voltage divider bias circuits for BJT.
3. Calculation of hybrid parameters of CE transistor amplifier.
4. Frequency response of single stage BJT and FET RC coupled amplifier and determination of half power points, bandwidth, input and output impedances.
5. Design and testing of BJT – RC phase shift oscillator for given frequency of oscillation.
6. Design and testing of Wien bridge oscillator for given frequency of oscillation.
7. Design and testing of Hartley and Colpitt's oscillator for given frequency of oscillation.
8. Determination of gain, input and output impedance of BJT Darlington emitter follower with and without bootstrapping.
9. Design and testing of Class A and Class B power amplifier and to determine conversion efficiency.
10. Design and simulation of Fullwave centre tapped transformer type and Bridge type rectifier circuits with and without Capacitor filter using MATLAB. Determination of ripple factor, regulation and efficiency.

References:

1. Jacob Milliman, Christos C. Halkias, Chetan D. Parikh, Integrated Electronics-Analog and Digital Circuits and Systems, 2ndEdition, Tata McGraw Hill Education Private Limited, New Delhi, 2015.
2. G. K. Mithall, Electronic Devices and Circuits, Khanna Publishers, New Delhi, 1998.
3. Electronic Devices and Circuit Theory, Robert L Boylestadand Louis Nashelsky, Pearson, 11th Edition, 2015
4. Electronic Devices and Circuits, Millman and Halkias, Mc Graw Hill, 4th Edition, 2015
5. Electronic Devices & Circuits, David A Bell, Oxford University Press, 5th Edition, 2008.

Course Outcomes:

After completion of the course the students will be able to:

1. Draw the circuit, write the procedure and select the required electronic components for a given experiment.
2. Rig up the circuit and conduct experiments using the electronic components to achieve desired results.
3. Analyze the results to write the inference and prepare a detailed report.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2			2	1							3	1
2	CO-2	3	3	3	2	2	1							3	1
3	CO-3	3	3	2	3	2	1							3	1

Syllabus for B.E III - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

BEEA308L	Electrical Machines Laboratory - I	01 - Credits (0 : 0 : 2)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. Open circuit and short circuit test on single phase transformer and pre-determination of efficiency, regulation for different loads at power factors. Calculations of equivalent circuit parameters of a given transformer.
2. Polarity test
3. Sumpner's test to calculate no load loss and full load loss and predetermine efficiency.
4. Parallel operation of two single phase transformers and determine their load sharing
5. Connection of three single phase transformers: star-star, star-delta, delta-delta and delta-star.
6. Brake load test on three phase induction motor and performance evaluation, (torque-speed, BHP-efficiency, slip BHP, etc).
7. No-load and blocked rotor test on three phase induction motor to calculate parameters of equivalent circuit diagram and performance evaluation.
8. No-load and blocked rotor test on three phase induction motor to draw the circle diagram and hence the performance evaluation of given motor.
9. Speed control of three phase slip ring induction motor by rotor resistance.
10. Brake load test on single phase induction motor and performance evaluation (torque-speed, BHP- efficiency, slip -BHP, etc.)

Reference Books:

1. I J Nagarath and DP Kothari, "Electrical machines", 4th Edition, TMH, New Delhi
2. Ashfaq Hussain, "Electrical Machines", DhanpatRai& Co. Publications, 3rd Edition, 2017
3. P.S. Bhimra, "Electrical machinery", Khanna publishers, 7th Edition 2018
4. Mohinder Singh Sejwal "Laboratory manual for Electro mechanics", Curriculum Development Cell, Dept. of EE IIT Delhi, Wiley Eastern Ltd, ISBN 0852261438

Course Outcomes:

After completion of the course the students will be able to:

1. Conduct open circuit, short circuit, Sumpner's test, and polarity test on single-phase transformers to evaluate efficiency, regulation, and equivalent circuit parameters.
2. Perform experiments on three-phase and single-phase induction motors to analyze performance characteristics and determine equivalent circuit parameters using tests like brake load, no-load, blocked rotor, and circle diagram method.
3. Demonstrate parallel operation of transformers, different types of three-phase transformer connections, and speed control methods for slip-ring induction motors, analyzing load sharing and performance under various configurations.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	3	2	1	1			2	2		3	2	
2	CO-2	3	3	3	2	2	1			2	2		3	3	
3	CO-3	3	2	3	2	2	1			2	2		3	3	

Syllabus for B.E III - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

BMAB300M	Bridge Course Mathematics-I	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction to root finding problems, Newton-Raphson's method. Finite differences, Forward and backward difference operators (no derivations on relations between operators) Newton-Gregory forward and backward interpolation formulae (Without proof), Lagrange's interpolation formulae (without proof). Simpson's 3/8th and 1/3rd rule(no derivation)-problems. Runge-Kutta 4 th order method, (no derivation)-problems. (RBT Levels: L1, L2 and L3)	
UNIT – II	**(10 Hours)**
Linear and Bernoulli's differential equations. Exact and reducible to exact differential equations Integrating factors , higher order linear differential equations with constant coefficients- Inverse differential operator(eax,sinax,coax,xn). (RBT Levels: L1, L2 and L3)	
UNIT – III	**(10 Hours)**
Introduction, Definition of Laplace Transform, Laplace Transform of standard functions, Properties: Shifting, differentiation, Integral and division by t. Periodic function, Heaviside's Unit step function. Inverse Laplace transform, Properties, Solutions of linear differential equations. (RBT Levels: L1, L2 and L3)	
UNIT – IV	**(10 Hours)**
Elementary transformations, Rank of a matrix, consistency of a system of linear equations, solution of homogeneous and non homogeneous equations, Gauss-elimination method, Gauss-seidel method, Eigen values and eigen vectors by Rayleigh's power method. (RBT Levels: L1, L2 and L3)	

Reference Books:

1. B. S. Grewal: "Higher Engineering Mathematics", Khanna Publishers, 44thEd., 2021.
2. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10thEd., 2018.
3. V. Ramana: "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed., 2017
4. Srimanta Pal & Subodh C.Bhunia: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
5. N.P Bali and Manish Goyal: "A Textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
6. C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics" McGraw – Hill Book Co., New York, 6th Ed., 2017.
7. Gupta C.B, Sing S.R and Mukesh Kumar: "Engineering Mathematic for Semester I and II", Mc-Graw Hill Education(India) Pvt. Ltd 2015.
8. H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics" S. Chand Publication, 3rd Ed., 2014.
9. David C Lay: "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.
10. Gareth Williams: "Linear Algebra with Applications", Jones Bartlett Publishers Inc., 6th Ed., 2017.

Syllabus for B.E III - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

Course Outcomes:

After completion of the course, the students will be able to:

1. Solve engineering problems using Numerical techniques
2. Explain various physical models through first and higher order differential equations and solve such linear ordinary differential equations.
3. Apply the Laplace transform techniques to solve differential equations.
4. Solve linear equations using matrix methods

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2			2									
2	CO-2	3	2			2									
3	CO-3	3	2			2									
4	CO-4	3	2			2									

Syllabus for B.E IV - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

BEEA401C	Signals and Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours

Introduction: Definition of signals and systems, classification of signals, elementary signals, basic operations on signals, interconnection of systems and operations, properties of systems. Usage of MATLAB command-line functions to verify the solution.

UNIT – II	10 Hours

Time domain representation of LTI systems: Convolution sum, convolution integral, impulse response representation. Properties of impulse response. Usage of MATLAB command-line functions to verify the solution.

UNIT – III	10 Hours

Fourier and inverse Fourier representation of signals: Introduction to complex sinusoidal signals and their use in Fourier representation of periodic signals (brief review of CTFS and DTFS). Continuous time Fourier transform, Discrete time Fourier Transform (DTFT), properties of DTFT and applications. Usage of MATLAB command-line functions to verify the solution.

UNIT – IV	10 Hours

Z -Transforms: Introduction, properties of ROC, properties of Z-transform and relation of Z -transform with Fourier transforms. Inverse Z-transform, transform analysis of LTI systems, transfers function, stability and causality, and solution of difference equations using Z-transfor Usage of MATLAB command-line functions to verify the solution.

Reference Books:

1. Simon Haykin and Barry Van Veen, Signals and Systems (2nd Edition), John Wiley &Sons
2. Michel J. Roberts, 2003 , Signals and Systems (2nd Edition), Tata McGraw Hill
3. Allan V. Oppenheam, Alan S. Willsky, and Hamid Nawab, 1997, Signals and Systems (2nd Edition), Pearson Education Asia.

Course Outcomes:

After completion of the course the students will be able to,

1. Analyze different types of signals and systems, and examine their interconnections and basic properties of the systems.
2. Evaluatelinear time-invariant (LTI) systems by determining output responses using convolution sum and integral, and asses the system properties using impulse responses.
3. Apply Fourier series and transforms (CTFS, DTFS, CTFT, DTFT) for the periodic and a-periodic signals and interpret their frequency-domain characteristics and properties.
4. Perform analysis of systems in the Z-domain, determine the properties on stability and causality, and resolve the difference equations using Z-transforms..

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	1		2						1		2	1
2	CO-2	3	3	2		2						1		2	1
3	CO-3	3	2	1		3						1		2	1
4	CO-4	3	3	1	2	3						1		2	1

Syllabus for B.E IV - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

BEEA402C	Logic Design	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
Introduction: Introduction to Digital logic Design; Binary Systems and Codes: Binary Numbers, Octal and Hexadecimal Numbers; Number Base Conversions; Arithmetic Operation with different Bases; Complements. Signed Binary Numbers; Binary Codes and conversions: BCD, Gray, ASCII and EBCDIC. Binary Logic and Logic Gates: AND, OR and NOT.	
UNIT – II	**10 Hours**
Boolean Algebra and Logic Gates: Basic Definition. Basic Theorems. Boolean Functions; Standard Forms: Minterm and Maxterm. Simplification of Boolean Functions using SOP and POS; Logic Operations: NAND, NOR, Exclusive-OR and Equivalence. Integrated Circuits **Gate-Level Minimization:** The Map Method. Two- and Three-Variable Map. Four-Variable Map. Product of Sums Simplification. Don't-Care Conditions, logic gates implementation, determination and selection of Prime Implicants, Essential and Nonessential prime Implicants.	
UNIT – III	**10 Hours**
Analysis and Synthesis of Combinational Circuits: Combinational Circuits. Analysis and Design Procedure; Binary Adders-Subtractor; Decoders and Multiplexers, Sequential Circuits, Latches. **Flip-Flops:** RS, D, JK and T; Analysis of Clocked Sequential Circuits. Design Procedure, Registers and Counters: Registers. Shift Registers; Synchronous Counters. Ripple Counters.	
UNIT – IV	**10 Hours**
Sequential Circuits with Programmable Logic Devices: Introduction, Random-Access Memory, Memory Decoding, Read-Only Memory. Programmable Logic Array. **Verilog:**Introduction to Verilog, Verilog Structural and Behavioral Design, Verilog Time Dimension and Test Benches.	
Reference Books: 1. Morris Mano, Charles R. Kime, Logic and computer design fundamentals, Pearson Prentice Hall, 2004 2. Basavaraj,B., Digital fundamentals, New Delhi: Vikas Publishing House, 1999. 3. KandelLangholz, Digital Logic Design, Prentice Hall, 1988. 4. Rafiquzzaman& Chandra, Modern Computer Architecture, West Pub. Comp., 1988. 5. Zvi. Kohavi, Switching and Finite Automata Theory, Tata McGraw Hill, India, 2004. 6. C. V. S. Rao, Switching and Logic Design, 3rd Edition, Pearson Education, India, 2009. 7. Donald D. Givone, Digital Principles and Design, Tata McGraw Hill, India, 2002.	
Course Outcomes: After completion of the course the students will be able to, 1. Apply number system conversions and binary coding techniques (BCD, Gray, ASCII, EBCDIC) to perform arithmetic and logical operations in digital systems. 2. Use Boolean algebra, standard forms (SOP/POS), and Karnaugh maps to simplify and implement digital logic circuits using basic and universal gates. 3. Analyze combinational and sequential circuits (e.g., adders, decoders, flip-flops, counters) for their logical behavior, timing, and design. 4. Analyze and interpret digital circuit behavior using programmable logic devices and Verilog, including memory decoding and simulation through test benches.	

Syllabus for B.E IV - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	1								1		2	1
2	CO-2	3	3	2		1						1		2	1
3	CO-3	3	3	3	2	1						1		2	1
4	CO-4	3	3	3	2	3						1		2	1

Syllabus for B.E IV - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

BEEA403C	Electrical Machines-II	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours

DC Generator: Construction of DC machines, introduction of armature windings, emf equation, types of excitations, no load and load characteristics (only separately excited and shunt field generator, no compound generator) Armature reaction and its effects, demagnetizing and cross magnetizing AT/pole, compensating winding, interpole, commutation.

DC Motors: Principle of Operation & concept of back EMF, torque equation, characteristics of D.C. motors (without compound motors), and applications, universal motor.

UNIT – II	10 Hours

Starting, Speed control and Braking of DC Motors: Necessity of starters, resistance starters(excluding three point and four-point starter), Speed control of shunt field, separately excited and series motors, Ward Leonard method of speed control, Braking of DC motors

Testing of D.C Motors: Losses in DC Machine, Efficiency, direct load test, Swinburne's test, Field's test on DC series motors.

UNIT – III	10 Hours

Synchronous Machines: Construction and types, types of field excitation, emf equation for generator, effect of distribution winding and chorded coils, effects of harmonics on emf generated, phasor diagram of a Synchronous generator with cylindrical rotor, voltage regulation, calculation of synchronous reactance by emf method

Salient pole synchronous machines: Two-reaction model, slip test.

UNIT – IV	10 Hours

Parallel operations of alternators: Synchronization, parallel operation, operation on infinite bus, operating characteristics, power flow equations of Alternators.

Synchronous Motors: Principle of operation, methods of starting, phasor diagram, effect of changing excitation, V and inverted V curves of synchronous machines, hunting in synchronous machines, effect of damper windings

Text Books:

1. I J Nagarath and DP Kothari, "Electrical machines", 5th - Edition, TMH, New Delhi, 2020
2. Ashfaq Hussain, "Electrical Machines", Dhanpat Rai & Co. Publications, 3rd Edition,2017
3. P.S. Bhimbhra, "Electrical Machinery", Khanna publishers, 7th Edition 2018
4. G D Rai, Non-conventional Energy sources, Khanna Publishers, 2014.

Reference Books:

5. Mulukuntla S. Sarma, "Electric Machines", Cengage, 1st Edition, 2009.
6. Theodore Wildi, "Electrical Machines, Drives and Power systems", Pearson, 6th Edition, 2014.
7. P.S. Bhimbhra, "Generalized Theory of Electrical Machines", Khanna publishers, 2014
8. V.K Mehta, Rohit Mehta, "Principles of Electrical Machines", S Chand, 2nd Edition, 2009.
9. Web links and Video Lectures (e-Resources):
   https://nptel.ac.in/courses/108102146
   https://nptel.ac.in/courses/108105131
   https://nptel.ac.in/courses/108105155

https://nptel.ac.in/courses/10810607

Course Outcomes:

After completion of the course the students will be able to,

1. Analyze the construction, working principle, EMF and torque equations, and performance characteristics of DC generators and motors, including armature reaction, commutation, and types of excitation.
2. Evaluate the need for starters, and apply suitable methods for starting, speed control, and braking of DC motors; and examine the testing procedures to determine losses and efficiency.
3. Analyze the construction, excitation systems, winding factors, and phasor diagrams of synchronous generators; and evaluate voltage regulation and salient pole machine behavior.
4. Examine the conditions for synchronization and parallel operation of alternators, and evaluate the performance of synchronous motors under varying excitation using V and inverted V curves.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	2	1	1	1					2	3	1	2
2	CO-2	3	2	3	2	2	1					2	3	1	3
3	CO-3	3	2	2	2	1	1					3	2	1	2
4	CO-4	3	2	3	2	1	1					3	2	2	2

Syllabus for B.E IV - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

BEEA404C	Control Systems	04 - Credits (4 : 0 : 0)
Hours/Week : 04		CIE Marks : 50
Total Hours :52		SEE Marks : 50

UNIT – I	(13 Hours)

Introduction: Objective of control system, Importance of control system, Examples of control system, Types of control systems, Open-loop and closed loop control systems, Feed-back and its effects on system performance characteristics.

Modeling of Physical Systems: Models of mechanical systems, Electrical systems and Electromechanical systems, Analogous systems: Force-voltage analogy, Force-current analogy. Usage of MATLAB command-line functions to verify the solution.

UNIT – II	(13 Hours)

Block Diagrams and Signal Flow Graphs: Transfer function; Block diagram reduction, Signal flow graphs, Mason's gain formula, and Application of Mason's gain formula to block diagrams.

Time Response of Feedback Control Systems: Standard test signals, Type and order of system, Steady state error and error constants, Unit-step response of standard second order systems, Time domain specifications. Usage of MATLAB command-line functions to verify the solution.

UNIT – III	(13 Hours)

Stability Analysis: The concept of stability, BIBO stability, Zero-input and asymptotic stability, Routh-Hurwitz(R-H) stability criterion, Application.

Root- Locus Analysis: The concept of root locus and Complementary root locus, Basic properties of root locus, Construction of root locus. Usage of MATLAB command – line functions to verify the solution.

UNIT – IV	(13 Hours)

Frequency Domain Analysis: The concept of frequency response, Bode plots, procedure for constructing Bode plots, Gain margin, Phase margin, Frequency domain specifications, Nyquist stability criterion and examples.

Control system analysis in state-space: State variable representation, conversion of state variable models to transfer functions and vice versa. Usage of MATLAB command-line functions to verify the solution.

Reference Books:

1. Benjamin C. Kuo, “Automatic Control System”, 7th Edition, PHI, 2010.
2. Richard C. Dorf Robert H. Bishop “Modern Control Systems”, 8thEdition, Addison-Wesley,1999
3. I.J.Nagarath and M Gopal, “Control Systems Engineering”, NewAge International (P) Ltd., 1999.
4. Norman S. Nise “Control System Engineering”, McGraw Hill, 2010.
5. R.S.Allurkar, “Control Systems”, EBPB, 2004.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply the concepts of open-loop and closed-loop control systems to model mechanical, electrical, and electromechanical systems using analogous methods and MATLAB tools.
2. Develop block diagrams and signal flow graphs, and apply Mason’s Gain Formula and MATLAB simulations to compute transfer functions of control systems.

3. Analyze time-domain response characteristics and system stability using Routh-Hurwitz criterion and root locus methods for first- and second-order systems.
4. Analyze system behavior in the frequency domain using Bode and Nyquist plots and evaluate gain/phase margins and system specifications using MATLAB tools.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	2		2						1		2	1
2	CO-2	3	3	2		2						1		2	1
3	CO-3	3	3	2	2	1						1		2	1
4	CO-4	3	3	2	2	3						1		2	1

Syllabus for B.E IV - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

BBTA405C	Biology for Engineers	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

UNIT – I	(13 Hours)

Introduction to Biology:

The cell: Structure, and functions of a cell. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, Proteins and Lipids. Importance of special biomolecules: Enzymes, vitamins and hormones -properties and functions.

Biomolecules and their Applications:

Carbohydrates in cellulose-based water filters production, PHA and PLA in bioplastics production, Nucleic acids in vaccines and diagnosis, Proteins in food production, Lipids in biodiesel, Enzymes in biosensor fabrication, food processing, detergent formulation and textile processing.

UNIT – II	(13 Hours)

Bio Inspiration Models Used In Engineering:

Bio inspiration - Introduction, Alliance between Engineering and Biology, Biomimicry - Science mimicking nature. Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Gecko Feet, Plant burrs (Velcro), Shark skin (Friction reducing swimsuits), Kingfisher beak (Bullet train), Fire fly LED.

Nature Bioinspired Materials And Mechanisms:

BioEcholocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf), Respiration (MFCs) Human Blood substitutes-hemoglobin based oxygen carriers (HBOCs) and perflourocarbons (PFCs).

UNIT – III	(13 Hours)

Human Organ Systems And Bio Designs

Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease).

Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators).

Lungs as purification system gas exchange mechanisms, spirometry, Ventilators, Heart-lung machine).

Eye as a Camera system, bionic eye. **Kidney** as a filtration system - dialysis systems.

UNIT – IV	(13 Hours)

Trends In Bioengineering

Bioprinting techniques and materials, 3D printing of ear, bone and skin, electrical tongue and electrical nose in food science, Self-healing bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes), Biomining via microbial surface adsorption. Artificial Intelligence for disease diagnosis. Biochips & their applications. Biosensors & their applications.

Reference Books:

1. Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.
2. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.

3. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
4. Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
5. Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
6. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
7. 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
8. Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016

Web links and Video Lectures (e-Resources)

- https://nptel.ac.in/courses/121106008
- https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
- https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
- https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
- https://www.coursera.org/courses?query=biology
- https://onlinecourses.nptel.ac.in/noc19_ge31/preview
- https://www.classcentral.com/subject/biology
- https://www.futurelearn.com/courses/biology-basic-concepts

Course Outcomes:

After completion of the course the students will be able to,

1. Elucidate the basic biological concepts required for engineering applications.
2. Use nature inspired concepts for domain specific applications.
3. Analyze and apply the principles of bioengineering in developing biomedical devices.
4. Apply the innovative biobased solutions for eco-friendly and socially relevant problems.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	3	2	2	2						3	3	2	2
2	CO-2	3	3	2	2	3						3	3	2	2
3	CO-3	3	3	2	2	3						3	3	2	2
4	CO-4	3	3	2	2	3						3	3	2	2

Syllabus for B.E IV - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

BEEA406L	PCB Design Laboratory	01 - Credits (0 : 0 : 2)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1.Introduction to PCB Design Tools

- Use locally available tools like Proteus or KiCAD to create a basic schematic layout and familiarize with the interface.

2.Schematic Entry and Netlisting

- Design a simple electronic circuit (e.g., LED flasher) and generate a netlist using the PCB design tool.

3.Manual and Automatic Component Placement

- Place components for a simple analog circuit (e.g., amplifier) manually and compare with automatic placement results.

4.Track Routing and Design Rules

- Route tracks for a basic circuit (e.g., rectifier circuit) and apply design rules such as track width, angle, and clearance.

5.PCB Design of Basic Circuits using Copper Connection

- Design and simulate a simple logic circuit (e.g., OR gate, AND gate) and generate a PCB layout.

6.Design of Power Supply Circuit using Copper Connection

- Design and simulate a regulated power supply circuit (e.g., 5V DC supply) and generate Gerber files.

7.Printing and Etching of PCB

- Print a PCB layout on a copper-clad board and etch it using a locally available etching solution like ferric chloride.

8.Drilling and Soldering

- Drill holes for components using a handheld drill and solder basic components like resistors, capacitors, and ICs.

9.Soldering and Desoldering Practice

- Practice soldering and desoldering components on a PCB without damaging the board or components.

10.PCB Testing and Debugging

- Test the designed circuit for continuity and functionality using a multimeter or an oscilloscope.

Textbooks:

1. Khandpur, R. S. Printed Circuit Boards: Design, Fabrication, Assembly and Testing. Tata McGraw-Hill, 2005.
2. Floyd, Thomas L. Electronic Devices and Circuit Theory. 11th ed., Pearson Education, 2015.
3. Rashid, Muhammad H. Introduction to PSpice Using OrCAD for Circuits and Electronics. 3rd ed., Pearson Education, 2017.

Textbooks:

1. Coombs, Clyde F., and Happy T. Holden. Printed Circuits Handbook. 7th ed., McGraw-Hill, 2016.
2. Sharma, Monika. Basics of PCB Design and Fabrication. IK International Publishing

House, 2019.
3. Williams, Timothy. EMC for Printed Circuit Boards: A Handbook of Design, Layout, and Troubleshooting. Newnes, 1996.
4. Buchanan, William D. PCB Design Using AutoCAD. Newnes, 1996.
1. Pandya, Ashish. Electronics Lab Manual Volume II. S. Chand & Company, 2020.

Course Outcomes:

After completion of the course the students will be able to:

1. Apply knowledge of PCB technology and electronic design automation tools to design and develop PCBs for basic analog and power electronic circuits.
2. Analyse design rules, track routing techniques, and fabrication processes to ensure optimal PCB performance and compliance with industry standards.
3. Create and fabricate PCBs using advanced tools, including Gerber generation, component mounting, and hardware testing, to deliver functional prototypes.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	3	2		3					2	3	2		
2	CO-2	3	3	2	3	3	2				2	3	1		
3	CO-3	3	3	3	3	3	2	2	1	1	1	2	3	2	1

Syllabus for B.E IV - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

BEEA407L	Logic Design Laboratory	01 - Credits (0 : 0 : 2)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. Study and verify the truth table of logic gates
2. Simplify the given expression and to realize it using Basic gates and Universal gates Design and testing of diode clipping and clamping circuits.
3. Realization of
   i. Half Adder and Full Adder
   ii. Half Subtractor and Full Subtractor by using Basic gates and NAND gates
4. Design and set up the following circuit using IC 7483.
   i. A 4-bit binary parallel adder.
   ii. A 4-bit binary parallel subtractor
5. Design and realize the following using IC 7483.
   i. BCD to Excess- 3 Code
   ii. Excess-3 to BCD Code.
6. Realization of Binary to Gray code converter and vice versa
7. Design and set up the MUX & DEMUX circuits for following cases
   i. 4:1 Multiplexer (MUX) using only NAND gates.
   ii. 1:4 Demultiplexer(DE-MUX) using only NAND gates.
   iii. Verify the various functions of IC 74153(MUX) and IC 74139(DEMUX).
   iv. Half/Full Adder and Half/Full Subtractor using IC 74153.
8. Realization of One & Two Bit Comparator and study of 7485 magnitude comparator
9. Realization of decoder circuits using basic gates and to verify with IC 74LS139
10. Set up and test a 7-segment static display system to display numbers
11. Design Encoder circuits for following cases
    i. Decimal-to-BCD Encoder using IC 74147.
    ii. Hexadecimal-to-Binary Encoder using IC
    iii. 74148 Encoders and IC 74157 Multiplexer
12. Truth Table verification of following Flip-Flops
    i. RS Flip Flop
    ii. T type Flip Flop.
    iii. D type Flip Flop.
    iv. JK Flip Flop.
    v. JK Master Slave Flip Flop.
13. Realization and study of following types of Shift Registers.
    i. SISO (Serial in Serial out)
    ii. SIPO (Serial in Parallel out)
    iii. PIPO (Parallel in Parallel out)
    iv. PISO (Parallel in Serial out)
14. Design and set up of Sequence Generator using IC 7495
15. Realization and study of Ring and Johnson counters
16. Design and test 3-bit binary synchronous & asynchronous counters using flip-flop IC 7476 for the given sequence.
17. Design IC 74193 as a up/down counter

18. Design IC 7490 as a decade counter with BCD count sequence

Reference Books:

1. Morris Mano, Charles R. Kime, Logic and computer design fundamentals, Pearson Prentice Hall, 2004
2. Basavaraj,B., Digital fundamentals, New Delhi: Vikas Publishing House, 1999.
3. KandelLangholz, Digital Logic Design, Prentice Hall, 1988.
4. Rafiquzzaman & Chandra, Modern Computer Architecture, West Pub. Comp., 1988.
5. Zvi. Kohavi, Switching and Finite Automata Theory, Tata McGraw Hill, India, 2004.

Course Outcomes:

After completion of the course the students will be able to:

1. Apply Boolean algebra and logic simplification techniques to design, implement, and verify combinational logic circuits using basic and universal gates.
2. Analyze and implement combinational and sequential digital circuits such as adders, subtractors, encoders, decoders, multiplexers, flip-flops, and counters using ICs and logic gates.
3. Design, set up, and troubleshoot digital systems including code converters, display systems, and sequence generators to meet specified functional requirements.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	3	1	1						1		2	
2	CO-2	3	3	3	2	2						1		2	
3	CO-3	3	3	3	2	2						1		2	

Syllabus for B.E IV - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

BEEA408L	**Electrical Machines –II Laboratory**	**01 - Credits (0 : 0 : 2)**
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. OCC characteristics of D.C. Shunt generator and determine critical resistance and critical speed.
2. Load characteristics of a D.C. generator.
3. Load test on a DC motor- determination of speed-torque and BHP-efficiency characteristics
4. Speed control of DC motor by armature voltage control and flux control.
5. Swinburne's test to determine losses of a dc shunt motor and efficiency.
6. Ward Leonard method of speed control of D.C. motor.
7. Fields test on dc series motors to determine losses and efficiency.
8. Voltage regulation of alternator by EMF and MMF method.
9. Synchronization of Alternator with infinite bus.
10. V and Inverted V curves of a synchronous motor

Reference Books:

1. I J Nagarath and DP Kothari, "Electrical machines", 4th - Edition, TMH, New Delhi
2. Ashfaq Hussain, "Electrical Machines", DhanpatRai& Co. Publications, 3rdEdition, 2017
3. P.S. Bhimra, "Electrical machinery", Khanna publishers, 7thEdition 2018
4. P.S. Bhimra, "Generalized theory of Electrical machines", Khanna publishers, 2014
5. M. G. Say, Performance and design of AC machines, CBS publishers.
6. Alexander Langsdorf, "Theory of alternating current machines", TMH, 1999

Course Outcomes:

After completion of the course the students will be able to:

1. Conduct experiments on DC generators and motors to determine OCC, load characteristics, torque-speed relations, losses, and efficiency using standard methods like Swinburne's and field tests.
2. Analyze speed control of DC motors using armature voltage, field control, and Ward Leonard method, and evaluate performance characteristics under various operating conditions.
3. Perform experiments on synchronous machines to determine voltage regulation using EMF and MMF methods, analyze synchronization with infinite bus, and plot V and inverted V curves to assess operational behavior.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	3	2	2	1						3	2	
2	CO-2	3	3	3	3	2	1			1			3	2	
3	CO-3	3	3	3	3	2	1			1			3	3	

Syllabus for B.E IV - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

BHSA424C	**Universal Human Values**	**01 - Credits (1 : 0 : 0)**
Hours/Week : 01		CIE Marks : 50
Total Hours :15		SEE Marks : 50

UNIT – I	**(4 Hours)**
Introduction to Value Education: Right Understanding; Relationship and Physical Facility; Understanding Value Education; Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity -the Basic Human Aspiration-Current Scenario and Method to Fulfill the Basic Human Aspirations.	
UNIT – II	**(4 Hours)**
Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.	
UNIT – III	**(4 Hours)**
Harmony in the Family and Society and Nature: Harmony in the Family – the Basic Unit of Human Interaction; 'Trust' – the Foundational Value in Relationship; 'Respect' **–** as the Right Evaluation: Other Feelings, Justice in Human-to-Human Relationship; Understanding Harmony in the Society; Vision for the Universal Human Order.	
UNIT – IV	**(3 Hours)**
Harmony in the Nature/Existence Implications of the Holistic Understanding – a Look at Professional Ethics: Understanding Harmony in the Nature, Interconnectedness, self-regulation and MutualFulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels. The Holistic Perception of Harmony in Existence.Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-TypicalCase Studies, Strategies for Transition towards Value-based Life and Profession	

Reference Books:

1. Gaur R R, Asthana,R.G, Bagaria G P (2019).A Foundation Course in Human Values and Professional Ethics,2nd Revised Edition, Excel Books, New Delhi,
2. The Teacher‟s Manual for A Foundation Course in Human Values and Professiona Ethics, R R Gaur, R Asthana.
3. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak,1999.
4. Human Values, A.N.Tripathi, NewAge Intl.Publishers, New Delhi, 2004.
5. The Story of Stuff(Book).
6. The Story of My Experiments with Truth-by Mohandas Karamchand Gandhi
7. Small is Beautiful -E. F Schumacher.
8. Andrews Cecile, Slow is Beautiful
9. Kumarappa JC , Economy of Permanence
10. Pandit Sunderlal, Bharat Mein Angreji Raj
11. Dharampa l, Red is covering India
12. Gandhi Mohandas K ,Hind Swaraj or Indian Home Rule.
13. Maulana Abdul Kalam Azad :India Wins Freedom
14. Roma in Rolland (English) Vivekananda
15. Roma in Rolland(English), Gandhi
16. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986,

1991

17. Donella H.Meadows, Dennis L. Meadows, Jorgen Randers, William W. BehrensIII, 1972, Limits to Growth – Club of Rome'sreport, Universe Books.
18. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
19. P L Dhar, R R Gaur, 1990, Science and Humanism, Common wealth Publishers.
20. A N Tripathy, 2003, Human Values, NewAge International Publishers.
21. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
22. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.
23. M Govindrajran, S Natrajan & V. S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, PrenticeHall of India Ltd.
24. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
25. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow, Reprinted 2008.

Suggested Web Links:

1. Value Education websites,
2. https://www.uhv.org.in/uhv-ii,
3. http://uhv.ac.in,
4. http://www.uptu.ac.in
5. Storyof Stuff,
6. http://www.storyofstuff.com
7. Al Gore, An Inconvenient Truth, Paramount Classics, USA
8. Charlie Chaplin, Modern Times, United Artists, USA
9. IIT Delhi, Modern Technology– the Untold Story
10. Gandhi A.,Right Here Right Now, Cycle wala Productions
11. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
12. https://fdp-si.aicte-india.org/8dayUHV_download.php
13. https://www.youtube.com/watch?v=8ovkLRYXIjE
14. https://www.youtube.com/watch?v=OgdNx0X923I
15. https://www.youtube.com/watch?v=nGRcbRpvGoU
16. https://www.youtube.com/watch?v=sDxGXOgYEKM

Course Outcomes:

At the completion of the course student will be able to:

1. Understand the need and role of value education for holistic development
2. Differentiate between self and body needs, and practice harmony within the human being.
3. Analyze relationship dynamics based on trust, respect, and justice within families and society.
4. Recognize harmony in nature and existence, and apply these ideas to sustainable living
5. Explore ethical practices and professional conduct within personal and professional contexts

Syllabus for B.E IV - Semester for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

Sl	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1						2		3		2	2			
2	CO-2		2						3						
3	CO-3		2				3	3	3		2	2			
4	CO-4							2	3			3			
5	CO-5								3		3	3			

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Power System -II	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**(10 Hours)**

Power System Representation: Standard symbols of power system components, Single line diagram, Per unit system, Per unit impedance of 3 phase components, Change of base, Per unit impedance diagram, Advantages of per unit system calculations.

Symmetrical Three Phase Faults: 3 - phase short circuit at the terminals of unloaded generator, Sub transient, Transient and Steady state reactance, Transients on a transmission line, Short circuit currents and Reactance of synchronous machines on load and no load, Short circuit MVA.

UNIT – II	**(10 Hours)**

Symmetrical Components: Definition of sequence components for 3-Phase unbalanced power systems, Operator "a" and its properties, Expressions for sequence components, Phase shift of symmetrical components in star delta transformer bank.

Sequence Networks:3- Ph power in terms of sequence components, voltage drop due to sequence currents, sequence impedance and sequence networks of power system elements (Alternator, Transformer and Transmission line), positive, negative and zero sequence networks of power system elements.

UNIT – III	**(10 Hours)**

Unsymmetrical Fault at the Terminals Unloaded Generator:L-G, L-L, L-L-G fault with and without fault impedance at the terminals of unloaded generator- derivation for connection of sequence network and fault currents.

Unsymmetrical Faults on Power Systems:L-G, L-L, L-L-G faults on unloaded power systems, Open conductor faults in power system.

UNIT – IV	**(10 Hours)**

Transient Stability Analysis: Classification of Power System Stability, Steady Rotor dynamics, Swing equation, Solution of swing equation by numerical techniques (Point by point method and RungeKutta Method), Power angle equation for salient and non-salient pole synchronous machines.

Equal Area Criterion: Equal area criterion – Stability analysis for sudden change in mechanical input power, 3- ph fault on Generator terminals and on transmission line, Expression for critical clearing angle, Methods to improve stability of power system.

Reference Books:

1. K. Uma Rao, "Computer Techniques and Models in Power Systems", 1stEdition, I. K. International publishing house, 2014.
2. Nagarath and Kothari, "Modern Power System Analysis", 3rd Edition, TMH, 2009.
3. W.D. Stevenson, "Elements of Power Systems Analysis", 4thEdition, Mc.Graw Hill Publishers, 2013.
4. HadiSaadat, "Power System Analysis", TMH, Publishers, 4th Edition 2015.
5. V Neelakantan, "Power System Analysis & Stability", Shiva Publishers, 2017.

Course Outcomes:

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

After completion of the course the students will be able to,

1. Represent power system networks as per unit reactance diagrams on the base of given MVA and KV values
2. Assess phase & line components of voltage/current and to draw the positive, negative & sequence networks using symmetrical components
3. Carry out analysis of unsymmetrical faults (LG,LL,LLG) to determine fault currents when fault occurs at generator terminals/in power systems networks
4. Assess stability of power system under different types of disturbances by applying equal area criterion/solving the swing equation

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	1	2	1	1							1	3		1
2	CO-2	1	3	2	1							1	3		1
3	CO-3	1	3	2	2							1	3		1
4	CO-4	1	3	2	2							1	3		1

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Power Electronics	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hours**
Introduction: Introduction to power electronics, block diagram of power electronic converter system, applications of power electronics. Types of power electronic circuits and their peripheral effects. **Power Transistors:** Introduction to Power BJT's and MOSFETs static characteristics, switching characteristics, switching limits, di/dt and dv/dt protection, cooling, heat sinks and snubber circuits. **Thyristors:** Introduction, static characteristics, two transistor model. Switching characteristics, di/dt and dv/dt protection	
UNIT – II	**10 Hours**
Controlled Rectifiers: Introduction. Classification of rectifiers, principle of phase-controlled converter operation. Single- phase half wave, semi-converters and full converters and problems. Three-phase half-wave, semi-converters and full converters with R, R-L and RLE load. Performance evaluation of Rectifier.	
UNIT – III	**10 Hours**
Commutation Techniques: Introduction. Natural commutation, forced commutation: self-commutation, impulse commutation, resonant pulse commutation and complementary commutation. **DC–DC Converter:** Introduction. Principle Operation of dc-dc converter, Control Strategies: constant frequency, Variable Frequency, Four quadrant operation of dc-dc converter. Detailed analysis of Class-A chopper with numerical, Principle operations of Class-B, Class-C, Class-D and Class-E chopper. Flyback converters-Boost, Buck and Buck-Boost converters	
UNIT – IV	**10 Hours**
Inverters: Introduction. Types of inverters, performance parameters, principle of operation of half bridge and full bridge inverters with R and R-L load. Three phase inverter configurations to operate with 120^0- and 180^0-degree modes. Voltage control of single-phase inverters – single pulse width modulation, multiple pulse width modulation and sinusoidal pulse width modulation. **AC Voltage Controllers:** Introduction. Principle of ON-OFF control and phase control. Single-phase half wave and full-wave AC voltage controllers with resistive and inductive loads.	

Reference Books:

1. M.H. Rashid, "Power Electronics", 3rd Edition, P.H.I./Pearson, New Delhi, 2002.
2. Mohan, Undel and, Robbins, "Power Electronics" Wiley Edition, 2003
3. P.S.Bimbra, "Power Electronics", 4th Edition Khanna Publishers, 2009.
4. G.K.Dubey, S.R.Dorodla, A.Joshiand, R.M.K.Sinha, "Thyristorised Power Controllers", New Age International Publishers, 2005.
5. M. D. Singh and Khanchandani K. B., "Power Electronics", 2nd Edition, Khanna Publisher, 2007

Course Outcomes:

After completion of the course the students will be able to,

1. Select suitable power switches, heat sinks and power converters for industrial applications.

2. Investigate performance of the power switches-based on switching characteristics, power converters based on performance indices
3. Compute power loss in power switches and power converters, average and rms voltage, average and rms currents, ripple factors and harmonic components of power converters
4. Design various components of power converters employed in industrial application

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	3	2	1	1				1	1	2	3	2	1
2	CO-2	3	2	3	3	1				1	1	2	2	2	1
3	CO-3	3	3	3	2	1				1	1	2	2	3	1
4	CO-4	3	2	2	3	1				1	1	2	3	1	2

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Power Electronics Laboratory	**01 - Credits (0 : 0 : 2)**
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. Static characteristic of SCR
2. Static and switching characteristic of IGBT and MOSFET
3. Static characteristic of TRIAC
4. Study of SCR firing circuit (R, RC, UJT)
5. Single phase half wave controlled rectifier with R and RL load
6. Single phase half controlled bridge rectifier with R and RL load
7. Single phase fully controlled bridge rectifier with R and RL load
8. Speed control of a separately excited D.C. motor using an IGBT an MOSFET chopper
9. Study of SCR commutation circuit
10. Half wave and Full wave bridge Inverter for R and RL load

Reference Books:

1. M. H. Rashid, “Power Electronics”, 3rd Edition, P.H.I./Pearson, New Delhi, 2002.
2. Mohan, Undel and, Robbins, “Power Electronics” Wiley Edition, 2003
3. P. S. Bimbra, “Power Electronics”, 4th Edition Khanna Publishers, 2009.
4. G. K. Dubey, S.R.Dorodla, A.Joshiand, R.M.K.Sinha, “Thyristorised Power Controllers”, New Age International Publishers, 2005.

Course Outcomes:

After completion of the course the students will be able to:

1. Select appropriate power equipment and instruments for realization of static and switching characteristics of MoSFET, SCR, IGBT and various power converter circuits
2. Conduct the experiments to evaluate performance characteristics of power devices and power electronics converter circuits
3. Interpret experiment results to investigate performance of various switching device and power converter

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	1	2	2	1				2	2	2	3	2	1
2	CO-2	3	2	3	2	1				1	1	2	2	2	2
3	CO-3	3	1	2	2	1				1	2	2	2	2	1

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Power System – I Laboratory	**01 - Credits (0 : 0 : 2)**
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. Operating characteristics of static Under/Over Voltage relay.
2. Operating characteristics of Microcontroller over voltage relay (DMT and IDMT)
3. Operating characteristics of Electro-Mechanical over current relay.
4. Operating characteristics of Electro-Mechanical Earth fault relay.
5. Operating characteristics of Microcontroller over current relay (DMT and IDMT).
6. Operating characteristics of static Over Current relay (DMT).
7. Break down strength of transformer oil.
8. Experiment on field plotting using electrodes.
9. Measurement of high AC and DC voltage using Sphere-gap.
10. Flash-over characteristics of uniform and non-uniform Gaps for HVAC
    a) Plane-Plane Electrodes (Uniform field)
    b) Point-Plane Electrodes (Non-uniform field)

Reference Books:

1. Mehta V K and Rohit Mehta, “Principals of Power Systems”, 4th Edition, S Chand and Company Ltd, Publishers, New Delhi, 2015.
2. Soni, Gupta and Bhatnagar, “Power System Engineering”, 5th Edition, DhanapatRai and Co.(P) Ltd. Publishers, New Delhi, 2016.
3. Sunil Rao, “Switchgear and Protection and Power Systems”, 13th Edition, Khanna Publishers, 2008.
4. J.B.Gupta, “Switchgear and Protection”, (2nd Edition), Katson Publisher, 2013.
5. Ravindarnath B, “Power System Protection and Switchgear”, 2nd Edition, New age International, 2008.

Course Outcomes:

After completion of the course the students will be able to:

1. Demonstrate and analyze the operating characteristics of various protective relays, including static, electro-mechanical, and microcontroller-based types for overcurrent, earth fault, and voltage protection.
2. Evaluate the dielectric strength of transformer oil and assess flashover characteristics under uniform and non-uniform field conditions in HVAC systems.
3. Measure high voltages using sphere gaps and interpret electric field distributions using field plotting techniques with electrode configurations

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	3		2	3							3	3	
2	CO-2	3	2		3	2							3	3	
3	CO-3	3	2		2	2							3	3	

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Control System Laboratory	**01 - Credits (0 : 0 : 2)**
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. To determine the characteristics of synchro-transmitter and receiver system and to study its application as remote position indicator.
2. To determine the time domain response of a second order system using RLC circuit for a step input.
3. To determine the frequency response of a second -order system.
4. To determine the frequency response of RC lag compensating network.
5. To determine the frequency response RC lead compensating network.
6. To draw the speed – torque characteristic of A.C. servomotor.
7. To sketch the root loci for the given control system for $K \geq 0$. Find the value of K at the breakaway point. Also write a MATLAB program to verify the same.
8. To sketch the Bode plot of the given open-loop transfer function and determine the gain cross-over frequency and phase cross-over frequency, GM, PM. Also write a MATLAB program to verify the same.
9. To sketch the Nyquist plot of the given feedback control system and examine the stability of the closed loop system using Nyquist criterion. Also write a MATLAB program to verify the same.
10. To Incorporate MATLAB program into a Simulation Model.

Reference Books:

1. Benjamin C. Kuo, “Automatic Control System”, 7th Edition, PHI, 2010.
2. Richard C. Dorf Robert H. Bishop “Modern Control Systems”, 8th Edition, Addison-Wesley,1999
3. I.J. Nagarath and M Gopal, “Control Systems Engineering”, New Age International (P) Ltd.,1999
4. Norman S. Nise “Control System Engineering”, McGraw Hill, 2010.
5. R. S. Allurkar, “Control Systems”, EBPB, 2004

Course Outcomes:

After completion of the course the students will be able to:

1. To realize and analyze lead and lag compensator networks.
2. Examine characteristics of control system components such as AC servomotor, and synchros.
3. To analyze stability of the system through Root Locus, Bode plot and Nyquist plot using MATLAB

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	2		1						1		2	
2	CO-2	3	3									1		2	
3	CO-3	3	3	2	2	3						1		2	

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Mini Project	**02- Credits (0 : 0 : 4)**
Hours/Week : 0L+4P		CIE Marks : 50
Total Hours : 48		SEE Marks : 50

The Mini Project is a laboratory-oriented course designed to provide students with a platform to enhance their practical knowledge and technical skills through the development of small-scale systems or applications. It serves as a foundation for larger project work in the final year and beyond, encouraging creativity, collaboration, and hands-on learning.

Students will undertake a mini project either individually or in teams of up to four members, based on their abilities and the recommendations of the faculty mentor. Projects may be single-disciplinary or multidisciplinary, depending on the nature of the problem and the interests of the students.

The evaluation of the Mini Project will be carried out in two stages: Continuous Internal Evaluation (CIE) and Semester End Evaluation (SEE), each carrying 50 marks. The CIE will be conducted by a committee comprising the Head of the Department (HOD) or nominee, the Mini Project Coordinator, and the assigned faculty guide. Students will be assessed based on predefined rubrics that consider the relevance and clarity of the problem identified, technical depth, innovation, quality of implementation, teamwork, and effectiveness of presentation and communication. For the SEE, students are required to present their completed mini project to the Mini Project Evaluation Committee (MPEC), which includes the Mini Project Coordinator, HOD or nominee, and an External Examiner. The committee will evaluate the students based on the demonstration of the project, technical content, report quality, and overall presentation. This dual-stage evaluation ensures a comprehensive assessment of both the process and the outcome of the mini project work.

Course Outcomes

After undergoing the internship, students will be able to:

1. Identify engineering problems associated with electrical & electronics engineering and interdisciplinary research.
2. Analyze Data and interpret contemporary tools & resources to analyze / validate the solutions for engineering problems.
3. Communicate effectively and present the work to technical audience.
4. Prepare quality technical report with detailed analysis and representation of the executed work.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	3	2	1	2	1	1	2	2	2	1	2	2	3
2	CO-2	2	3	3	2	3	1	1	1	1	1	1	2	2	3
3	CO-3							1	1	3	1	1	2	2	3
4	CO-4				1	2	1	1	1	2	1	1	2	2	3

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Environmental Studies	**01 - Credits (1 : 0 : 0)**
Hours/Week : 01		CIE Marks : 50
Total Hours : 15		SEE Marks : 50

UNIT – I	**(04 Hours)**
Natural Resources: Human activities and their impacts. Environmental Impact Assessment, **Renewable Energy**: Solar energy, Wind energy, Hydropower, Tidal energy, Ocean thermal energy, Geo thermal energy, Biomass energy, Biogas, Biodiesel, Bioethanol, Hydrogen as fuel. **Non renewable Energy**: Coal, Petroleum, Natural gas, Nuclear energy.	
UNIT – II	**(04 Hours)**
Environmental Pollution: Water pollution, water quality standards, water borne diseases, Fluoride problem, Air pollution, Noise pollution. Effect of electromagnetic waves. **Sustainable future**: Concept of sustainable development, threats to sustainability, strategies for sustainable development. Environment economics – concept of green building, Circular Economy.	
UNIT – III	**(03 Hours)**
Current Environmental Issues of concern: Greenhouse Effect- Greenhouse gases and Global Warming, Climate change, ozone layer depletion, Acid rain, Eutrophication Environmental policy legislation rules & regulations	
UNIT – IV	**(04 Hours)**
Fundamentals of Waste management: Solid waste management: Sources, classification, characteristics, collection & transportation, disposal, and processing methods. Hazardous waste management and handling. Concept of waste water treatment, Bioremediation. Industrial waste management (Case studies: Cement, plastic, chemical, E–waste, food & construction industry waste management).	
Reference Books: 1. Benny Joseph "Environmental Studies" Tata McGraw Hill, 2005 2. Dr. D. L. Manjunath, "Environmental Studies" Pearson Education, 2006 3. Koushik and Koushik "Environmental Science & Engineering" New Age International Publishers, New Delhi, 2006 4. Meenakshi "Environmental Science & Engineering" Pranticce Hall of India, 2006	
Course Outcomes: After completion of the course the students will be able to, 1. Identify natural resources and its uses. 2. Understand pollution and its effects on environment and to implement sustainable future in the work place. 3. Analyze current environmental issues. 4. Apply the waste management techniques in various fields.	

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	2		2			3					3	3		3
2	CO-2	2		2			3					3	3		3
3	CO-3	2		2			3					3	3		3
4	CO-4	2		2			3					3	3		3

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

Professional Elective Course – I

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Electrical Machine Design	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**(10 Hours)**
Principles of Electrical Machine Design: Introduction to design of electrical machines, limitations. Different types of materials and insulators used in electrical machines. **Design of DC Machines:** Output equation, choice of specific loadings and number of poles, design of main dimensions, armature slot dimensions and estimation of ampere turns.	
UNIT – II	**(10 Hours)**
Design of Transformers (Single phase and three phase): Output equation for single phase and three phase transformer, choice of specific loadings, expression tor volts/turn, determination of main dimensions of the core, types of windings and estimation of number of turns and cross sectional area of Primary and secondary coils and Design of tank and cooling tubes.	
UNIT – III	**(10 Hours)**
Design of Induction Motors: Output equation, choice of specific loadings, main dimensions of three phase induction motor, stator winding design, choice of length of the air gap, estimation of number of slots for the squirrel cage rotor, end ring current.	
UNIT – IV	**(10 Hours)**
Design of Synchronous Machines: Output equation, choice of specific loadings, short circuit ratio, design of main dimensions, armature slots and windings, slot details for the stator of salient and non salient pole synchronous machine. Design of rotor of salient pole synchronous machines, magnetic circuits and rotor of non salient pole machine.	

Reference Books:

1. A.K. Sawhney, A Course in Electrical Machine Design, Dhanpat Rai & Co. (P) Limited (2017), ISBN-10: 8177001019, ISBN-13: 978-8177001013.
2. Mittle V.N., Arvind Mittal, Design of Electrical Machines, Standard Publishers Distributors (2009), ISBN-13: 978-81-8014-126-3, ISBN: 81-8014-126-8.
3. V. Rajini, V. S. Nagarajan Electrical Machine Design Pearson Education (May 2018) ISBN-10: 9332585571, ISBN-13: 978-9332585577
4. K. G. UpadhyayDesign of Electrical Machines (2010) Publisher: New Age International ISBN: 9788122422825, 8122422829.

Course Outcomes:

After completion of the course the students will be able to,

1. Explain the fundamental principles and limitations of electrical machine design, and identify materials and insulators used in DC machines.
2. Design single-phase and three-phase transformers by formulating output equations, selecting specific loadings, and determining winding and core dimensions.
3. Apply design principles to three-phase induction motors including main dimensions, stator winding, air gap, and rotor slots.
4. Design salient and non-salient pole synchronous machines by determining main dimensions, armature slots, rotor configurations, and magnetic circuits.

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	1		2							3	2	1
2	CO-2	3	3	2	2	3							2	3	2
3	CO-3	3	2	2		3							2	3	3
4	CO-4	3	3	2	2	2							3	3	3

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Electrical Engineering Materials	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**(10 Hours)**
Introduction to Electrical and Electronic Materials: Importance of materials, Classification of electrical and electronic materials, Scope of electrical and electronic materials, Requirement of Engineering materials, Operational requirements of electrical and electronic materials, Classification of solids on the basis of energy gap, Products – working principle and materials, Types of engineering materials, Levels of material structure. Spintronics and Spintronic materials, Ferromagnetic semiconductors, Left handed materials.	
UNIT – II	**(10 Hours)**
Conductors: Conductor materials, Factors affecting conductivity, Thermal conductivity, Heating effect of current, Thermoelectric effect, Seebeck effect, Thomson effect, Wiedemann – Franz law and Lorentz relation, Problems. **Conductive Materials and Applications:** Mechanically processed forms of electrical materials, Types of conducting materials, Low resistivity materials, High resistivity materials, Contact materials, Fusible materials, Filament materials, Carbon as filamentary and brush material, Material for conductors, cables, wires, solder, sheathing and sealing.	
UNIT – III	**(10 Hours)**
Dielectrics: Introduction to dielectric materials, classification of dielectric materials, Dielectric constant, Dielectric strength and Dielectric loss. Polarization, Mechanisms of polarization, Comparison of different polarization process, Factors affecting polarization, Spontaneous polarization, Behavior of polarization under impulse and frequency switching, Decay and build-up of polarization under ac field, Complex dielectric constant. **Insulating Materials:** Insulating materials and applications – Ceramic, Mica, Porcelain, Glass, Micanite and Glass bonded mica. Polymeric materials – Bakelite, Polyethylene. Natural and synthetic rubber. Paper. Choice of solid insulating material for different applications, Liquid insulating materials – Requirements, Transformer oil, Bubble theory, Aging of mineral insulating oils. Gaseous insulating Materials – Air, Nitrogen, Vacuum.	
UNIT – IV	**(10 Hours)**
Magnetic Materials: Origin of permanent magnetic dipole, Magnetic terminology, Relation between relative permeability and magnetic susceptibility. Classification of magnetic materials, Diamagnetic, Paramagnetism, Ferromagnetism, Antiferromagnetic and the corresponding materials. Ferrimagnetism and ferrites – properties and applications, Soft and hard ferrites. Curie temperature, Laws of magnetic materials. Magnetization curve, Initial, and maximum permeability. Hysteresis loop and loss, Eddy current loss. Types of magnetic materials, Soft and hard magnetic materials, High energy magnetic materials, Commercial grade soft and hard magnetic materials.	
Reference Books: 1. K.M. Gupta, Nishu Gupta, “Advanced Electrical and Electronics Materials; Processes and Applications”, 1st Edition, Scrivener Publishing, 2015 2. R.K. Shukla, Archana Singh, “Electronic Engineering Materials”, Tata McGraw Hill Education PVT Ltd, 2012. 3. L Solymar, D. Walsh, R. R. A. Syms, “Electrical Properties of Materials”, 10th	

Edition, Oxford Publishing, 2018.
4. A.J. Dekker, “Electrical Engineering Materials”, 1st Edition, Pearson, 2015.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply the classification and structural characteristics of electrical and electronic materials, including spintronic and left-handed materials, for engineering applications.
2. Analyze the electrical, thermal, and mechanical properties of conducting materials using principles such as Seebeck effect, Wiedemann–Franz law, and Lorentz relation.
3. Evaluate the dielectric behavior and insulation performance of solid, liquid, and gaseous materials for various electrical engineering applications.
4. Examine the magnetic properties, hysteresis behavior, and performance of soft and hard magnetic materials under varying operating conditions.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	1		2		2	1	1	2		3	2	
2	CO-2	3	3	2	2	2					2	1	3	3	
3	CO-3	3	2	2	1	1	1	3			2		3	2	1
4	CO-4	3	2	2	2	1	1	2			2	1	3	3	2

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Testing and Commissioning of Electrical Equipment	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**(10 Hours)**
Electrical Safety, Tools, and Regulatory Standards:-Electrical tools and instruments: Types, usage, and care – for installation, maintenance, and repair. Electrical accessories: Terminals, lugs, connectors, clamps, insulating materials, etc. Workmen's safety devices: Safety belts, gloves, helmets, earthing rods, shock protection. Electrical hazards and accident prevention: Causes and preventive measures. Artificial respiration methods (CPR basics).Safety codes and Indian Electricity Rules: Key regulations, permissions, and documentation. Earthing systems and safety audits in industrial premises.	
UNIT – II	**(10 Hours)**
Transformers – Installation, Testing, and Commissioning:-Site selection and foundation for transformers – outdoor/indoor setup, mode of transportation. Installation practices: Polarity, terminal plates, oil tanks, and winding drying methods. General and detailed inspection before commissioning. Commissioning tests as per IS/IEC standards: Voltage ratio test Earth resistance measurement Oil dielectric strength and insulation resistance Polarization Index and Impulse Tests Load and temperature rise tests Performance evaluation: Efficiency, voltage regulation, and mechanical stress under load, Preventive maintenance schedule and failure case studies.	
UNIT – III	**(10 Hours)**
Synchronous Machines: Installation: BIS specifications, alignment, cooling systems, control gear, excitation. Commissioning: Insulation tests, waveform analysis, telephone interference, line charging capacitance. Performance tests: Slip test, reluctance power, short-circuit test, sequence impedance, etc. Factory tests: Gap length, balancing, bearing performance, magnetic eccentricity. **Induction Motors:** Installation: Location, shaft alignment, pulley coupling, drying of windings. Commissioning: Air-gap symmetry, vibration and bearing testing, mechanical alignment. Performance tests: Temperature rise, stray load losses, re-winding needs, special duty performance. Maintenance techniques and troubleshooting common faults.	
UNIT – IV	**(10 Hours)**
Laying of Underground Cables: Inspection, handling, and storage of power and control cables. Cable laying: Depths, clearances, coordination with water/gas/telecom services. Trenching, backfilling, and protection measures for underground cables. Cable jointing and terminations – indoor, outdoor, and straight joints. Cable testing and commissioning: IR testing, continuity, and insulation resistance. Fault location techniques: Megger testing, loop tests, and TDR method overview. Troubleshooting issues: Loose neutral, flickering lights, service fuse failure impacts. Industry practices on service reliability and system integrity. **Switchgear and Protective Devices:** Standards, Types, Specification, Installation, Commissioning Tests, Maintenance Schedule, Type and Routine Tests.	

Reference Books:

1. Testing, Commissioning, Operation and Maintenance of Electrical Equipment S. Rao Khanna Publishers 6th Edition, 19th Reprint, 2015
2. Testing and Commissioning of Electrical Equipment R.L.Chakrasali Prism Books Pvt Ltd 1st Edition,2014
3. Preventive Maintenance of Electrical Apparatus S.K.SharotriKatson Publishing House 1st Edition, 1980
4. Handbook of Switchgears BHEL McGraw Hill 1st Edition, 2005

Course Outcomes:

After completion of the course the students will be able to,

1. **Analyze** the selection, usage, and maintenance of electrical safety tools, accessories, and safety systems, in compliance with Indian safety regulations and standards for industrial installations.
2. **Evaluate** the procedures for installation, testing, and commissioning of transformers, synchronous machines, and induction motors, ensuring performance efficiency and compliance with IS/IEC standards.
3. **Formulate** and implement underground cable practices, including jointing and fault analysis, in alignment with technical and regulatory standards..
4. **Develop** maintenance schedules and trouble shooting strategies for switchgear, protective devices, and rotating machines based on performance diagnostics and case studies.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2			2						1	2	2	1
2	CO-2	3	3	2	2	2						1	2	2	2
3	CO-3	2	3	3	2	3						1	2	2	1
4	CO-4	3	2	3	2	3						1	2	2	2

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Data Base Management Systems	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**(10 Hours)**
Introduction to Data Base Systems: Managing data, a historical perspective, File systems versus DBMS, Advantages of DBMS, Describing and Storing Data in DBMS, Queries in DBMS, Transaction management, Structure of DBMS, People who work with databases. **Entity – Relationship Model:** Using high-Level Conceptual Data Models for Database Design, An example of Database Application, Entity types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Refining the ER Design for the COMPANY database, ER Diagrams, Naming Conventions and Design Issues.	
UNIT – II	**(10 Hours)**
Relational Model and Relational Algebra: Relational model concepts, relational model constraints and relational database schemes, update operations and dealing with Constraint Violations, Unary relational Operations, SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations, JOIN and DIVISION, Additional Relational Operations, examples of Queries in Relational algebra, relational database design using ER – to-Relational mapping. **SQL-The Relational Database Standard:** SQL Data definition and data types, specifying basic constraints in SQL, Schemes, Change statements in SQL, basic Queries in SQL, more complex SQL queries, Insert, Delete and Update statements in SQL, additional features of SQL, specifying general constraints as assertion, views (virtual tables) in SQL,	
UNIT – III	**(10 Hours)**
Data Base Design: Informal Design Guidelines for Relation Schemes, Functional Dependencies, Normal Forms based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Properties of Relational Decompositions, Algorithms for Relational Database Scheme Design, Multivalued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Inclusion Dependencies, Other Dependencies and Normal Forms.	
UNIT – IV	**(10 Hours)**
Transaction Management: The ACID properties, Transactions and Schedules, Concurrent Execution of transactions, Lock-based Concurrency control, performance of locking, Transaction support In SQL, Introduction to crash recovery; 2PL, ss for 4rializability and recoverability, Introduction to lock management, Lock Conversions, Dealing with Deadlocks, Specialized locking Techniques, Concurrency control without locking, Introduction to ARIES	
Reference Books: 1. Silberschatz, Korth and Sudharahan, “Data Base System Concepts”, 5th Edition, Mc- Graw Hill, 2007 2. C.J. Date, A.Kannan, S.Swamynatham, “An Introduction to Database Systems”, 8th Edition, Pearson Education, 2006.	

3. Raghu Ramakrishnan and JohannesGehrke, “Database Management Systems”, 3rd Edition, McGraw Hill, 2004.
4. Elmasri and Navathe, “Fundamentals of Database Systems”, 4th Edition, Pearson Publication.

Course Outcomes:

After completion of the course the students will be able to,

1. Construct, manipulate and share data base, for various applications and Draw ER diagram.
2. Construct relational database schemes, perform relational algebra operations and ER- to Relational Mapping and queues from database using SQL.
3. Describe different normal forms and properties of relational decomposition.
4. Perform operations about Transaction Management and Crash recovery.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1		2	3		2								1	1
2	CO-2		2	3	1	2								1	1
3	CO-3		1		1									1	
4	CO-4		2	2	1	3								1	1

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Operation Research	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**(10 Hours)**
Introduction: Definition, OR models characteristics and phase of OR. Modeling with linear Programming: Two variable LP model, Graphical LP solution, model in equation from graphical to algebraic solution. **Simplex Method:** Special cases in Simplex method and Big M method.	
UNIT – II	**(10 Hours)**
Duality: Formation of Dual Problems, Definition of dual problems, dual simplex method. **Transportation Model:** Definition of transportation model basic feasible solution by different methods, finding optimal solutions, stepping stone method, MODI method, the assignment model,traveling sales man problem.	
UNIT – III	**(10 Hours)**
GameTheory: Formulation of two–person, zero sum games, Games with and without saddle points, Max–Min, Min–Max principles, graphical solution procedure for 2×n or m×2 games, solving by linear programming.	
UNIT – IV	**(10 Hours)**
PERT and CPM Techniques: Network representation, critical path computation, construction of the time schedule, variation under probabilistic models, crossing of simple networks, PERTcalculation.	

Reference Books:

1. Hamdy A. Taha, "Operations Research: An Introduction", 10th Edition, Pearson Education, 2017.
2. Fredrick S. Hillier and Lieverman "Operation Research Concept and Cases", 8th edition, TMH, 2009.
3. S.D. Sharma, "Operation Research" 16th revised edition, KNRN New Delhi 2009.
4. J K Sharma, "Operations Research – Theory and Applications", 6th Edition, Macmillan Publishers, 2022.
5. S. S. Rao, "Optimization Techniques", 3rd edition New age International Publishers, 2010.
6. Kanti Swarup, P.K. Gupta and Man Mohan, "Operations Research", 19th Edition, Sultan Chand & Sons, New Delhi, 2022.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply the basic concepts and formulate mathematical models of Linear Programming problems using appropriate methods.
2. Analyze and solve transportation and assignment problems including special cases using systematic procedures.
3. Develop strategic solutions for competitive situations using Game Theory models and graphical methods.
4. Evaluate project activities through PERT and CPM techniques to determine critical paths and project duration in uncertain environments.

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	3	2	2							1	3	2	
2	CO-2	3	3	2	3	2						1	3	2	
3	CO-3	3	3	3	2	2						1	3	3	
4	CO-4	3	3	3	3	2						1	3	3	

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Field Theory	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**(10 Hours)**
Coulomb's Law and Electric Field Intensity: Experimental law of Coulomb, electric field intensity, field due to continuous volume charge distribution, field of a line charge, field of a sheet charge. **Electric Flux Density, Gauss' Law and Divergence:** Electric Flux Density, Gauss' law, divergence. Maxwell's first equation (Electrostatics), vector operator V and the divergence theorem.	
UNIT – II	**(10 Hours)**
Energy and Potential: Energy expended in moving a point charge in an electric filed, the line integral, definition of potential difference and potential. The potential field of a point charge and system of charges, potential gradient, the dipole. Current and current density, Continuity of current.	
UNIT – III	**(10 Hours)**
The Steady Magnetic Field: Biot-Savart law, Ampere's circuital law, Curl, Stokes' theorem, magnetic flux and flux density. **Magnetic Forces:** Force on a moving charge and differential current element, force between differential current elements.	
UNIT – IV	**(10 Hours)**
Materials and Inductance: The nature of magnetic materials, Magnetization and permeability. **Time Varying Fields and Maxwell's Equations:** Faraday's law, displacement current, Maxwell's equation in point and Integral form.	

Reference Books:

1. William H. Hayt Jr. and John A Buck, "Engineering Electromagnetics", 17th - Edition, Tata McGraw Hill, 2012.
2. John Karuss, Daniel A Fleisch, "Electromagnetics with Applications", 5th Edition McGraw-Hill,1999.
3. Edward C. Jordan and Keith G Balmain, "Electromagnetic Waves and Radiating Systems," II- Edition, Prentice Hall of India / Pearson Education, 1968. Reprint 2002.
4. Dr. D. Ganesh Rao, "Field Theory" Sanguine Technical Publishers, 1st Edition, 2014.

Course Outcomes:

After completion of the course the students will be able to,

1. Identify differential coordinate elements for the various electric and magnetic field applications
2. Estimate the flux density, field intensity of electric and magnetic fields for various charges
3. Analyze the time varying and static electric and magnetic fields for various charges
4. Select the suitable time varying maxwells equation for real-time application of electromagnetism.

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	3	2	2	1							3		
2	CO-2	3	3	3	2	2							3		
3	CO-3	3	3	3	3	2							3		
4	CO-4	3	3	3	2	2							3	2	

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

Open Elective Course-I

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Electric Vehicles	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hours**

Introduction to EV:
Historical Background, Benefits of Using Evs, Overview of types of Evs and its Challenges, EV Motor Drive Technologies, EV Energy Source Technologies, EV Battery Charging Technologies, EV Vehicle to Grid

EV Subsystem: EV Subsystems and Configurations, HEV Subsystems and Configurations. HEV Subsystems and Configurations, Motion and dynamic equations for vehicles

UNIT – II	**10 Hours**

Energy Storage:
Batteries-Overview of Batteries, Battery Parameters, Lead Acid Batteries, Lithium Batteries, Metal Air Batteries. Alternative and Novel Energy Sources-Solar Photovoltaics, Flywheels, Super Capacitors. Fuel Cells-Main issues in the fuel cell, Hydrogen Fuel Cells: Basic Principles, Fuel Cell Thermodynamics (Introduction)

UNIT – III	**10 Hours**

Architecture of EV and HEV:
Vehicle Power Plant and Transmission Characteristics- Introduction, Drive train Configuration, Vehicle power plant, Internal combustion engine, Electric Motor, The need for gearbox, Drive train tractive effort and vehicle speed, Vehicle performance. Basic Architecture of Hybrid Drive Trains and Analysis of Series Drive Train- The Hybrid Electric Vehicle (HEV), Energy Use in Conventional Vehicles, Energy Savings Potential ofHybrid Drivetrains, HEV Configurations, Series and parallel Hybrid System.

UNIT – IV	**10 Hours**

Power Flow in HEVs:
Introduction, Power Flow Control, Power Flow Control in Series Hybrid, Power Flow Control in Parallel Hybrid, Power Flow Control in series-Parallel Hybrid, Power Flow Control Complex HybridControl

Reference Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

Course Outcomes:

After completion of the course the students will be able to,

1. Illustrate the evolution, classification, and components of electric and hybrid vehicles.
2. Analyze different energy storage and alternative energy sources used in EV applications.
3. Interpret the drive-train architecture and vehicle dynamics of electric and hybrid vehicles.
4. Evaluate the power flow control strategies in various hybrid electric vehicle configurations.

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2					2							
2	CO-2	3	3	2											
3	CO-3	3	2	3	2										
4	CO-4	2	2	3	3	2									

Syllabus for B.E V - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Fundamentals of Wind Energy Conversion Systems	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hours**
Introduction: Historical Development (BC – 20th Century); Historical Development (20th Century – 1980s); Recent Developments (1980s – present); The Nature of the Wind, origin of wind; Wind Energy Potential; Offshore Wind Energy; Modern Wind Turbines; Wind Vs Conventional power generation.	
UNIT – II	**10 Hours**
Wind Resource Assessment: Introduction – Spatial variation, Time variation; Characteristics of steady wind; Weibull wind speed distribution function; Vertical profiles of steady wind; Wind rose; Energy content of wind; Resource assessment.	
UNIT – III	**10 Hours**
Aerodynamics: Introduction; Aerofoil – Two dimensional theory, Relative wind velocity, Stall control; Wind flow models – Wind flow pattern; Axial momentum theory; Momentum theory for rotating wake; Blade element theory, Strip theory; Tip losses and correction; Wind Machine Characteristics.	
UNIT – IV	**10 Hours**
Wind Turbines: Introduction; Classification of Wind Turbines; Wind Turbine Components; Basic principles of wind energy extraction; Extraction of wind turbine power (Numerical problems) - Weibull distribution-Wind power generation curve-Betz's Law-Modes of wind power generation.	

Reference Books:

1. Siraj Ahmed, "Wind Energy- Theory and Practice", Prentice Hall of India, New Delhi, 2010.
2. D. P. Kothari, S. Umashankar, Wind Energy Systems and Applications, Narosa publishers, 2017.
3. Khan B. H., Non-Conventional Energy Resources, Tata McGraw Hill, 2009.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply various parameters and features of wind energy conversion systems.
2. Analyse various concepts and theory related to wind energy conversion systems.
3. Evaluate/calculate various parameters related to wind energy conversion systems.
4. Relate/articulate the concepts and theories related to wind energy conversion systems.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	2	2	1					1				
2	CO-2	3	3	3	2	2									
3	CO-3	3	2	3	3	2					1	1			
4	CO-4	3	3	3	2	2					1	1			

Syllabus for B.E VI - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Power System-III	**04 - Credits (4 : 0 : 0)**
Hours/Week : 04		CIE Marks : 50
Total Hours :52		SEE Marks : 50

UNIT – I	**10 Hours**

Network Topology: Introduction, Elementary Graph Theory, connected graph, sub graph Loop, Cut-set, Tree, Co- tree, Basic loops, Basic cut-set. Incidence Matrices: Element-node incidence matrix A (Bus-incidence matrix), Branch path incidence matrix K, Basic(Fundamental) cut-set incidence matrix B, Augmented cut-set matrix, Basic loop incidence matrix C, Augmented loop incidence matrix. Algorithm for formation of Bus Impedance Matrix, formation of Y_{bus} by inspection method and singular transformation method.

UNIT – II	**10 Hours**

Load Flow Studies: Introduction, Power Flow Equation, Classification of Buses

Gauss - Seidel Method: Algorithm for GS method, Modification of algorithm including PV buses, Q-limit violations, Acceleration of convergence and examples.

Newton – Raphson Method: Introduction, Algorithm for NR method in polar coordinates and rectangular coordinates. Fast Decoupled Load Flow and examples.

UNIT – III	**10 Hours**

Economic Operations of Power System: Introduction, Performance curves, Economic generation scheduling neglecting losses and generator limits, Economic generation including generator limits and neglecting losses, Iterative technique, Economic Dispatch Including Transmission Losses: Approximation penalty factor, Derivation of transmission loss formula. Introduction to optimal scheduling for hydro thermal plants. Problem formulation, solution procedure and algorithm.

UNIT – IV	**10 Hours**

Excitation Systems: Introduction, DC Excitation system, AC Excitation, static Excitation, Dynamic performance measures of Excitation system, control and protective functions: AC and DC regulators, excitation system stabilizing circuits, power system stabilizer, load compensation, under excitation limiter, over excitation limiter. Modeling of AVR, steady state and dynamic performance analysis of AVR.

References:

1. Stag. G. W, EI - Abaid, A. H., "Computer Methods in Power System Analysis", MEDTECH, A Division of Scientific International, 2019.
2. Olle I. Elgerd, "Electric Energy Systems Theory-An Introduction", 2nd Edition McGraw-Hill Book Company.
3. Pai M.A.,"Computer Techniques in Power System Analysis", 2nd Edition, TMH, 2006.
4. K. Uma Rao, "Computer Techniques and Modeling Power Systems", 2nd Edition, I.K. International, 2014.
5. Singh L. P, "Advanced Power System Analysis and Dynamics", 6th Edition, NewAge International (P) Ltd, New Delhi, 2014.
6. Nagrath, I .J., and Kothari, D.P., "Modern Power System Analysis", 4th Edition, TMH, 2011.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply suitable network topology, primitive network, types of power system buses

for load flow studies and economic scheduling algorithms and excitation systems for power system operation.

2. Investigate performance of the power systems using load flow analysis, optimum scheduling of thermal generators and excitation systems.
3. Calculate Y_{BUS} matrix, real power, reactive power and power flow for a given power systems using load flow studies and optimum cost of generation of thermal power plants using economic scheduling study and components of excitation systems.
4. Formulate the load flow models, economic scheduling of thermal generators.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	3	2	2	1				2	2	2	3	1	2
2	CO-2	3	2	3	2	1				1	2	2	2	2	3
3	CO-3	3	3	3	2	2				1	1	2	3	2	2
4	CO-4	3	2	3	1	1				1	1	2	2	2	1

Syllabus for B.E VI - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Microcontrollers	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

UNIT – I	**10 Hours**
8051 Microcontroller Basics: Inside the Computer, Microcontrollers and Embedded Processors, Block Diagram of 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Usage in 8051, Types of Special Function Registers and their uses in 8051, Pins of 8051. Memory Address Decoding, 8031/51 Interfacing with External ROM And RAM.8051 Addressing Modes.	
UNIT – II	**10 Hours**
Assembly Programming and Instruction of 8051: Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives Arithmetic, logic instructions, Rotate and swap instructions, Programs, Jump, loop and call instructions, IO port programming.	
UNIT – III	**10 Hours**
8051 Programming in C: Data types and time delay in 8051C, IO programming in 8051C, Logic operations in 8051 C. **8051Timer Programming in Assembly and C:** Programming 8051 timers, Counter programming, Programming timers 0 and 1 in 8051 C. **8051 Interrupt Programming in Assembly and C:** 8051 interrupts, Programming timer, external hardware, serial communication interrupt, Interrupt priority in 8051/52, Interrupt programming in C.	
UNIT – IV	**10 Hours**
8051 Interfacing and Applications: Interfacing 8051 to LCD, parallel ADC0809, serial ADC MAX1112, DAC, Stepper motor **Introduction to the Raspberry Pi:** Basics of Raspberry Pi, Hardware layout, Operating Systems on Raspberry Pi, Configuring Raspberry Pi, Programming Raspberry Pi with Python.	
Reference Books: 1. The 8051 Microcontroller and Embedded Systems Using Assembly and C, Muhammad Ali Mazadi, Pearson, 2ndEdition, 2008. 2. The 8051 Microcontroller, Kenneth Ayala, Cengage, 3rd Edition,2005. 3. Microcontrollers: Architecture, Programming, Interfacing and System Design, RajKamal, Pearson, 1st Edition, 2012.	
Course Outcomes: At the end of the course, the student will be able to: 1. Apply the concepts of microcontroller architecture, memory organization, I/O ports, and addressing modes to design and interface simple embedded systems. 2. Develop and analyze assembly language programs using arithmetic, logic, branching, looping, and I/O instructions in 8051 microcontroller. 3. Develop timer, interrupt, and I/O-based applications using embedded C programming for 8051 microcontroller. 4. Design and implement embedded system applications by interfacing 8051 with peripherals and demonstrate basic Raspberry Pi programming using Python.	

Syllabus for B.E VI - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	3	3	2	3						1		2	2
2	CO-2	3	3	3	2	3						1		2	2
3	CO-3	3	3	3	2	3						1		2	2
4	CO-4	3	3	3	2	3						1		2	2

Syllabus for B.E VI - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Digital Signal Processing	**04 - Credits (4 : 0 : 0)**
Hours/Week : 04		CIE Marks : 50
Total Hours :52		SEE Marks : 50

UNIT – I	**10 Hours**
Discrete Fourier Transform: Introduction, Definition, and derivation of DFT and IDFT, Properties-linearity, shift, Symmetry etc., circular convolution, use of tabular arrays, circular arrays, Stock Ham's methods (via DFT-IDFT), Linear convolution of long duration sequences: Overlap-save and overlap-add methods.	
UNIT – II	**10 Hours**
Fast Fourier Transform Algorithms: Introduction, redix-2, decimation in time algorithm (DIT-FFT, DIT-IFFT), First decomposition, Continuation of decomposition, number of computations, number of multiplications, Computational efficiency **Design of FIR Digital filters:** Introduction, Windowing, rectangular, Hamming window	
UNIT – III	**10 Hours**
Design of IIR Digital Filters: Introduction, all pole analog filters- Butterworth and Chebyshev-I, Design of analog filters, Bilinear Transformation, Design of digital Butterworth and Chebyshev-I filters, Frequency transformations	
UNIT – IV	**10 Hours**
Realization of Digital Systems: Introduction, block diagrams and SFG's, Realization of IIR systems- direct form, cascade form, Parallel form, Realization of FIR systems- direct form, cascade form, Linear phase realizations	
Reference Books: 1. Proakis and Manolakis, "Digital Signal Processing Principle, algorithms and applications", 5th Edition, Pearson Education, 2021. 2. Sanjith K. Mithra, "Digital Signal Processing", 4th Edition, 2013. 3. P.RameshBabu, "Digital Signal Processing", 7th Edition, Scitech, 2018. 4. Salivahanam, "Digital Signal Processing", 4th Edition, TMH 2019. 5. Emmanuel, "Digital Signal Processing", 2nd Edition Pearson, 2001.	
Course Outcomes: After completion of the course the students will be able to, 1. Apply Discrete Fourier Transform (DFT), Inverse DFT, and convolution methods (circular, overlap-add, overlap-save) to analyze discrete-time signals. 2. Implement Fast Fourier Transform (FFT) algorithms such as radix-2 DIT-FFT and IFFT to improve computational efficiency in spectral analysis. 3. Analyze and design digital FIR filters using windowing methods and digital IIR Filters using bilinear transformation, and analog prototypes like Butterworth and Chebyshev -I filters. 4. Analyze and realize digital systems using various structures such as direct form, cascade and parallel realizations for both FIR and IIR filters.	

Syllabus for B.E VI - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	1		2						1		1	
2	CO-2	3	2	2		3						1		1	
3	CO-3	3	3	3	2	2						1		1	
4	CO-4	3	3	2	2	2						1		1	

Syllabus for B.E VI - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Power System-II Laboratory	**01 - Credits (0 : 0 : 2)**
Hours/Week : 02		CIE Marks : 50
Total Hours :26		SEE Marks : 50

List of Experiments

1. Determination of regulation, efficiency, symmetry and reciprocity of transmission lines by assessment of ABCD parameters
2. Determination of fault currents and voltages in a power systems at a specified location for LG, LL & LLG faults and to check boundary conditions
3. Formation of Y_{Bus} of power systems by singular transformation and inspection method.
4. Determination of power angle diagrams for salient and non-salient pole synchronous machines.
5. Determination of power system stability using swing equation
6. Determination of critical clearing time for SMIB system by varying inertia constant, line parameters/fault location.
7. Load flow study of power systems using Gauss-Seidel method (only pq Bus not exceeding 4-buses).
8. Load flow study of power systems using Jacobian matrix for a given power system not exceeding 4 buses in polar Coordinates (no PV buses).
9. Load flow study of power systems using fast-decoupled method.
10. Optimal generator scheduling for thermal power plants connected to load dispatch center.

Reference Books:

1. K. Uma Rao, "Computer Techniques and Model in Power Systems", 2nd Edition, I.K. International, 2014.
2. Singh L. P., "Advanced Power System Analysis and Dynamics", 6th Edition, New Age International (P) Ltd, New Delhi, 2014.
3. Nagrath, I .J., and Kothari, D.P., "Modern Power System Analysis", 4th Edition, TMH, 2011

Course Outcomes:

After completion of the course the students will be able to:

1. Apply MATLAB and Mi Power software tools to model, simulate, and analyze various power system components and networks.
2. Conduct experiments related to transmission line parameters, fault analysis, stability studies, load flow methods, and optimal scheduling in power systems using laboratory setups and software tools.
3. Interpret experimental results, analyze system performance, and formulate conclusions to evaluate and improve the efficiency, stability, and reliability of power systems.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1		1	1	3	3						1	3		2
2	CO-2	1	2	2	3	3						1	3		2
3	CO-3	1	2	3	3	3						1	3		2

Syllabus for B.E VI - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Microcontrollers Laboratory	**01 - Credits (0 : 0 : 2)**
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

Part-A: Assembly Language Programming

1. Addition of two 8-bit numbers, 16-bit numbers, array of 8-bit numbers, average of an array.
2. Subtraction of two 8-bit numbers, 16-bit numbers.
3. BCD Addition- two digit numbers, 4 digit numbers.
4. Multiplication, Division
5. Arranging an array of number in ascending/descending order.
6. To find maximum/minimum number of an array.
7. Block of data transfer- Internal RAM, Internal RAM to external RAM.
8. To find number of positive and negative numbers in an array.

Part-B: Hardware interfacing using Raspberry Pi/Arduino

1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2. To interface LED/Buzzer with Arduino Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
3. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
4. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
5. To interface DISPLAY with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
6. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smart phone using Bluetooth
7. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to Thing speak cloud.
8. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from Thing speak cloud.

Reference Books:

1. The 8051 Microcontroller and Embedded Systems Using Assembly and C, Muhammad Ali Mazadi, Pearson, 2nd Edition, 2008.
2. The 8051 Microcontroller, Kenneth Ayala, Cengage, 3rd Edition, 2005.
3. Microcontrollers: Architecture, Programming, Interfacing and System Design, Raj Kamal, Pearson, 1st Edition, 2012.

Course Outcomes:

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

1. Develop and verify assembly language programes for the specified applications.
2. Analyze and execute the assembly language programes in keil software.
3. Interface and analyze the functioning of peripheral devices using Raspberry Pi/Arduino.

Syllabus for B.E VI - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	3	3	2	3						1		2	2
2	CO-2	3	3	3	2	3						1		2	2
3	CO-3	3	3	3	2	3						1		2	2

Syllabus for B.E VI - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

22UHS600C	**Indian Knowledge System**	**01 - Credits (1 : 0 : 0)**
Hours/Week : 01		CIE Marks : 50
Total Hours :15		SEE Marks : 50

UNIT – I	**10 Hours**
Indian Knowledge Systems (IKS) Overview, Vedic Corpus, Philosophy in Indian Knowledge system	
UNIT – II	**10 Hours**
Traditional Knowledge in Mathematics Introduction to Indian Mathematics, Unique aspects of Indian Mathematics, Indian Mathematicians and their Contribution. Number Systems and Units of Measurement.	
UNIT – III	**10 Hours**
Traditional Knowledge in Science Measurements for time, distance and weight, Astronomy, Indian contributions in astronomy, Astrology, The celestial coordinate system, Elements of the Indian calendar, Notion of years and month, Panchanga – The Indian calendar system.	
UNIT – IV	**10 Hours**
Traditional Knowledge in Professional domain Town Planning and Architecture, Agriculture, Governance and Public Administration.	

Reference Books:

1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. "Introduction to Indian Knowledge System: Concepts and Applications", PHI Learning Private Ltd. Delhi (2022**).** Pride of India: A Glimpse into India's Scientific Heritage, Samskrita Bharati, New Delhi.
2. Sampad and Vijay "The Wonder that is Sanskrit", Sri Aurobindo Society, Puducherry. (2011).
3. Acarya, P.K. Indian Architecture, Munshiram Manoharlal Publishers, New Delhi. (1996).
4. Kapoor Kapil, Singh Avadhesh "Indian Knowledge Systems Vol – I & II", Indian Institute of Advanced Study, Shimla, H.P. (2021).
5. Dasgupta,S. A History of Indian Philosophy- Volume 1, Motilal Banarsidass, New Delhi. (1975).
6. P Lofker, K. (1963). Mathematics in India, Princeton University Press, New Jeresy, USA"

Suggested Web Links:

1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/121106003/
3. http://www.iitkgp.ac.in/department/KS;jsessionid=C5042785F727F6EB46CBF432D7683B63 (Centre of Excellence for Indian Knowledge System, IIT Kharagpur)
4. https://www.wipo.int/pressroom/en/briefs/tk_ip.html
5. https://unctad.org/system/files/official-document/ditcted10_en.pdf
6. http://nbaindia.org/uploaded/docs/traditionalknowledge_190707.pdf

Course Outcomes:

At the completion of the course student will be able to:

1. Provide an overview of the concept of the Indian Knowledge System and its importance
2. Appreciate the need and importance of protecting traditional knowledge.

3. Recognize the relevance of Traditional knowledge in different domains.
4. Establish the significance of Indian Knowledge systems in the contemporary world.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	2	2		1		2	1	3		2	2			
2	CO-2	1	2				3	2	3		1	2			
3	CO-3	2	2	1		1	3	3	3		2	2			
4	CO-4	2	2	2		1	3	2	3	1	2	3			

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(For students admitted to I year in 2024-25)

Professional Elective Course – II

Syllabus for B.E VI - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Integration of Distributed Generation	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**(10 Hours)**
Distributed Generation: Introduction, Sources of Energy - Wind Power, Solar Power, Combined Heat-and-Power, Hydropower, Tidal Power, Wave Power, Geothermal Power, Thermal Power Plants	
UNIT – II	**(10 Hours)**
Distributed Generation (continued): Interface with the Grid. Power System Performance: Impact of Distributed Generation on the Power System, Aims of the Power System, Hosting Capacity Approach, Power Quality, Voltage Quality and Design of Distributed Generation, Hosting Capacity Approach for Events, Increasing the Hosting Capacity.	
UNIT – III	**(10 Hours)**
Overloading and Losses: Impact of Distributed Generation, Overloading: Radial Distribution Networks, Overloading: Redundancy and Meshed Operation, Losses Overloading and Losses (continued): Increasing the Hosting Capacity. Voltage Magnitude Variations: Impact of Distributed Generation, Voltage Margin and Hosting Capacity, Design of Distribution Feeders, A Numerical Approach to Voltage Variations, Tap Changers with Line-Drop Compensation, Probabilistic Methods for Design of Distribution Feeders	
UNIT – IV	**(10 Hours)**
Voltage Magnitude Variations (continued): Statistical Approach to Hosting Capacity, Increasing the Hosting Capacity. Power Quality Disturbances: Impact of Distributed Generation, Fast Voltage Fluctuations, Voltage Unbalance.	

Reference Books:

1. Math Bollen, “Integration of Distributed Generation in the Power System”, Wiley publications, 2011.
2. Amirnaser Yezdani, and Reza Iravani, “Voltage Source Converters in Power Systems: Modeling, Control and Applications”, IEEE John Wiley Publications, 2009.
3. Dorin Neacsu, “Power Switching Converters: Medium and High Power”, CRC Press, Taylor & Francis, 2006.
4. Chetan Singh Solanki, “Solar Photo Voltaics”, PHI learning Pvt. Ltd., New Delhi, 2009
5. J.F. Manwell, J.G “Wind Energy Explained, Theory Design and Applications,” McGowan Wiley publication, 2nd Edition, 2009.
6. John Twidell and Tony Weir, “Renewable Energy Resources”, Taylor and Francis Publications, Second Edition, 2006.

Course Outcomes:

After completion of the course the students will be able to,

1. Determine the variation in production capacity at different timescales, the size of individual units, and the flexibility in choosing locations with respect to of wind and solar systems.
2. Evaluate the performance of the system when distributed generation is integrated

to the system.

3. Analyze effects of the integration of DG in terms of increased risk of overload, losses, over voltages and power quality disturbances
4. Assess the impact the integration of DG on power system stability and operation

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3					1	1					2	1	1
2	CO-2	3	3	2	1		1						2	1	1
3	CO-3	3	3	2	1	1	1						2	1	1
4	CO-4	3	3	2	1	1	1				1		2	1	1

Syllabus for B.E VI - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Automotive Electronics	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**(10 Hours)**
Introduction: Need For Electronics In Automotive Control Systems, Structure Of Vehicle Electronics Systems, Common Features Of Vehicle Systems, Measurement System, Sensors And Actuators. Introduction To Electronics: Electronic Components, Diodes, Transistors, Electronic Circuits, Analog Circuits, Digital Circuits, Integrated Circuits, Microprocessor Systems, Systems Approach To Control And Instrumentation.	
UNIT – II	**(10 Hours)**
Electronic Ignition Systems: Types Of Ignition Systems, Conventional Ignition System, Cdi, Programmed Ignition System, Distributor-Less Ignition System, Direct Ignition. Electronic Fuel Control: Electronic Control Of Carburetion, Petrol Injection System, Single And Multi-Point Injection System, Components, Flow Diagram, Diesel Fuel Injection.	
UNIT – III	**(10 Hours)**
Engine Management System: Combined Ignition And Fuel Management System, Exhaust Emission Control, Digital Control Techniques, Complete Vehicle Control Systems, Artificial Intelligence And Engine Management Chassis Electrical Systems: Anti-Lock Brakes, Active Suspension, Traction Control, Electronic Control Of Automatic Transmission.	
UNIT – IV	**(10 Hours)**
Electronics For Comfort, Safety And Security: Electric Seats, Mirrors And Sun-Roof Operation, Central Looking And Electric Windows, Cruise Control, In Car Entertainment (Ice) And Communications, Adaptive Noise Control, Airbags And Seatbelt Tensioners, Obstacle Avoidance Radar, Security Systems - Engine Immobilizer, Icat.	

Reference Books:

1. Tom Denton, “Automotive electrical and electronic systems”, 3rd Edition, SAE International, 2015.
2. Eric Chowanietz, “Automotive Electronics”, 1st Edition NewAge publishers, 1995.
3. William B Ribbens, “Understanding Automotive Electronics”, 7th Edition, Butterworth-Heinemann –Elsevier, 2012.
4. Bernhard Mencher, et. al., “Bosch Professional Automotive Information”, 5th Edition, Springer Vieweg, 2014.

Course Outcomes:

After completion of the course the students will be able to,

1. Explain the need for electronics in modern automobiles and describe the structure and function of key electronic components, sensors, actuators, and control systems used in vehicles.
2. Analyze various electronic ignition and fuel control systems including CDI, programmed ignition, and petrol/diesel injection systems.
3. Examine the role of electronics in engine management systems and advanced chassis control systems such as ABS, traction control, and electronic suspension.
4. Evaluate comfort, safety, and security features in automobiles enabled by electronics such as airbags, cruise control, infotainment systems, and electronic

locking mechanisms.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2			1							2	2	1
2	CO-2	2	3			2								3	2
3	CO-3	3	2	2		3								3	3
4	CO-4	2	3		2	2								3	3

Syllabus for B.E VI - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Intelligent Instrumentation	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**(10 Hours)**
Introduction: Intelligent instrumentation, Definition, Historical Perspective, Current status, software based instruments. **Intelligent Sensors**: Classification, Smart sensors, Monolithic Integrated Smart Sensors, Hybrid Integrated Smart Sensors, Cogent Sensors, Soft or Virtual sensors, Self-adaptive, Self- validating sensors, Soft Sensor Secondary Variable Selection, Rough Set Theory, Model Structures. Self-Adaptive Sensors, Self-Validating Sensors, VLSI Sensors, Temperature Compensating Intelligent Sensors, Pressure Sensor.	
UNIT – II	**(10 Hours)**
Sensor Characterization and Linearization: Analog Linearization of Positive and Negative Coefficient Resistive Sensors. Higher-Order Linearization, Quadratic Linearization, Third-Order Linearization Circuit, Nonlinear ADC- and Amplifier-Based Linearization, Interpolation, Piecewise Linearization, Microcontroller-Based Linearization, Lookup Table Method, Artificial Neural Network– Based Linearization, Nonlinear Adaptive Filter–Based Linearization.	
UNIT – III	**(10 Hours)**
Sensor Calibration and Compensation: Sensor Calibration, Conventional Calibration Circuits, Offset Compensation, Error and Drift Compensation, Lead Wire Compensation. **Sensors with Artificial Intelligence:** Artificial Intelligence, Sensors with Artificial Intelligence, Multidimensional Intelligent Sensors, AI for Prognostic Instrumentation, ANN-Based Intelligent Sensors, Fuzzy Logic–Based Intelligent Sensors.	
UNIT – IV	**(10 Hours)**
Intelligent Sensor Standards and Protocols: IEEE 1451 Standard: STIM, TEDS, NCAP. Network Technologies, LonTalk, CEBUS, J1850 Bus: Signal Logic and Format, MI Bus, Plug-n-Play Smart Sensor Protocol.	

Reference Books:

1. Manabendra Bhuyan, “Intelligent Instrumentation: Principles and Applications,” CRC Press, Taylor and Francis Group, 2011.
2. G. C. Barney, “Intelligent Instrumentation,” Prentice Hall, 1995.
3. J.B Dixit, Amit Yadav, “Intelligent Instrumentation for Engineers,” Laxmi Publications Ltd., 2011

Course Outcomes:

After completion of the course the students will be able to,

1. Explain intelligent instrumentation and analyze the structure and types of smart and self-adaptive sensors.
2. Apply and compare analog and digital linearization techniques for accurate sensor characterization.
3. Apply sensor calibration and compensation techniques and analyze the role of AI in intelligent sensors.
4. Describe IEEE 1451 standards and evaluate protocols used for smart sensor communication and integration.

Syllabus for B.E VI - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	1		2						1	3	2	
2	CO-2	3	3	2		3							3	3	
3	CO-3	3	3	2		3						1	3	3	
4	CO-4	3	2	2		3						2	3	3	

Syllabus for B.E VI - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	VLSI Design	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**(10 Hours)**
Introduction: Overview of VLSI design methodology, VLSI design flow, Design hierarchy, Concept of regularity, Modularity, and Locality, VLSI design style, Design quality, package technology, introduction to FPGA and CPLD, computer aided design technology. Fabrication of MOSFET: Introduction, Fabrication Process flow: Basic steps, C-MOS nWellProcess, Layout Design rules, full custom mask layout design.	
UNIT – II	**(10 Hours)**
MOS Transistor: The Metal Oxide Semiconductor (MOS) structure, The MOS System under external bias, Structure and Operation of MOS transistor, MOSFET Current-Voltage characteristics, MOSFET scaling and small-geometry effects, MOSFET capacitances MOS Inverters - Static Characteristics: Introduction, Resistive load Inverter, Inverter with n-type MOSFET load(Enhancement and Depletion type MOSFET load), CMOS Inverter	
UNIT – III	**(10 Hours)**
MOS Inverters Switching characteristics and Interconnect Effects: Introduction, Delay-time definitions, Calculation of Delay times, Inverter design with delay constraints, Estimation of Interconnect Parasitic, Calculation of interconnect delay, Switching Power Dissipation of CMOS Inverters	
UNIT – IV	**(10 Hours)**
Combinational MOS Logic Circuits: Introduction, MOS logic circuits with Depletion nMOS Loads, CMOS logic circuits, Complex logic circuits, CMOS Transmission Gates (TGs) Sequential MOS Logic Circuits: Introduction, Behavior of Bistable elements, The SR latch circuit, Clocked latch and Flip-flop circuit, CMOS D-latch and Edge-triggered flip-flop Dynamic Logic Circuits: Introduction, Basic Principles of pass transistor circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, CMOS Dynamic Circuit Techniques, High-performance Dynamic CMOS circuits	

Reference Books:

1. Sung – Mo Kang, Yusuf Leblebici, “CMOS Digital Integrated circuits – Analysis and Design”, TATA McGraw-Hill Pub. Company Ltd.
2. Pucknell, Eshraghian, “Basic VLSI Design”, PHI publications, 3rdEdition, 2018.
3. Mead C and Conway, “Introduction to VLSI Systems”, Addison Wesley publications, 2ndEdition, 1990.
4. John P. Uyemura, “Introduction to VLSI Circuits & Systems”, Wiley Publications, 2006.
5. Brown and Vranesic, “Fundamentals of Digital Logic Design with VHDL”, McGraw Hill Education, 3rdEdition, 2017.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply VLSI design flow, hierarchy, and layout rules to illustrate MOSFET fabrication and design methodologies.
2. Analyze MOS transistor characteristics, scaling effects, and evaluate static performance of CMOS inverters.
3. Compute delay parameters, interconnect parasitics, and power dissipation to

assess switching behavior of CMOS inverters.

4. Design and evaluate combinational, sequential, and dynamic MOS logic circuits using CMOS and transmission gate techniques.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	2	2	1					1		3	2	
2	CO-2	3	3	2	2	2					1		3	2	
3	CO-3	3	3	3	2	2					2		3	2	1
4	CO-4	3	3	3	2	3					2		3	3	2

Syllabus for B.E VI - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Electric Machine Drives	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**(10 Hours)**
Fundamentals of Electric Drives Electric drive – Concept, classification, parts and advantages of electrical dives, Types of Loads, Components of load toques Fundamental torque equation – Load torque components – Nature and classification of load torques – Steady state stability – Transient stability -Load equalization– Four quadrant operation of drive (hoist control) – Braking methods: Dynamic – Plugging – Regenerative methods	
UNIT – II	**(10 Hours)**
Converter Controlled DC Motor Drives Modeling of DC motors, State space modeling, block diagram & Transfer function, Single phase, three phases fully controlled and half controlled DC drives. Dual converter control of DC drives. Power factor, supply harmonics and ripple in motor current **DC–DC Converters Controlled DC Motor Drives** Single quadrant – Two quadrant and four quadrant DC-DC converter fed separately excited and self-excited DC motors – Continuous current operation – Output voltage and current waveforms – Speed–torque expressions – Speed–torque characteristics – Four quadrant operation – Closed loop operation (qualitative treatment only).	
UNIT – III	**(10 Hours)**
Induction motor Drive Stator voltage variation by three phase controllers, Speed control using chopper resistance in the rotor circuit, slip power recovery scheme. Pulse width modulated inverter fed and current source inverter fed induction motor drive. Volts/Hertz Control, Vector or Field oriented control	
UNIT – IV	**(10 Hours)**
Synchronous motor drives Variable frequency control, Self-Control, Voltage source inverter fed synchronous motor drive, Vector control **Solar and Battery Powered Drive** Introduction, Stepper motor, Switched Reluctance motor drive **Industrial application** Drive consideration for Textile mills, Steel rolling mills, Cement mills, Paper mills, Machine tools. Cranes & hoist drives	

Reference Books:

1. G K Dubey, “Fundamentals of Electric Drives”, Narosa Publications, 2nd Edition, 2011.
2. S.B. Dewan, G.R. Slemon, A. Straughen, “Power Semiconductor Drives”, Wiley-India Publications, 2nd Edition, 2009.
3. VedamSubrahmanyam, “Electric Drives”, Tata McGraw Hill, 2nd Edition, 2011.
4. R. Krishnan, “Electric Motor Drives- Modelling, Analysis and Control”, Prentice Hall Inc., 2008.
5. Bimal K. Bose, “Modern Power Electronics & AC drives”, Prentice Hall Inc., 2001
6. Austin Hughes, “Electric Motor & Drives” Newnes-Elsevier, 3rd Edition, 2006.

7. S.K. Pillai, “A first course on Electrical Drives”, New Age International Publication, 2nd Edition, 1982.

Course Outcomes:

After completion of the course the students will be able to,

1. Identify and classify suitable drive system for industrial application
2. Analyze the operation of three phase converter and DC-DC converter fed dc motors for four quadrant operation
3. Design suitable drives system based on the performance of motor for various industrial application
4. Model and analyze the DC motor, induction motor and synchronous motor for converter-controlled drive system

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	2	2	1				1	2	1	3	1	3
2	CO-2	3	3	3	2	3				1	2	1	3	2	2
3	CO-3	3	2	3	3	3				1	2	1	3	2	1
4	CO-4	3	2	2	2	3				1	2	1	3	3	2

Syllabus for B.E VI - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Modern Control Theory	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**(10 Hours)**
State Variable Analysis and Design:-Introduction, concept of state, state variables and state model, state modeling of linear systems, linearization of state equations. State space representation using physical variables, phase variables & canonical variables. Usage of MATLAB command-line functions to verify the solution.	
UNIT – II	**(10 Hours)**
Derivation of transfer function from state model:-Derivation of transfer function from state model, diagolization, Eigen values, Eigen vectors, generalized Eigen vectors. **Solution of state equation:-** Solution of state equation, state transition matrix and its properties, computation using Laplace transformation, power series method, Cayley-Hamilton method, concept of controllability & observability, methods of determining the same. Usage of MATLAB command-line functions to verify the solution.	
UNIT – III	**(10 Hours)**
Control system design in state-space: State variable feedback structure, pole-placement design using feedback, state feedback with integral control, critique of pole-placement state feedback control, observer-based state feedback control. **Pole Placement Techniques and Controllers:-** Stability improvements by state feedback, necessary & sufficient conditions for arbitrary pole placement, state regulator design, and design of state observer, Controllers- P,PI, PID. Usage of MATLAB command-line functions to verify the solution.	
UNIT – IV	**(10 Hours)**
Nonlinear system analysis: Introduction, behavior of non-linear system, common physical non linearity-saturation, friction, backlash, dead zone, relay, multi variable non-linearity. **Phase plane method:-**Phase plane method, singular points, stability of nonlinear system, limit cycles **Liapunov stability criteria:-**Liapunov stability criteria, Liapunov functions, direct method of Liapunov& the linear system, construction of Liapunov functions for nonlinear system by Krasvskii's method.	
Reference Books: 1. M. Gopal, "Control Systems Principles and Design", 3rd Edition, Tata McGraw Hill, 2011. 2. Katsuhiko Ogata, "Modern Control Engineering", 4th Edition, Pearson Education, 2002. 3. A Nagoor Kani, "Advanced Control Theory", CBS Publishers, 3rd Edition, 2020	
Course Outcomes: After completion of the course the students will be able to, 1. Apply state-space representation techniques to model linear and nonlinear control systems. 2. Analyze system properties such as controllability, observability, and stability using mathematical tools and system matrices. 3. Design state feedback controllers and observers for modern control systems based on pole placement and canonical forms. 4. Evaluate nonlinear control system behavior using phase-plane methods and	

Liapunov's stability criteria for system performance analysis.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	2	2	2						1	3	2	2
2	CO-2	3	3	2	2	2						2	3	3	2
3	CO-3	3	2	3	3	2						2	3	3	2
4	CO-4	3	3	2	3	2						3	3	2	2

Syllabus for B.E VI - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

Open Elective Course – II

Syllabus for B.E VI - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Electrical Safety for Engineers	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hours**
Introduction to Electrical Safety, Electric Shocks and their Prevention: OSHA standards on electrical safety, objectives of safety and security measures, hazards associated with electric current and voltage, principles of electrical safety, approaches to prevent accidents, review of IE rules & acts. Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns	
UNIT – II	**10 Hours**
First Aid in Case of Electric Shock: First principles of actions after electric shock, first aid-artificial respiration methods, Cardiac Pulmonary Resuscitation, accident management and safety management. **Equipment Earthing and System Neutral Earthing:** Earthing, need for earthing, types of earthing, distinction between system grounding and equipment grounding, functional requirement of earthing system, technical consideration of station earthing system, step and touch potential, neutral grounding and its advantages	
UNIT – III	**10 Hours**
Safety in Residential, Commercial and Agricultural Installations: Domestic wiring methods and installations, safety requirements, shocks from domestic equipment-water taps- wet walls-agricultural pumps, types of cables and specifications, underground cables, best practices with use of electricity. **Accident Investigation:** Why and how to investigate, investigation report writing. Case studies of accidents in HESCOM/GESCOM region	
UNIT – IV	**10 Hours**
Electrical System Safety: Safety devices and their characteristics, safety clearances and creepage distances in electrical plants, line supports, insulators Circuit Breakers: Arc phenomenon, principles of arc extinction, oil & air blast breakers Protective Relays: Fundamental requirements of relaying, classification of relays Protection of Alternators, Transformers, Bus bars and Lines, protection against over voltages	
Reference Books: 1. S. Rao., R. K. Jain., H.L. Saluja., "Electrical safety, fire safety Engineering and safety management", Khanna Publishers New Delhi,2ndEdition, 2021 2. Pradeep Chaturvedi, "Energy management policy, planning and utilization", Concept Publishing company, New Delhi, 1997. 3. V. K.Mehta, Rohit Mehta, "Principles of Power Systems", S Chand Publications, 4thEdition, 2008. 4. The Electricity Act, 2003, https://cercind.gov.in/Act-with-amendment.pdf	
Course Outcomes:	

Syllabus for B.E VI - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

After successful completion of this course the student will be able to:

1. Identify the type of the electric shock and suggest probable electric safety & security measures in the given electric system
2. Analyze the safety & grounding requirements in Residential, Commercial, Agricultural installations and suggest best practices with use of electricity
3. Carry out detailed fault investigation and suggest the methods to rescue & first aid approaches in case of electrical accidents
4. Analyze the need for safety devices and requirements in the electric systems

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1		1	1	1				1						
2	CO-2	1	2	1	2		1					1			
3	CO-3	1	2	1	2		1		1			1			
4	CO-4	1	2	1	2		1					1			

Syllabus for B.E VI - Semester for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

	Energy Storage Systems	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hours**
Energy storage systems overview- Scope of energy storage, needs and opportunities in energy storage, Technology overview and key disciplines, comparison of time scale of storages and applications, Energy storage in the power and transportation sectors. Importance of energy storage systems in electric vehicles, Current electric vehicle market. **Thermal storage system**-heat pumps, hot water storage tank, solar thermal collector, application of phase change materials for heat storage-organic and inorganic materials, efficiencies, and economic evaluation of thermal energy storage systems.	
UNIT – II	**10 Hours**
Chemical storage system- hydrogen, methane etc., concept of chemical storage of solar energy, application of chemical energy storage system, advantages and limitations of chemical energy storage, challenges, and future prospects of chemical storage systems **Electromagnetic storage systems** - double layer capacitors with electro statically charge storage, superconducting magnetic energy storage (SMES), concepts, advantages and limitations of electromagnetic energy storage systems, and future prospects of electrochemical storage systems.	
UNIT – III	**10 Hours**
Electrochemical storage system **Batteries-**Working principle of battery, primary and secondary (flow) batteries, battery performance evaluation methods, major battery chemistries and their voltages- Li-ion battery& Metal hydride battery vs lead-acid battery. **Super capacitors-**Working principle of super capacitor, types of super capacitors, cycling and performance characteristics, difference between battery and super capacitors, Introduction to Hybrid electro chemical super capacitors **Fuel cell:** Operational principle of a fuel cell, types of fuel cells, hybrid fuel cell-battery systems, hybrid fuel cell-super capacitor systems.	
UNIT – IV	**10 Hours**
Battery design:- Battery design for transportation, Mechanical Design and Packaging of Battery Packs for Electric Vehicles, Advanced Battery-Assisted Quick Charger for Electric Vehicles, Charging Optimization Methods for Lithium-Ion Batteries, Thermal run-away for battery systems, Thermal management of battery systems, State of Charge and State of Health Estimation Over the Battery Lifespan, Recycling of Batteries from Electric Vehicles	
Reference Books: 1. Frank S. Barnes and Jonah G. Levine, Large Energy Storage Systems Handbook (Mechanical and Aerospace Engineering Series), CRC press (2011) 2. Ralph Zito, Energy storage: A new approach, Wiley (2010) 3. Pistoia, Gianfranco, and Boryann Liaw. Behavior of Lithium-Ion Batteries in Electric Vehicles: Battery Health, Performance, Safety, and Cost. Springer International Publishing AG, 2018. 4. Robert A. Huggins, Energy storage, Springer Science & Business Media (2010) 5. Ibrahim Dincer and Mark A. Rosen, Thermal Energy Storage Systems and Applications, John Wiley & Sons, 3rd Edition, 2021.	

6. Ru-shi Liu, Lei Zhang and Xueliang sun, electrochemical technologies for energy storage and conversion, Wiley publications, 2nd Volume set, 2012.
7. James Larminie and Andrew Dicks, Fuel cell systems Explained, Wiley publications, 3rd Edition, 2018.

Course Outcomes:

After completion of the course the students will be able to,

1. Identify the requirement, current status and future prospectus of energy storage.
2. Describe and compare various thermal, chemical energy storage technologies on the basis of technical characteristics.
3. Verify various types of energy losses and the associated energy efficient technologies for the routinely used thermal, chemical and electrical energy systems.
4. Design and Model the battery storage system and its applications

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	1	1	1	1										
2	CO-2	1	1	2	2										
3	CO-3	1	1	2	2										
4	CO-4	1	1	1	1										

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEA701C	Power System - IV	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Automatic Load Frequency Control: Introduction, Control loops of power systems modeling of Automatic Load Frequency Control (ALFC) of single area systems, performance of ALFC. ALFC of two area systems, expression for tie-line flow and frequency deviation, parallel operation. Generation Control: Supplementary Control Action, Tie line Control, Generation Allocation.

Control of Voltage and Reactive Power: Introduction, generation and absorption of reactive power, methods of voltage control: Shunt reactor, shunt capacitor, series capacitor, tap changing transformer and booster transformer Compensating Devices-Characteristics of SVC, TCR, TSC and STATCOM. voltage stability, PV and QV curves, voltage collapse, prevention of voltage collapse**.**

UNIT – II	(10 Hours)

Unit Commitment: Statement of the problem, need and importance of unit, constraints in unit commitment, spinning reserve, Thermal Unit Constraints, Other constraints, Hydro constraints, Must Run, Fuel constraints, Unit commitment Solution methods: Priority-List methods, Dynamic Programming solution. Reliability Considerations, Patton's Security Function, Security constrained Optimal Unit Commitment

Interchange of Power and Energy: Introduction, Economy Interchange between Interconnected Utilities, Infertility Economy Energy Evaluation, Multiple-Utility Interchange Transaction, Power pools, Transmissions Effects and Issues

UNIT – III	(10 Hours)

Power System Security: Introduction, factors affecting power system security, power system contingency analysis, detection of network problems, network sensitivity methods, calculation of network sensitivity factor, contingency ranking

Power System State Estimation: Introduction, power system state estimation, maximum likeli-hood weighted least-square estimation, maximum likeli- hood concept with example, matrix formulations, Detection and Identification of bad measurements

UNIT – IV	(10 Hours)

Power System SCADA: Introduction, building blocks of SCADA, Remote Terminal Unit (RTU)-Evolution and Components of RTU, Communication Subsystem, Logic subsystem, Termination subsystem, HMI subsystem, Advanced RTU functionalities.

Intelligent Electronic Device (IED)-IED functional block diagram, hardware and software architecture of IED, IED communication systems. Data concentrator and merging units, SCADA communication system, Master station, Human Machine Interface (HMI), Building SCADA system, Classification of SCADA,SCADA implementation and Case studies in SCADA

Reference Books:

1. Allaen J Wood Bruce F. Wollenberg, “Power Generation, Operation and Control”, 2nd Edition, John Wiley and Sons, Reprint 2014.
2. G.L. Kusic, “Computer Aided Power System Analysis”, 2nd Edition, PHI, 1992.
3. T.J.E Miler, “Reactive Power Control in Electric Power Systems”, John Wiely and Sons NY, 1982.
4. Mini S Thomas, Jhon D. McDonald. “Power System SCADA and Smart Grid”, CRC

press Taylor and Francis groups, 2015.

5. Nagrath,I.J., Kothari,D.P, "Modern Power SystemAnalysis", 4th Edition, TMH, 2014.
6. PrabhaKundur, "Power System Stability and Control", 9th reprint, TMH, 2009.

Course Outcomes:

After completion of the course the students will be able to,

1. Analyze and design automatic load frequency control (ALFC) and voltage control strategies in power systems, including modeling of single and two-area systems, reactive power management, and the application of compensating devices to enhance system stability and prevent voltage collapse.
2. Evaluate and apply unit commitment strategies and economic interchange methods in interconnected power systems, considering system constraints, reliability, and transmission effects to ensure optimal and secure operation.
3. Assess and improve power system security through contingency analysis, sensitivity methods, and state estimation techniques, using tools like maximum likelihood estimation and matrix formulations to detect network issues and ensure system reliability.
4. Describe the concepts behind the design and operation of SCADA systems, including the roles of Remote Terminal Units (RTUs), Intelligent Electronic Devices (IEDs), communication subsystems, and Human-Machine Interfaces (HMIs) for effective power system monitoring and control.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	1	3	2	1							1	3		1
2	CO-2	1	3	2	1							1	3		1
3	CO-3	1	3	2	1							1	3		1
4	CO-4	1	1	1	1							1	3		1

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEA702C	High Voltage Engineering	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours

Conduction and Breakdown in Gases: Gases as InsulatingMedia, Collision Process, Ionization Processes, Townsend's Current Growth Equation, Current Growth in the Presence of Secondary Processes, Townsend's Criterion for Breakdown, Experimental Determination of Coefficients α and γ, Breakdown in Electronegative Gases, Time Lags 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: Liquids as Insulators, Pure Liquids and Commercial Liquids, Conduction and Breakdown in Pure Liquids, Conduction and Breakdown in Commercial Liquids.

Breakdown in Solid Dielectrics: Introduction, Intrinsic Breakdown, Electromechanical Breakdown, Thermal Breakdown.

UNIT – II	10 Hours

Generation of HV AC and DC Voltage:L-06 Hours

Classification of high voltages, HVAC-transformer, Need for cascade connection, working of transformer units connected in cascade, Series resonant circuit – principle of operation and advantages, Tesla coil.HV – DC voltage doublers circuit, Cock croft – Walton type high voltage DC set. Calculation of high voltage regulation, ripple and optimum number of stages for minimum voltage drop, Important applications of high voltages.

UNIT – III	10 Hours

Generation of Impulse Voltage and Current:L-04 Hours

Introduction to standard lightning and switching impulse voltages. Analysis of single -stage impulse generator, expression for output impulse voltage. Multistage impulse generator, working of Mark impulse generator, Rating of impulse generator, Components of multistage impulse generator.

Measurement of High Voltages:L-05 Hours

Electrostatic voltmeter – principle, construction and limitation. Chubb and Fortessue method for HVDC measurements. Series resistance micro ammeter, Standard Sphere gap measurements for HVAC, HVDC and factors affecting the measurements.

UNIT – IV	10 Hours

Non-Destructive Testing of Materials and Electrical Apparatus: Introduction, Measurement of Dielectric Constant and Loss Factor, Partial Discharge Measurements.

High Voltage Testing of Electrical Apparatus: Testing of Insulators and Bushings, Testing of Isolators and Circuit Breakers, Testing of Cables, Testing of Transformers, Testing of Surge Arrestors, Radio Interference Measurements, Testing of HVDC Valves and Equipment.

Reference Books:

1. Kuffel E., Zaengl W.S. and KuffelJ.,'High Voltage Engineering Fundamentals', Butterworth-Heineman press, Oxford, 2000.
2. M S Naidu & V Kamaraju, High Voltage Engineering, Tata McGraw Hill, 2004.
3. C. L. Wadhwa, “High Voltage Engineering”, New Age Intl. Publishers, 2015
4. A.vonHippel and A. S. Labounsky, “Dielectric Materials and Applications”, ArtechHouse, Boston, 1995.

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

Course Outcomes:

After completion of the course the students will be able to,

1. Explain the mechanisms of conduction and breakdown in gases, liquids, and solid dielectrics.
2. Analyze the methods and principles used in the generation of high AC, DC, and impulse voltages.
3. Demonstrate various techniques for measuring high voltages and currents used in high voltage engineering.
4. Evaluate the testing methods for high voltage equipment and materials through non-destructive and standard testing procedures.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2										3		
2	CO-2	3	3	3									3	2	2
3	CO-3	2	3	3	2	2							2	3	2
4	CO-4	2	2	3	3	2							2	2	3

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

Professional Elective Course – III

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEA703E	Smart Grids	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Smart Grid Architectural Designs: Introduction, Today's Grid versus the Smart Grid, Energy Independence and Security Act of 2007: Computational Intelligence, Power System Enhancement, General View of the Smart Grid Market Drivers, Stakeholder Roles and Function, Working Definition of the Smart Grid Based on Performance Measures, Representative Architecture, Functions of Smart Grid Components. **Smart Grid Communications and Measurement Technology:** Communication and Measurement, Monitoring, PMU, Smart Meters, and Measurements Technologies, GIS and Google Mapping Tools, Multiagent Systems (MAS) Technology, Microgrid and Smart Grid Comparison. **Performance Analysis Tools for Smart Grid Design:** Introduction to Load Flow Studies, Challenges to Load Flow in Smart Grid and Weaknesses of the Present Load Flow Methods, Load, Flow State of the Art: Classical, Extended Formulations, and Algorithms, Congestion Management, Effect, Load Flow for Smart Grid Design.	
UNIT – II	**(10 Hours)**
Stability Analysis: Introduction to Stability, Strengths and Weaknesses of Existing Voltage Stability Analysis Tools, Voltage Stability Assessment, Voltage Stability Assessment Techniques, Voltage Stability Indexing, Analysis Techniques for Steady-State Voltage Stability Studies, Optimizing Stability Constraint through Preventive Control of Voltage Stability, Angle Stability Assessment. **Computation Tools for Smart Grid:** Introduction to Computational Tools, Decision Support Tools, Optimization Techniques, Classical Optimization Method, Heuristic Optimization, Evolutionary Computational Techniques.	
UNIT – III	**(10 Hours)**
Pathway for Designing Smart Grid: : Introduction to Smart Grid Pathway Design, Barriers and Solutions to Smart Grid Development, Solution Pathways for Designing Smart Grid Using Advanced Optimization and Control Techniques for Selection Functions, General Level Automation, Bulk Power Systems Automation of the Smart Grid at Transmission Level, Distribution System Automation Requirement of the Power Grid, End User/Appliance Level of the Smart Grid, Applications for Adaptive Control and Optimization. **Renewable Energy and Storage:** Renewable Energy Resources, Sustainable Energy Options for the Smart Grid, Penetration and Variability Issues Associated with Sustainable Energy Technology, Demand Response Issues, Electric Vehicles and Plug-in Hybrids, PHEV Technology, Environmental Implications, Storage Technologies, Tax Credits.	
UNIT – IV	**(10 Hours)**
Interoperability, Standards, and Cyber Security: Introduction, Interoperability, Standards, Smart Grid Cyber Security, Cyber Security and Possible Operation for Improving Methodology for Other Users. **Research, Education, and Training for the Smart Grid:** Introduction, Research Areas for Smart Grid Development, Research Activities in the Smart Grid, Multidisciplinary Research Activities, Smart Grid Education, Training and Professional Development.	

Case Studies and Test beds for the Smart Grid:

Introduction, Demonstration Projects, Advanced Metering, Microgrid with Renewable Energy, Power System Unit Commitment (UC) Problem, ADP for Optimal Network Reconfiguration in Distribution Automation, Case Study of RER Integration, Testbeds and Benchmark Systems, Challenges of Smart Transmission, Benefits of Smart Transmission.

Reference Books:

1. James Momoh., "Smart Grid, Fundamentals of Design and Analysis", 1st Edition, Wiley, 2012.
2. Clark W Gellings, "The Smart Grid, Enabling Energy Efficiency and Demand Side Response"- CRC Press, 2009.
3. Yokoyama, Nick Jenkins, "Smart Grid: Technology and Applications"- Wiley, 2012.

Course Outcomes:

After completion of the course the students will be able to,

1. Identify the smart measuring instruments for two way communication of each components in grid.
2. Apply the suitable load flow analysis technique for exiting distribution system.
3. Evaluate the optimal value for distribution system including renewable energy and storage systems.
4. Formulate the existing distribution for the conversion to smartgrid using standards as for the case studies.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	2	2	3					1		3	2	2
2	CO-2	3	3	2	3	2					1		3	3	2
3	CO-3	3	3	3	3	3		2		1	2	2	3	3	3
4	CO-4	3	3	3	3	2	2	2	2	2	3	2	3	3	3

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEB703E	Electric Vehicles	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
Introduction to EV: Historical Background, Benefits of Using Evs, Overview of types of Evs and its Challenges, EV Motor Drive Technologies, EV Energy Source Technologies, EV Battery Charging Technologies, EV Vehicle to Grid **EV Subsystem**: EV Subsystems and Configurations, HEV Subsystems and Configurations. HEV Subsystems and Configurations, Motion and dynamic equations for vehicles	
UNIT – II	**10 Hours**
Energy Storage: Batteries-Overview of Batteries, Battery Parameters, Lead Acid Batteries, Lithium Batteries, Metal Air Batteries. Alternative and Novel Energy Sources-Solar Photovoltaics, Flywheels, Super Capacitors. Fuel Cells-Main issues in the fuel cell, Hydrogen Fuel Cells: Basic Principles, Fuel Cell Thermodynamics (Introduction)	
UNIT – III	**10 Hours**
Architecture of EV and HEV: Vehicle Power Plant and Transmission Characteristics- Introduction, Drive train Configuration, Vehicle power plant, Internal combustion engine, Electric Motor, The need for gearbox, Drive train tractive effort and vehicle speed, Vehicle performance. Basic Architecture of Hybrid Drive Trains and Analysis of Series Drive Train- The Hybrid Electric Vehicle (HEV), Energy Use in Conventional Vehicles, Energy Savings Potential of Hybrid Drivetrains, HEV Configurations, Series and parallel Hybrid System.	
UNIT – IV	**10 Hours**
Power Flow in HEVs: Introduction, Power Flow Control, Power Flow Control in Series Hybrid, Power Flow Control in Parallel Hybrid, Power Flow Control in series-Parallel Hybrid, Power Flow Control Complex Hybrid Control	

Reference Books:

1. Iqbal Hussein, “Electric and Hybrid Vehicles: Design Fundamentals”, CRC Press, 2003.
2. MehrdadEhsani, YimiGao, Sebastian E. Gay, Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 2004.
3. James Larminie, John Lowry, “Electric Vehicle Technology Explained”, Wiley publications, 2003.

Course Outcomes:

After completion of the course the students will be able to,

1. Illustrate the evolution, classification, and components of electric and hybrid vehicles.
2. Analyze different energy storage and alternative energy sources used in EV applications.
3. Interpret the drive-train architecture and vehicle dynamics of electric and hybrid vehicles.
4. Evaluate the power flow control strategies in various hybrid electric vehicle configurations.

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2					2					3		
2	CO-2	3	3	2									2	3	
3	CO-3	3	2	3	2								3	3	2
4	CO-4	2	2	3	3	2							2	3	3

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEC703E	Solar Photovoltaic Systems Design	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Chapter-01: Solar Energy – Introduction and its scenario of India and global; Solar Radiation – solar radiation spectrum, diffuse & beam radiation and solar radiation measurement.

Chapter-02: Solar Cells – I-V & P-V characteristics; Technologies; Parameters; Factors affecting electricity generated; series, parallel and series & parallel connections; Numerical problems.

UNIT – II	(10 Hours)

Chapter-03: SPV module – Ratings, standard parameters; factors affecting electricity generated; I-V & P-V Characteristics; connection of modules in series, parallel and series & parallel; Mismatch in series and parallel connections, Introduction to arrays.

Chapter-04: Balance of System (BoS) - Batteries; Charge Controllers; MPPT; Inverters. (BoS to cover functions, working, types, features, typical specifications and cost). Numerical problems.

UNIT – III	(10 Hours)

Chapter-05: Wires – Introduction, basics of current conduction, types of wires, measurement of wire dimensions, wire sizing; junction box;

Chapter-06: Installation, troubleshooting of stand-alone and grid connected solar PV power systems; Safety of SPV power plants; Solar PV plant installation check list – Electrical testing of PV array, inverter; islanding protection; commissioning and system functioning. Field visits within campus to study installations.

UNIT – IV	(10 Hours)

Chapter-07: SPV system design and integration–Types of SPV systems; Design Methodology for Stand-alone SPV systems.

Chapter-08: Grid connected Solar PV Power Systems (GCSPVPS) – Introduction, Configurations & Components of GCSPVPS, GCSPVPS Design for small applications andforpowerplants.

Reference Books:

1. Chetan Singh Solanki, "Solar Photovoltaics – Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi, 3rd Edition, 2015.
2. Chetan Singh Solanki, "Solar Photovoltaic Technology and Systems – A Manual for Technicians, Trainers and Engineers", PHI Learning Private Limited, New Delhi, 2014
3. Tiwari, G. N and Ghosal, M. K., "Fundamentals of Renewable Energy Sources", Alpha Science International Ltd, New Delhi, 2007.

Course Outcomes:

After completion of the course the students will be able to,

1. Analyze the performance of solar photovoltaic systems under varying load and environmental conditions using numerical and analytical methods.
2. Apply knowledge of solar PV system components and configurations to select appropriate systems for specific applications.
3. Evaluate the operation, testing, and troubleshooting of solar PV systems and their components ensuring safe and effective performance.

4. Design stand-alone and grid-connected solar photovoltaic systems based on specific load requirements and integration methodologies.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	3	2	2	2		2			2		3	2	2
2	CO-2	3	2	2	2	3		2			2		3	3	2
3	CO-3	3	3	3	3	3	2	2			2	2	3	3	3
4	CO-4	3	3	3	3	3	2	2		2	3	2	3	3	3

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEED703E	Reactive Power Management	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction Importance of reactive power control in electrical power system, objectives of load compensation, ideal compensator, load compensation specific of a compensator, power factor correction and voltage regulation in single phase system, reactive power bias.	
UNIT – II	**(10 Hours)**
Basic requirement in AC power transmission Factor affecting stability and voltage, uncompensated Transmission line: performance equations and performance requirement of lines, voltage profile, voltage-power characteristics, load ability characteristics. Transmission line compensation: types passive/active compensators, series/shunt compensation and compensation by sectioning.	
UNIT – III	**(10 Hours)**
Harmonics Characteristics and un characteristics harmonics, sources, troubles caused by harmonics on electrical equipment, means of reducing harmonics, types of harmonic filters, DC filters IEEE 519-1992 guidelines telephone interferences.	
UNIT – IV	**(10 Hours)**
Reactive power co-ordination Reactive power management and planning, utility objectives, practices, transmission benefits, reactive power dispatch & equipment impact, reactive power forecasting, reactive power control by DSM, power pooling.	

Reference Books:

1. T. J. E. Miller, “Reactive Power Control in Electric Power Systems”, John Wiley & Sons NY 2009
2. D. Tagare, “Reactive Power Management”, TMH, 1st Edition, 2004.
3. PrabhaKundur, “Power System Stability and Control”, TMH 9th reprint, 2007.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply suitable compensation scheme for load and power factor correction
2. Investigate performance of the transmission lines through voltage-power and loadability characteristics
3. Identify type of harmonics in transmission line by calculating magnitude of harmonics
4. Develop reactive power management scheme for utilities

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	1	3	2				1	2	2	3	2	2
2	CO-2	3	3	3	1	3				1	1	2	3	2	1
3	CO-3	3	2	2	2	2				1	1	2	3	3	2
4	CO-4	3	2	3	2	3				1	2	2	3	3	2

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEE703E	Power System Planning	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction of Power Planning: National and regional planning, structure of power system, planning tools, electricity regulation, Load forecasting, forecasting techniques, modeling. **Generation Planning:** Integrated power generation, co-generation / captive power, power pooling and power trading, transmission and distribution planning.	
UNIT – II	**(10 Hours)**
Power System Economics: Power system economics, power sector finance, financial planning, private participation, rural electrification investment, concept of rational tariffs. **Computer Aided Planning:** Wheeling, environmental effects, greenhouse effect, technological impacts, insulation co-ordination, reactive compensation.	
UNIT – III	**(10 Hours)**
Power System Reliability: Reliability definition, system reliability, system adequacy and security, reliability planning, reliability evaluation, functional zones, generation, transmission, reliability target, quality of supply.	
UNIT – IV	**(10 Hours)**
System Operation Planning: Operations, Maintenance, Load management, Load prediction, Reactive power balance, Power grid, Online power flow studies, State estimation, Computerized management, Power system simulator.	

Reference Books:

1. A.S.Pabla, Macmillan “Electrical Power System Planning”, (1st Edition), India Ltd, 2016.
2. M. E. Van Valkenburg, "Network analysis", 3rd Edition, PHI Learning, 2014.
3. Charles E Ebeling by “Reliability and Maintainability Engineering”, 1st Edition, Tata McGraw Hill, 2004.

Course Outcomes:

After completion of the course the students will be able to,

1. Analyze the structure of national and regional power systems, and apply forecasting techniques and planning tools for effective generation, transmission, and distribution planning.
2. Evaluatethe economic aspects of power system planning, including tariff structuring, investment strategies, financial modeling, and the role of private participation in the power sector.
3. Assessthe reliability of power systems by evaluating generation, transmission, and distribution adequacy using system reliability models and performance indicators.
4. Develop strategies for power system operation through load management, state estimation, reactive power balancing, and the application of simulation and computerized planning tools.

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	2		2						1	2	3	1
2	CO-2	2	3	2		2	1					1	2	3	2
3	CO-3	3	3	2	2	2						1	2	3	1
4	CO-4	3	2	3	2	3						1	2	3	2

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEF703E	HVDC Transmission	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

General Aspects of DC Transmission: Historical sketch, constitution of EHVAC and DC links, Limitations and Advantages of AC and DC Transmission and comparison of DC with AC transmission

Analysis of the Bridge Converter: Analysis with grid control but no overlap, Analysis with grid control and with overlap less than 60 deg, Analysis with overlap greater than 60 deg, complete characteristics of rectifier, Inversion.

UNIT – II	(10 Hours)

Control of HVDC Converters and Systems:

Grid control, basic means of control, power reversal, limitations of manual control, constant current versus constant voltage, desired feature of control, actual control characteristics, constant -minimum -Ignition –angle control, constant –current control, constant –extinction –angle control, stability of control.

Grid control, basic means of control, power reversal, limitations of manual control, constant current versus constant voltage, desired feature of control, actual control characteristics, constant -minimum -Ignition –angle control, constant –current control, constant –extinction –angle control, stability of control.

UNIT – III	(10 Hours)

Smoothing Reactor and DC Line: Smoothing reactor, voltage oscillations and valve dampers, current oscillations and anode dampers, DC line oscillations and line dampers, clear line faults and reenergizing the line, DC Breakers, Effects of proximity of AC and DC Transmission Lines

Harmonics, Filters and Torsional Interaction: Generation of Harmonics, design of AC filters, DC filters, harmonic interactions and torsional interaction. Torsional interactions with HVDC systems, counter measures to torsional interaction with DC systems

UNIT – IV	(10 Hours)

Multiterminal DC Systems: Potential Applications of MTDC Systems, Types of MTDC Systems, Control and protection of MTDC systems, study of MTDC systems

Power Flow Analysis in AC/DC Systems: Modeling of DC Links, solution of DC load flow, per unit system for DC quantities, solution of SC-AC power flow. An example: Five terminal DC system.

Reference Books:

1. PrabhaKundur, “Power System Stability and Control”, TMH, 5th reprint 2008.
2. EW Kimbark, “Direct current Transmission”,Vol.No1, John Wiley, New York, 1971
3. K R Padiyar, “HVDC Power Transmission Systems Technology and System Interation”, (3rd Edition), New Age International Publishers, Reprint 2017.

Course Outcomes:

After completion of the course the students will be able to,

1. Explain the principles of HVDC transmission and analyze converter characteristics.
2. Evaluate control strategies for HVDC systems and their impact on system performance
3. Analyze filtering, harmonic effects, line protection, and system stability in HVDC

systems
4. Examine MTDC system configurations and perform power flow analysis in AC/DC systems

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	3	2	2			2					3	2	
2	CO-2	3	3	3	3	2							2	3	2
3	CO-3	3	2	3	2	2							2	3	3
4	CO-4	3	3	3	3	3							3	3	3

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

Professional Elective Course – IV

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEA704E	Flexible AC Transmission Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Review of AC transmission lines: Electrical characteristics, performance equations, natural or surge impedance loading, equivalent circuit of a transmission line, performance requirements of power transmission lines, voltage and current profile under no load.

Power transfer and stability considerations, Principles of transmission system compensation - series and shunt, Compensation by line sectioning, Concept of flexible AC transmission, FACTS-Benefits, Types and Brief descriptions.

UNIT – II	(10 Hours)

Static Shunt Compensators: Objective of shunt compensation, Methods of controllable VAR Generation. SVC and STATCOM: Operating principle, Regulation slope, Transfer function and Dynamic performance, Transient stability enhanced and power oscillation damping, VAR Reserve Control.

Comparison between STATCOM and SVC: V-I and V-Q Characteristics, Transient Stability, Response Time, Capability to Exchange real power, operating with unbalanced AC system, Physical size and Installation, Merit of hybrid compensator, Static Var Systems.

UNIT – III	(10 Hours)

Static Series Compensators GCSC, TSSC, TCSC: Objectives of series compensation, Voltage stability, Improvement of transient stability, power oscillation damping, sub synchronous oscillation damping, approaches to controlled series compensation.

Variable Impedance Type series compensators: GTO Thyristor- controlled series capacitor (GCSC), Thyristor-Switched Series Capacitor (TSSC), Thyristor Controlled Series Capacitor (TCSC), Thyristor- Controlled Voltage and Phase Angle Regulators (TCVRs and TCPARs).

UNIT – IV	(10 Hours)

Unified Power Flow Controller (UPFC): Basic operating principle, control capabilities, implementation, comparison to series compensators and Phase Angle Regulators, Control structure, Dynamic performance. Interline Power Flow Controller (IPFC): operating Principle, control structure and Applications.

Dynamic Voltage Restorer (DVR) – Introduction to DVR, overview of voltage sag and swells.

Reference Books:

1. Narain G. Hingorani and Lazlo Gyugyi, Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, IEEE Press and John Wiley & Sons, Inc, 2000.
2. PrabhaKundur, Power System Stability and Control Tata McGraw Hill Publishers, New Delhi, 2006.
3. R. Mohan Mathur, Static Controllers for Electrical Transmission Systems, IEEE Press and John Wiley & Sons, Inc. 2008.
4. R. Mohan Mathur, Rajiv K Varma, Thyristor-Based FACTS Controllers for Electrical Transmission Systems, IEEE Press and John Wiley & Sons, Inc. 2008.

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

Course Outcomes:

After completion of the course the students will be able to,

1. Analyze the operations of different FACTS devices on a given transmission line and assess the impact of FACTS controller
2. Choose proper controller for the specific application based on system requirements
3. Interpret the control circuits of Shunt Controllers SVC & STATCOM for various functions viz. Transient stability Enhancement, voltage instability prevention and power oscillation damping
4. Detect the Power and control circuits of Series Controllers GCSC, TSSC and TCSC

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	1	3	2				1	2	2	3	2	2
2	CO-2	3	2	2	1	3				1	2	2	2	2	1
3	CO-3	3	2	2	2	2				1	1	2	2	3	2
4	CO-4	3	2	3	2	3				1	2	2	3	3	2

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEB704E	Battery Management Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Battery Management System Requirements: Introduction and BMS functionality. Requirements: Sensing, High-voltage contactor control, Isolation sensing and thermal control, Protection and interface, State-of-charge estimation and Energy & power estimation.	
UNIT – II	**(10 Hours)**
Battery State Estimation: Preliminary definitions, approaches to estimate state of charge, Review of probability, Overview of vector random (stochastic) processes, Sequential-probabilistic-inference solution, The six-step process, Deriving the linear Kalman filter, Visualizing the Kalman filter, MATLAB code for the Kalman filter steps, Practical considerations, The extended Kalman filter (EKF)	
UNIT – III	**(10 Hours)**
Battery Health Estimation: Introduction, Lithium-ion aging: Negative electrode, Lithium-ion aging: Positive electrode, Sensitivity of voltage to ESR and total capacity, A Kalman filter framework for estimating parameters, EKF for parameter estimation, Simultaneous state and parameter estimation, Robustness and speed, The problem with least-squares capacity estimates, Derivation of weighted ordinary least squares, Derivation of weighted total least squares, Goodness of the model fit and confidence intervals, Simplified method with proportional confidence on xi and yi.	
UNIT – IV	**(10 Hours)**
Cell Balancing: Causes (and not causes) of imbalance, Design choices when implementing balancing, Circuits for balancing (1): Passive, Circuits for balancing (2): Active, capacitive, Circuits for balancing (3): Active, inductive and dc-dc, How quickly must I balance a pack? And results of balancing simulations. Voltage-Based Power-Limit Estimation: Problem definition, Voltage-based rate limits, using simple cell model, Voltage-based rate limits, using comprehensive cell model, Bisection search and Power-limits estimation example.	
Reference Books: 1. A.R. JHA, Next-Generation Batteries and Fuel Cells for Commercial, Military, and Space Applications, CRC Press, 2012. 2. Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric, Springer, 2013. 3. Gregory L. Plett, Battery Management Systems, Volume 1: Battery Modeling , Artech House September 2015	
Course Outcomes: After completion of the course the students will be able to, 1. Explain the functional requirements and critical roles of a Battery Management System (BMS) in electric energy systems. 2. Apply probabilistic and filtering techniques for battery state estimation using Kalman and Extended Kalman Filters. 3. Evaluate battery health and degradation mechanisms using statistical and estimation	

models.

4. Analyze balancing circuits and estimate voltage-based power limits for optimal battery pack performance

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	2									3	2	
2	CO-2	3	3	3	3	3							2	3	3
3	CO-3	3	3	3	3	2							2	3	3
4	CO-4	2	3	3	2	2							2	3	3

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEC704E	Energy Conservation, Audit and DSM	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Energy Scenario: Introduction to Energy; Units and Conversions; GDP, GNP and Per Capita Energy Consumption; Renewable Energy Act, International Energy Agency, OECD and Kyoto Protocol (only overview)

Economic Analysis of Energy: Economic analysis of investment, Cash Flows and CF diagrams, Economic analysis technique – Simple payback period method, Discounted cash flow method or Time adjustment technique, Net present value method, Present value index method or Profitability index method, Internal rate of return method, Accounting on average rate of return method; Interest Factors – Single Payment Compound Amount (SPCA), Single Payment Present Worth (SPPW), Uniform Series Compound Amount (USCA), Sinking Fund Payment (SFP), Uniform Series Present Worth (USPW), Capital Recovery (CR). (Simple Numerical problems).

UNIT – II	(10 Hours)

Motors: Introduction, Motor Efficiency, Motor Selection; Determination of energy saving, Energy saving options in oversized motors, Effect of variation of voltage on performance of motor, Effect on efficiency due to variation in load; Energy Efficient Motors, Choice of energy efficient motor, Factors Affecting Energy Efficiency, Rewinding Effects on Energy Efficiency, Standards and Star Labeling of Energy Efficient Induction Motors.

Lighting: Introduction, Terms and definitions – Lumen, Lux, Load efficacy, Lamp circuit efficacy, Colour rendering index (CRI); Characteristic of different types of lamps, Aspects of lighting system designing, Installed load efficacy ratio, Various means of energy savings – Use of natural day light, Reduction in light fixture, High efficiency lamps and luminaries, Effect of reduction in supply voltage on energy consumption, Timers and occupancy sensors.

UNIT – III	(10 Hours)

Energy Management and Audit: Energy management; Developing energy use profiles; Sankey Diagram; Process flow diagrams; Material and energy balance; Energy auditing instruments. Energy audit – Need for energy audit, Scope of energy audit, Types of energy audit – Preliminary energy audit, Detailed energy audit.

UNIT – IV	(10 Hours)

Energy Conservation: Introduction, Results of energy conservation, Principles of energy conservation, Energy conservation planning, Energy conservation Act,; Energy conservation in residential and commercial sectors, Energy conservation in transportation, considerations for Energy conservation in industry, Energy conservation in electricity generation, transmission and distribution, Energy conservation in agricultural sector.

Demand Side Management: Introduction to DSM – Definition, Evolution, Benefits and Scope; Role of Energy Companies, Load Management, Application of Load Control, DSM Implementation Issues, Strategies to implement and Promote DSM, Customer acceptance of DSM, Environment & DSM, International experience with DSM, DSM in India.

Reference Books:

1. Suresh Kumar Soni and Manoj Nair, "Energy Conservation and Audit", Satya Prakashan, New Delhi, 2010.
2. Rajiv Shankar, "Energy Auditing in Electrical Utilities", Viva Books, New Delhi, 2010.
3. Larry C. White, Philip S. Schmidt, David R. Brown, "Industrial Energy Management Systems", Hemisphere Publishing Corp, New York.
4. Albert Thumann, "Fundamentals of Energy Engineering", Prentice Hall Inc, Englewood Cliffs, New Jersey.
5. Gupta, B. R., "Generation of Electrical Energy", Eurasia Publishing House Pvt. Ltd., New Delhi, 6th, 2006

Course Outcomes:

After completion of the course the students will be able to,

1. Solve issues & interpret outcomes related to energy economics and energy efficient motors
2. Compare & contrast on selection of energy economic techniques, lighting criterion, energy efficient motors and energy alternative from DSM techniques
3. Evaluate various methods of energy conservation and DSM in different sectors like agriculture, commercial, transpiration and domestic
4. Design and develop methods/techniques for energy conservation, audit & management

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	1	2	2	3								3		1
2	CO-2	1	2	3	3			1		1	1		3		1
3	CO-3	1	2	3	3			1		1	1		3		1
4	CO-4	1	2	3	3						1		3		1

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEED704E	Energy Efficient Motors	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction: Need for energy efficient machines, energy cost and two part tariff, energy conservation in industries and farms -a necessity, introduction to energy management and energy audit system. Review of induction motor characteristics.	
UNIT – II	**(10 Hours)**
Power Factor: The power factor in sinusoidal systems, power factor improvement, power factor with nonlinear loads, Harmonics and the power factor.	
UNIT – III	**(10 Hours)**
Energy Efficient Motors: Standard motor efficiency, why more efficient motors? An energy efficient motor, efficiency determination methods, Direct Measurement method, Loss segregation method, Comparison, motor efficiency labelling, energy efficient motor standards. Motor life cycle.	
UNIT – IV	**(10 Hours)**
Induction Motors and Adjustable Drive Systems: Energy Conservation, adjustable speed systems, Application of adjustable speed systems to fans, pumps and constant torque loads.	

Reference Books:

1. Ali Emadi, "Energy Efficient Electric Motors: Selection and Application", CRC Press, 2018 (3rd Ed.).
2. Witte. L.C., P.S. Schmidt, D.R. Brown, “Industrial Energy Management and Utilisation”, Hemisphere Publishers, Washington, 1988.
3. Callaghn, P.W. “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.
4. Dryden. I.G.C., “The Efficient Use of Energy”, Butterworths, London, 1982
5. Turner. W.C., “Energy Management Hand book”, Wiley, New York, 1982.
6. Murphy. W.R. and G. Mc KAY, “Energy Management”, Butterworths, London 1987.

Course Outcomes:

After completion of the course the students will be able to,

1. Examine the need for energy efficiency in machines and industries, and analyze the role of energy audits and management systems in reducing energy costs.
2. Analyze the concept of power factor under linear and nonlinear loads and evaluate its significance in energy conservation.
3. Evaluate the performance of energy efficient motors using efficiency determination methods and compare with conventional motors.
4. Apply energy conservation techniques in induction motor drive systems and analyze the suitability of adjustable speed drives for various industrial loads.

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2		2		1	2					2		1
2	CO-2	3	3		2	2		2					3	2	
3	CO-3	3	2	3	2								3	3	
4	CO-4	3	2	3	2	2							3	2	2

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEE704E	Wind Energy Conversion Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction: Introduction: Nature of wind, historical uses of wind, history of wind electric generation, working principle of wind turbines (lift and drag mechanism), components of horizontal and vertical axis wind turbines, classification, applications, advantages and disadvantages.	
UNIT – II	**(10 Hours)**
Wind Resource Assessment: Wind Data Analysis: Wind velocity – measurement and representation, wind speed statistics, probability distribution functions – Weibull and Raleigh. **Performance of Wind Turbine Generators:** Basics of fluid mechanics (simple terms & definitions), elementary fluid flow concepts,	
UNIT – III	**(10 Hours)**
Power in the wind: maximum power output of wind turbine (Betz limit), axial force and thrust on blades, torque developed by turbine, dynamic matching for maximum power extraction - tip speed ratio & blade pitch angle, power vs wind speed characteristics, electrical power output from wind energy conversion system, capacity factor, energy production.	
UNIT – IV	**(10 Hours)**
Electric Generators for WECS: Classification, basic working principle, advantages and disadvantages. **Grid-connected and Self-excited Induction Generator Operation:** Constant-voltage, constant-frequency generation, reactive power compensation, variable-voltage, variable-frequency generation, effect of wind generator on the network. **Wind Energy Conversion Systems (WECS):** Stand-alone and grid connected wind farms, simulation model of WECS. Site matching of wind turbine generators. Economics of wind systems: Reliability consideration, estimation of O&M costs, capital costs, cost of energy, estimation of payback period	

Reference Books:

1. Bhadra, S. N., Kashta, D., and Bannerjee, S., Wind Electrical Systems, Oxford University Press, New Delhi, 2009.
2. Gary L. Johnson, Wind Energy Systems, Prentice hall Publication, 1985.
3. G. D. Rai, Non-Conventional Energy Sources, Khanna Publishers New Delhi, 2007.
4. B. H. Khan, Non-Conventional Energy Resources, 2nd Edition, Tata McGraw Hill Publishing Ltd. New Delhi, 2009
5. D. Mukhaerjee and S. Chakrabarti, Fundamentals of Renewable Energy Systems, New Age International Publishers New Delhi, 2007.
6. D. P. Kothari, S. Umashankar, “Wind Energy Systems and Applications”, Narosa publishers, 2017.
7. Khan B. H., Non-Conventional Energy Resources, Tata McGraw Hill, 2009.

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

Course Outcomes:

After completion of the course the students will be able to,

1. Apply the principles of wind energy conversion and turbine operation in analyzing different types of wind turbines and their components.
2. Analyze wind resource data, turbine characteristics, and fluid flow behavior for performance assessment of wind energy systems.
3. Calculate the power output, capacity factor, and economic parameters of wind energy systems using appropriate performance equations and site data.
4. Design wind energy systems for standalone and grid-connected applications considering technical constraints, environmental impact, and economic viability.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	2			2	3							
2	CO-2	3	2	2	2			2							
3	CO-3	3	3	3	3	3		2			2				
4	CO-4	3	3	3	3	3	2	2		2	2				

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEF704E	AI Applications to Power Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Artificial Intelligence: History and Applications Introduction, Intelligence, Communication, Learning, Artificial Intelligence, History, Early Works, Importance, Definitions, Programming Methods, Techniques, Progress of Artificial Intelligence, Growth of AI, AI and Industry, AI and the world, Current Trends in Applied AI, Modeling, Simulation and AI, Intelligent Systems, Role of IS, Comparisons with conventional programs.	
UNIT – II	**(10 Hours)**
Artificial Neural Network: difference between human machine and intelligence, biological neural network, artificial neuron model, Concept of Perceptron, ADALINE, Feedback in Neural Network, Neural Network Architectures: Application of Neural Network in Power System **Fuzzy Logic:** Introduction, Foundation of Fuzzy Systems, Representing Fuzzy Elements, Basic Terms and Operations, Properties of Fuzzy Sets, Fuzzification, Arithmetic Operations of Fuzzy Numbers.	
UNIT – III	**(10 Hours)**
Genetic Algorithms and Evolutionary Programming: Introduction, Genetic Algorithms, Procedure of Genetic Algorithms, Genetic Representations, Initialization and Selection, Genetic Operators, Mutation, The Working of Genetic Algorithms, Evolutionary Programming, The Working of Evolutionary Programming.	
UNIT – IV	**(10 Hours)**
Application of AI in Power Systems: Application of Neural Network and Expert Systems in Voltage Control, Application of ANN for security assessment, Schedule Maintenance of Electrical Power Transmission Networks using Genetic Algorithm, Intelligent Systems for Demand Forecasting.	

Reference Books:

1. N. P. Padhy, “Artificial Intelligence and Intelligent Systems”, OXFORD University Press, New Delhi, 2005.
2. Stamations V. Kartalopoulos, “Understanding Neural Networks and Fuzzy Logic: Basic concepts and Applications”, Prentice Hall India Private Limited, New Delhi, 2002.
3. AbhisekUkil, “Intelligent Systems and Signal Processing in Power Engineering, Springer Berlin Heidelberg”, New York, 2002.
4. Kevin Warwick, Arthur Ekwue and Raj Aggarwal, “Artificial Intelligence Techniques in Power Systems”, IEEE Power Engineering Series, UK, 1997.
5. Rajashekran, S. and VijaylaksmiPai, G.A., “Neural Networks, Fuzzy Logic and Genetic Algorithm Synthesis and Applications”, Prentice–Hall of India Private Limited, 2004.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply the fundamentals of Artificial Intelligence, neural networks, fuzzy logic, and evolutionary algorithms for power system applications.
2. Analyze the behavior of neural networks, fuzzy systems, and genetic algorithms for solving engineering problems.
3. Solve practical problems related to power system operation, control, and

optimization using AI-based tools and techniques.

4. Evaluate the suitability of various AI methods for specific power system applications like voltage control, demand forecasting, and preventive maintenance.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2	2	2	2							3	2	2
2	CO-2	3	3	3	3	2							3	3	2
3	CO-3	2	3	3	3	3				2	2	2	3	3	2
4	CO-4	2	3	3	3	3		2		2	2	2	3	3	3

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

22UHS711C / 22UHS811C	**Research Methodology & IPR**	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

UNIT – I	**(10 Hours)**
Introduction to Engineering Research Fundamentals of Research: Meaning, objectives, and motivation in engineering research. Types of Engineering Research: Basic, applied, and translational research; identifying and solving Worthwhile problems. Research Ethics: Ethics in engineering research and practice, types of research misconduct, and ethical issues in authorship.	
UNIT – II	**(10 Hours)**
Literature Review and Citations, Technical Reading & Analysis: Methods for reviewing literature, analyzing prior art, and synthesizing new and existing knowledge. Bibliographic Databases: Web of Science, Google, Google Scholar, effective search strategies. Conceptualizing Research: Critical and creative reading, taking notes, reading mathematical models, algorithms, and datasheets. Citations & Acknowledgments: Attribution, citation styles, impact of keywords, citing datasets, and knowledge dissemination	
UNIT – III	**(10 Hours)**
Intellectual Property Rights (IPR) & Patents: Introduction to Intellectual Property: Concepts of property and rights, forms of IPR, role in research and economic development, IP governance, and global innovation indicators. Patents: Definition, objectives, criteria for patentability, software/business method patents, infringement, compulsory licensing, and government use of inventions. Patent Process: Prior art search strategies, patent databases (free and paid), drafting specifications and claims, filing requirements, jurisdiction, opposition procedures, and renewal. Filing Requirement of patent: Patent Application Forms. Work flow chart in obtaining Patents, Jurisdiction of Filing Patent Application. Pre-grant & Post-grant Opposition. Forms to be submitted, filing mechanism through Individual patent office and PCT route. Need for a Patent Attorney/AgentRevocation. Term of Patent, Patent renewal and Fee Structure National Bodies Dealing with Patent Affairs. Utility Models	
UNIT – IV	**(10 Hours)**
Copyrights and Related Rights: Classes of Copyrights. Criteria for Copyright. Ownership of Copyright. Copyrights of the Author. Copyright Infringements. Copyright Infringement and remedies in case of infringement. Fair Use Doctrine. Copyrights and Internet. Non-Copyright Work. Copyright Registration. Judicial Powers of the Registrar of Copyrights. Fee Structure. Validity of Copyright. Copyright Profile of India. Copyright and the word 'Publish'. Transfer of Copyrights to a Publisher. Copyrights and the Word 'Adaptation'. Copyrights and the Word 'Indian Work'. Joint Authorship. Copyright Society. Copyright Board. Copyright Enforcement Advisory Council (CEAC). International Copyright Agreements, Conventions and Treaties. Interesting Copyrights Cases. Trademarks: Eligibility Criteria. Who Can Apply for a Trademark. Acts and Laws. Classification of Trademarks. Registration of a Trademark. Process for Trademarks Registration. Prior Art Search. Validity of Trademark. Trademark Registry. Famous Case Law: Coca-Cola Company vs. Bisleri International Pvt. Ltd. Industrial Designs: Eligibility Criteria. Acts and Laws to Govern Industrial Designs. Design Rights. Enforcement of Design Rights. Non-Protectable Industrial Designs India. Protection Term. Procedure for Registration of Industrial Designs. Prior Art Search. Application for	

Registration. Duration of the Registration of a Design. Importance of Design Registration. Cancellation of the Registered Design. Application Forms. Classification of Industrial Designs. Designs Registration Trend in India. International Treaties. Famous Case Law: Apple Inc. vs. Samsung Electronics Co.

Geographical Indications: Acts, Laws and Rules Pertaining to GI. Ownership of GI. Rights Granted to the Holders. Registered GI in India. Identification of Registered GI. Classes of GI. Non-Registerable GI. Protection of GI. Collective or Certification Marks. Enforcement of GI Rights. Procedure for GI Registration Documents Required for GI Registration. GI Ecosystem in India.

Case Studies on Patents. Case study of Curcuma (Turmeric) Patent, Case study of Neem Patent, Case study of Basmati patent. IP Organizations In India. Schemes and Programmes.

Reference Books:

1. Dr.Nejakar SantoshM,Dr.Bendigeri Harish (2023-24) "Research Methodology and Intellectual Property Rights",ISBN978-93-5987-928-4,
2. Thiel DavidV."Research Methods for Engineers" Cambridge University Press,
3. Acharya N.K Intellectual Property Rights. 6th Edition, Asia Law House.
4. P. Naryan, (2007). "Intellectual Property Law", 3rd Ed, Eastern Law House,
5. Dr. Myneni S.R.,(2019) "Law of Intellectual Property", 9th edition, Asia law House,.
6. Dr. Reddy G.B, (2020) "Intellectual Property Rights and Law", Reprint edition, Gogia Law Agency. Hydrabad,.
7. N.R. Subbaram. S. Viswanathan, (2008). "Hand book Indian Patent Law and, Practice" Printers and publishers Pvt,Ltd,
8. Cornish, "Intellectual Property Rights", Universal publications.
9. Dr.B.L.Wadehra,"Law Relating to Intellectual Property" 5thedition,Universal Law publishing Co, Dehli.
10. SWAYAM / NPTL/ MOOCS/ We blinks/ Internet sources/ YouTube videos and other materials / notes
11.

Course Outcomes:

After successful completion of this course the student should be able to:

1. Integrate research methodology in engineering sciences in relevant trades.
2. Exhibit reflective thinking in problem solving exercises.
3. Identify criteria to fit one's own intellectual work in particular form of IPRs and able to apply statutory provisions and procedure to protect different forms of IPRs at national and international level.
4. Develop skill of making search using modern tools and techniques and also student is able to become patent agent by cracking patent agent exam.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1		2	2	3	2	1	2	3		1	2			
2	CO-2		3	2	3		2	2	2			2			
3	CO-3					2	3	2	3		1	3			
4	CO-4				2	3	2		1		1				

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEA706P	Project Work	12 - Credits (0 : 0 : 18)
Hours/Week : 18Hrs/Week		CIE Marks : 50
Total Hours : 160		SEE Marks : 50

	(0L-0T-P Hours)
Students have to take up literature survey, formulate the problem of the project, define the project objectives and prepare the project implementation schedule. Project work, based on the problem defined, should be completed and implemented. The implementation of the project work can be done either in a reputed industry/ research organization/ parent institute. A certified report with project demonstration and a seminar is to be presented by the students. The seminar should highlight – Broad project area of their project work carried out. CIE of 50 marks will be conducted by the Committee consisting of HOD/Nominee + Project Coordinator + Guides as per the rubrics. For SEE, student has to make a presentation of the work carried out to Project Evaluation Committee (PEC- Project coordinator, Hod/Nominee, External Examiner). PEC will allot SEE marks for 50.	

Course Outcomes

At the end of this course, students will be able to:

1. Identify, formulate & analyze the engineering problems associated with electrical & electronics engineering and interdisciplinary research.
2. Design & implement proposed solutions for complex engineering problems to meet specified objectives by analyzing / validating the design / solutions of engineering problems using contemporary tools & resources.
3. Prepare engineering documents and make effective presentation to communicate effectively and collaboratively with detailed analysis and interpretation of results to yield valid conclusions.
4. Demonstrate social, ethical cultural & engineering professional responsibilities.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	3	2	2	1	1	1		2	2	2	3	2	1
2	CO-2	3	3	3	3	3				2	2	2	3	3	1
3	CO-3	2	2	2	2	2	2	1		2	3	2	2	3	1
4	CO-4								3	2	2	2	2	2	1

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

22UEE701I/801I	Internship	10 - Credits (0 : 0 : 30)
Hours/Week : 30		CIE Marks : 50
Total Hours : --		SEE Marks : 50

All the students have to undergo mandatory Research/Industrial internship in any one of the reputed industry/ research institute. The internship program has to be taken up during the entire semester. The duration of the training program should be for entire semester for 15 weeks. A report on the internship is to be submitted. The supervisor/ guide from industry shall allot 100 marks of the CIE and the other 100 by the internal evaluation committee. SEE evaluation will be made by a committee comprising of HoD as Chairman/his nominee, internship coordinator and a senior faculty. The SEE will be a Technical Seminar on the industrial training.

Course Outcomes

After undergoing the internship, students shall be able to:

1. Test the theoretical learning in practical situations by accomplishing the tasks assigned during the internship period.
2. Operate the systems/ devices independently and tabulate the experimental results in consultation with supervisor.
3. Apply various soft skills such as time management, positive attitude and communication skills during performance of the tasks assigned in internship organization.
4. Analyze the real time functioning of internship organization.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE701I/801I.1	2	2	2	3	1			1	1		2	1	1	3
2	22UEE701I/801I.2	2	2	1	3	3			1	1		2	1	1	3
3	22UEE701I/801I.3						1	1	3	3	3	2			3
4	22UEE701I/801I.4	2	2	3	3	3	1	1	1	2	2	1	2	2	2

Annexure 10

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Scheme of Teaching and Evaluation of 1st year

(Effective from the academic year 2025-26)

I Semester **(Chemistry Group)**

Sl. No	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SAAE	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	ASC	1BMATx101	Applied Mathematics-I (Stream Specific)	Maths Dept	3	2	0		03	50	50	100	04
2	ASC(IC)	1BCHEx102	Applied Chemistry (Stream Specific)	CHE Dept	3	0	2		03	50	50	100	04
3	ETC	1BAIA103/ BETC105x	Introduction to AI and Applications	Any Dept	3	0	0		03	50	50	100	03
4	ESC	1BESC104x	Engineering Science Course I	Respective Engg Dept	3	0	0		03	50	50	100	03
5	PLC(IC)	1BPLC105x	Programming Language Course	CSE & allied Dept	3	0	2		03	50	50	100	04
6	AEC	1BENGL106	Communication Skills	Humanities Dept	1	0	0		02	50	50	100	01
7	AEC (NCMC)	1BICO107	Indian Constitution & Engineering Ethics	Humanities Dept	1	0	0		--	100	--	100	PP
8	AEC/SDC	1BIDTL158	Innovation and Design Thinking Lab **(Project-based learning)**	Any Dept	0	0	2		02	50	50	100	01
	TOTAL				**17**	**02**	**07**		**20**	**450**	**350**	**800**	**20**
9	**AICTE Activity Points** (students have to earn **100** activity points between 01 to 08 semesters)				Compulsory requirement for the award of a degree								

Applied Mathematics-I					Applied Chemistry				
Code	**Title**	**L**	**T**	**P**	**Code**	**Title**	**L**	**T**	**P**
1BMATC101	Differential Calculus and Linear Algebra: CV Stream	3	2	0	1BCHEC102	Applied Chemistry for Sustainable Structure & Material Design (CV)	3	0	2
1BMATM101	Differential Calculus and Linear Algebra: ME Stream	3	2	0	1BCHEM102	**Applied Chemistry for Advanced Metal Protection and Sustainable Energy Systems** (ME)	3	0	2
1BMATE101	Differential Calculus and Linear Algebra: EEE stream	3	2	0	1BCHEE102	**Applied Chemistry for Emerging Electronics and Futuristic Devices** (EEE, ECE)	3	0	2
1BMATS101	Calculus And Linear Algebra: CSE stream	3	2	0	1BCHES102	Applied Chemistry for Smart Systems (CSE)	3	0	2
Engineering Science Courses-I (ESC-I)					**Programming Language Courses (PLC)**				
Code	**Title**	**L**	**T**	**P**	**Code**	**Title**	**L**	**T**	**P**
1BESC104A	Building Sciences & Mechanics	3	0	0	1BPLC105E	Introduction to C Programming (For none IT programmes)	3	0	0
1BESC104B	Introduction to Electrical Engineering	3	0	0	1BPLC105B	Python Programming (for CSE and allied programmes)	3	0	0
1BESC104C	Introduction to Electronics and Communication Engineering	3	0	0					
1BESC104D	Introduction to Mechanical Engineering	3	0	0					
1BESC104E	Essentials of Information Technology	3	0	0					

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Scheme of Teaching and Evaluation of 1st year
(Effective from the academic year 2025-26)

II Semester (For the students who have studied the Chemistry group in I semester)

Sl. No	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SAAE	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	ASC	1BMATx201	Applied Mathematics -II (Stream Specific)	Maths Dept	3	2	0		03	50	50	100	04
2	ASC(IC)	1BPHYx202	Applied Physics (Stream Specific)	PHY Dept	3	0	2		03	50	50	100	04
3	ESC	1BCEDx203	Computer-Aided Engineering Drawing (Stream Specific)	ME dept	2	0	2		03	50	50	100	03
4	ESC	1Bxxx204x	Engineering Science Course-II	Respective Engg Dept	3	0	0		03	50	50	100	03
5	PSC	1Bxxx205	Programme Specific Courses	Respective Engg Dept	3	0	0		03	50	50	100	03
6	AEC (NCMC)	1Bxxx206	Soft Skills	Humanities Dept	1	0	0		--	100	---	100	PP
7	PSC/ESC	1Bxxxl207x	Program-Specific Course Lab	Respective dept	0	0	2		02	50	50	100	01
8	AEC/SDC	1BPRJ258	Interdisciplinary Project-Based Learning	Combination of Departments	0	0	0	02	02	50	50	100	01
9	HSMC	1BKSK209(BKSK107)/ 1BKBK209(BKBK107)	Samskrutika Kannada/ Balake Kannada	Humanities Dept	1	0	0		01	50	50	100	01
				TOTAL	**16**	**02**	**06**		**21**	**500**	**400**	**900**	**20**

Applied Mathematics-II					Applied Physics				
Code	**Title**	**L**	**T**	**P**	**Code**	**Title**	**L**	**T**	**P**
1BMATC201	Differential Calculus and Numerical Methods: CV stream	3	2	0	1BPHYC202	Physics for Sustainable Structural Systems (CV stream)	3	0	2
1BMATM201	Multivariable Calculus and Numerical Methods: ME stream	3	2	0	1BPHYM202	Physics of Materials (Mech stream)	3	0	2
1BMATE201	Calculus, Laplace Transform, and Numerical Techniques: EEE stream	3	2	0	1BPHEC202	Quantum Physics and Electronic Sensors (ECE stream)	3	0	2
1BMATS201	Numerical Methods: CSE Stream	3	2	0	1BPHEE202	Electrical Engineering Materials (EEE)	3	0	2
					1BPHYS202	Quantum Physics and Applications (CSE stream)	3	0	2
Programme Specific Courses (PSC)					**Programme Specific Courses Lab (PSCL)**				
1BCIV205	Engineering Mechanics	3	0	0	1BMEML207	Mechanics and Materials Lab	0	0	2
1BEME205	Elements of Mechanical Engineering	3	0	0	1BEMEL207	Elements of Mechanical Engineering Lab	0	0	2
1BBEE205	Basic Electrical Engineering	3	0	0	1BBEEL207	Basic Electrical Engineering Lab	0	0	2
1BECE205	Fundamentals of Electronics & Communication Engineering	3	0	0	1BECEL207	Fundamentals of Electronics & Communication Engineering Lab	0	0	2
1BEIT205	Programming in C	3	0	0	1BPOPL207	C Programming Lab	0	0	2
1BEBT205	Elements of Biotechnology and Biomimetics	3	0	0	1BSSAL207	Soil Science and Agronomy Field Lab	0	0	2
1BSSA205	Principles of Soil Science and Agronomy	3	0	0	1BEBTL207	Elements of Biotechnology Lab	0	0	2
Engineering Science Courses-II (ESC-II)					**Computer-Aided Engineering Drawing**				
1BESC204A	Introduction to Building Sciences	3	0	0	**Code**	**Title**	**L**	**T**	**P**
1BESC204B	Introduction to Electrical Engineering	3	0	0	1BCEDC203	Computer-Aided Engineering Drawing for CV Stream	2	0	2
1BESC204C	Introduction to Electronics & Communication Engineering	3	0	0	1BCEDM203	Computer-Aided Engineering Drawing for ME stream Engineering	2	0	2
1BESC204D	Introduction to Mechanical Engineering	3	0	0	1BCEDEC203	Computer-Aided Engineering Drawing for EEE stream	2	0	2
1BESC204E	Essentials of Information Technology	3	0	0	1BCEDEE203	Computer-Aided Engineering Drawing for EEE stream (Only for EEE Students)	2	0	2
					1BCEDS203	Computer-Aided Engineering Drawing for CSE stream	2	0	2

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Scheme of Teaching and Evaluation of 1st year

(Effective from the academic year 2025-26)

I Semester **(Physic Group)**

Sl. No	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SAAE	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	ASC	1BMATx101	Applied Mathematics -I (Stream Specific)	Maths Dept	3	2	0		03	50	50	100	04
2	ASC(IC)	1BPHYx102	Applied Physics (Stream Specific)	PHY Dept	3	0	2		03	50	50	100	04
3	ESC	1BCEDx103	Computer-Aided Engineering Drawing (Stream Specific)	ME Dept	2	0	2		03	50	50	100	03
4	ESC	1BXXX104x	Engineering Science Courses-I	Respective Engg Dept	3	0	0		03	50	50	100	03
5	PSC	1Bxxx105	Programme Specific Course	Respective Engg dept	3	0	0		03	50	50	100	03
6	AEC (NCMC)	1BSKS106	Soft Skills	Humanities Dept	1	0	0		-	100	---	100	PP
7	PSC	1BxxxL107	Program-Specific Course Lab	Respective Engg Dept	0	0	2		02	50	50	100	01
8	AEC/SDC	1BIDTL158	Innovation and Design Thinking Lab (**Project-based learning)**	Respective Dept	0	0	2		02	50	50	100	01
9	HSMS	1BKSK109(BKSK107)/ 1BKBK109(BKBK107)	Samskrutika Kannada/ Balake Kannada	Humanities Dept	1	0	0		01	50	50	100	01
				TOTAL	16	02	08		20	500	400	**900**	**20**
10	**AICTE Activity Points** (students have to earn **100** activity points between 01 to 08 semester)				Compulsory requirement for the award of a degree								

Applied Mathematics-I					Applied Physics				
Code	**Title**	**L**	**T**	**P**	**Code**	**Title**	**L**	**T**	**P**
1BMATC101	Differential Calculus And Linear Algebra: CV Stream	3	2	0	1BPHYC102	Physics for Sustainable Structural Systems (CV stream)	3	0	2
1BMATM101	Differential Calculus and Linear Algebra: ME Stream	3	2	0	1BPHYM102	Physics of Materials (Mech stream)	3	0	2
1BMATE101	Differential Calculus And Linear Algebra: EEE stream	3	2	0	1BPHEC102	Quantum Physics and Electronics Sensors (EEE stream)	3	0	2
1BMATS101	Calculus and Linear Algebra: CSE Stream	3	2	0	1BPHEE102	Electrical Engineering Materials (EEE stream-only for EEE students)	3	0	2
					1BPHYS102	Quantum Physics and Applications (CSE stream)	3	0	2
Computer-Aided Engineering Drawing					**Engineering Science Courses-I(ESC-I)**				
1BCEDC103	Computer-Aided Engineering Drawing for CV Stream	2	0	2	1BESC104A	Building Sciences and Mechanics	3	0	0
1BCEDM103	Computer-Aided Engineering Drawing for ME stream	2	0	2	1BESC104B	Introduction to Electrical Engineering	3	0	0
1BCEADEC103	Computer-Aided Engineering Drawing for EEE stream	2	0	2	1BESC104C	Introduction to Electronics & Communication Engineering	3	0	0
1BCEADEE103	Computer-Aided Engineering Drawing for EEE stream(only for EEE students)	2	0	2	1BESC104D	Introduction to Mechanical Engineering	3	0	0
1BCEDS103	Computer-Aided Engineering Drawing for CSE stream				1BESC104E	Essentials of Information Technology	3	0	0
Programme Specific Courses (PSC)					**Program-Specific Course Lab (PSCL)**				
1BCIV105	Engineering Mechanics	3	0	0	1BMEML107	Mechanics and Materials Lab	0	0	2
1BBEE105	Basic Electrical Engineering	3	0	0	1BBEEL107	Basic Electrical Engineering Lab	0	0	2
1BECE105	Fundamentals of Electronics & Communication Engineering	3	0	0	1BECEL107	Fundamentals of Electronics & Communication Engineering Lab	0	0	2
1BEME105	Elements of Mechanical Engineering	3	0	0	1BEMEL107	Elements of Mechanical Engineering Lab	0	0	2
1BEIT105	Programming in C	3	0	0	1BPOPL107	C Programming Lab	0	0	2
1BEBT105	Elements of Biotechnology and Biomimetics	3	0	0	1BEBTL107	Elements of Biotechnology Lab	0	0	2
1BSSA105	Principles of Soil Science and Agronomy	3	0	0	1BSSAL107	Soil Science and Agronomy Field Lab	0	0	2

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(Effective from the academic year 2025-26)

II Semester (For the students who have studied Physics group in I semester)

Sl. No	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SAAE	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	ASC	1BMATx201	Applied Mathematics -II (Stream Specific)	Maths Dept	3	2	0		03	50	50	100	04
2	ASC(IC)	1BCHEx202	Applied Chemistry (Stream Specific)	CHE Dept	3	0	2		03	50	50	100	04
3	ETC	1BAIA203/ BETC205x	Introduction to AI and Applications	Any Dept	3	0	0		03	50	50	100	03
4	ESC	1BESC204x	Engineering Science Course-II	Respective Engg Dept	3	0	0		03	50	50	100	03
5	PLC(IC)	1BPLC205x	Programming Language Course	CSE & allied Dept	3	0	2		03	50	50	100	04
6	AEC	1BENG206	Communication Skills	Humanities Dept	1	0	0		02	50	50	100	01
7	AEC (NCMC)	1BICO207	Indian Constitution & Engineering Ethics	Humanities Dept	1	0	0		01	100	0	100	PP
8	AEC/SDC	1BPRJ258	Interdisciplinary Project-Based Learning	Respective Dept (Multiple Dept)	0	0	0	2	02	50	50	100	01
				TOTAL	**17**	**02**	**05**	**02**	**20**	**450**	**350**	**800**	**20**

Applied Mathematics-II					Applied Chemistry				
Code	**Title**	**L**	**T**	**P**	**Code**	**Title**	**L**	**T**	**P**
1BMATC201	Differential Calculus and Numerical Methods: CV Stream	3	2	0	1BCHEC202	Applied Chemistry for Sustainable Structure & Material Design (CV)	3	0	2
1BMATM201	Multivariable Calculus and Numerical Methods: ME Stream	3	2	0	1BCHEM202	**Applied Chemistry for Advanced Metal Protection and Sustainable Energy Systems** (ME)	3	0	2
1BMATE201	Calculus, Laplace Transform And Numerical Techniques: EEE stream	3	2	0	1BCHEE202	**Applied Chemistry for Emerging Electronics and Futuristic Devices** (EEE, ECE)	3	0	2
1BMATS201	Numerical Methods: CSE Stream	3	2	0	1BCHES202	Applied Chemistry for Smart Systems (CSE)	3	0	2
Engineering Sciences Courses II(ESC-II)					**Programming Language Courses (PLC)**				
1BESC204A	Building Sciences & Mechanics	3	0	0	1BPLC205E	Introduction to C Programming (for non-IT programmes)	3	0	2
1BESC204B	Introduction to Electrical Engineering	3	0	0	1BPLC205B	Python Programming (For CSE and allied programmes)	3	0	2
1BESC204C	Introduction to Electronics & Communication Engineering	3	0	0					
1BESC204D	Introduction to Mechanical Engineering	3	0	0					
1BESC204E	Essentials of Information Technology	3	0	0					

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Scheme of Teaching and Evaluation for B.E Electrical and Electronics Engineering

2025-26 (admitted batch), 2026-27 (sem 3&4), 2027-28 (sem 5&6), 2028-29 (sem 7&8).

Total Credits for BE=160 (as per VTU/AICTE)

Table-1: Breakdown of Credits suggested by the VTU Belagavi/AICTE New Delhi

Sl.	Category	VTU	AICTE	BEC Present	BEC Revised
1.	HSMC: HSS (English:2, Kannada:1, UHV:1, Constitution:1, EV:1), HRM:3 (Offered by Dept) = 9 AEC (Scientific foundations of Health: 1, Innovation and design Thinking: 1, SS:2, IKS: 1, MOOCS: 3)= 8	14+8=22	15	9+10=19	9+8=17
2.	BSC: Basic Science Courses (Physics, Chemistry and Mathematics)	22	23	22	22
3.	ESC/ETC: Engineering Science Courses (Basic Elect/ Electronics/ Computer/ Mechanics/ Workshop/ Drawing etc.)	18	17	18	18
4.	PCC: Professional Core Courses	57	61	56	61
5.	PEC: Professional Elective Courses relevant to the branch with at least one course either fully or partially supported by industry	12	12	12	12
6.	OEC: Open Electives Courses/ Subjects from other technical/Arts/Commerce (3 MOOCS + 6)	9	12	09	09
7.	Mini (2) and Major projects (9)/Industrial Internships (10)	20	20	24	21
8.	Mandatory Course: PE, Yoga, NSS, Bridge course Maths 1 and 2 (lateral Entry)	00	00	00	00
	Total	160	160	160	160

Table-2: Semester wise Breakdown of Credits

Sem.	BSC	ESC ETC PLC	HSMC	AEC	PCC	PEC	OEC	Proj.	Int.	Total
I	8	9	2	1						20
II	8	9	2	1						20
III	3				17					20
IV	3		1		16					20
V			1	2	9	3	3	2		20
VI				1	13	3	3			20
VII			3		6	6		9		24
VIII				3			3		10	16
Tot.	22	18	9	8	61	12	9	11	10	160

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Semester-I (C Group) CAY 2025-26 (160 Credits 2025-26 admitted batch)

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
			Total	20						

Semester-II (P Group) CAY 2025-26 (160 Credits 2025-26 admitted batch)

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
			Total	20						

Basaveshwar Engineering College, Bagalkote

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Semester-III **CAY 2026-27 (160 Credits 2025-26 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	BSC	BMA301	Mathematics – III for Electrical Science Stream	3	3	0	0	50	50	100
2.	PCC	BEEA302C	Network Analysis	3	2	2	0	50	50	100
3.	PCC	BEEA303C	Power Systems – I	3	3	0	0	50	50	100
4.	PCC	BEEA304C	Electronic Circuits	3	3	0	0	50	50	100
5.	PCC	BEEA305C	Electrical Machines – I	3	3	0	0	50	50	100
6.	IPCC	BEEA306C	Electrical and Electronic Measurements	3	2	0	2	50	50	100
7.	PCC	BEEA307L	Electronic Circuits Laboratory	1	0	0	2	50	50	100
8.	PCC	BEEA308L	Electrical Machines – I Laboratory	1	0	0	2	50	50	100
9.	BSC	BMA	Bridge Course Mathematics-I	0	3	0	0	50	50	100
10.	MC	BHSA360M	Yoga-I	0	0	0	2	100	-	100
		BHSB360M	National Service Scheme-I	0	0	0	2	100	-	100
		BHSC360M	Physical Education-I	0	0	0	2	100	-	100
		BHSD360M	Music-I	0	0	0	2	100	-	100
			Total	20						

All students have to register for any one of the courses namely National Service Scheme, Physical Education (Sports and Athletics), Yoga and Music with the concerned coordinator of the course during the first week of III semester. The activities shall be carried out between III semesters to VI semester (for 4 semesters).

Semester-IV **CAY 2026-27 (160 Credits 2025-26 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	BEEA401C	Signals and Systems	3	3	0	0	50	50	100
2.	PCC	BEEA402C	Logic Design	3	3	0	0	50	50	100
3.	PCC	BEEA403C	Electrical Machines – II	3	3	0	0	50	50	100
4.	PCC	BEEA404C	Control Systems	4	4	0	0	50	50	100
5.	BSC	BBTA405C	Biology for Engineers	3	3	0	0	50	50	100
6.	PCC	BEEA406L	PCB Design Laboratory	1	0	0	2	50	50	100
7.	PCC	BEEA407L	Logic Design Laboratory	1	0	0	2	50	50	100
8.	PCC	BEEA408L	Electrical Machines – II Laboratory	1	0	0	2	50	50	100
9.	UHV	BHSA424C	Universal Human Values-II	1	1	0	0	50	50	100
10.	MC	BHSA460M	Yoga-II	0	0	0	2	100	-	100
		BHSB460M	National Service Scheme-II	0	0	0	2	100	-	100
		BHSC460M	Physical Education-II	0	0	0	2	100	-	100
		BHSD460M	Music-II	0	0	0	2	100	-	100
			Total	20						

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Semester-V **CAY 2027-28 (160 Credits 2025-26 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	BEEA5XXX	Power System – II	3	3	0	0	50	50	100
2.	PCC	BEEA5XXX	Power Electronics	3	3	0	0	50	50	100
3.	PEC	BEEA5XXX	Professional Elective Course – I	3	3	0	0	50	50	100
4.	OEC	BEEA5XXX	Open Elective Course – I	3	3	0	0	50	50	100
5.	PCC	BEEA5XXX	Power Electronics Laboratory	1	0	0	2	50	50	100
6.	PCC	BEEA5XXX	Power System – I Laboratory	1	0	0	2	50	50	100
7.	PCC	BEEA5XXX	Control System Laboratory	1	0	0	2	50	50	100
8.	Proj	BEEA5XXX	Mini Project	2	0	0	4	50	50	100
9.	HSMC	BEEA5XXX	Environmental Studies	1	1	0	0	50	50	100
10.	AEC	BEEA5XXX	Quantitative Aptitude and Professional Skills	2	2	0	0	50	50	100
11.	MC	BHSA460M	Yoga-III	0	0	0	2	100	-	100
		BHSB460M	National Service Scheme-III	0	0	0	2	100	-	100
		BHSC460M	Physical Education-III	0	0	0	2	100	-	100
		BHSD460M	Music-III	0	0	0	2	100	-	100
			Total	20						

Semester-VI **CAY 2027-28 (160 Credits 2025-26 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	BEEA6XXX	Power System – III	4	4	0	0	50	50	100
2.	PCC	BEEA6XXX	Microcontrollers	3	3	0	0	50	50	100
3.	PCC	BEEA6XXX	Digital Signal Processing	4	4	0	0	50	50	100
4.	PEC	BEEA6XXX	Professional Elective Course – II	3	3	0	0	50	50	100
5.	OEC	BEEA6XXX	Open Elective Course – II	3	3	0	0	50	50	100
6.	PCC	BEEA6XXX	Power System – II Laboratory	1	0	0	2	50	50	100
7.	PCC	BEEA6XXX	Microcontrollers Laboratory	1	0	0	2	50	50	100
8.	AEC	BEEA6XXX	Indian Knowledge Systems	1	1	0	0	50	50	100
9.	MC	BHSA460M	Yoga-IV	0	0	0	2	100	-	100
		BHSB460M	National Service Scheme-IV	0	0	0	2	100	-	100
		BHSC460M	Physical Education-IV	0	0	0	2	100	-	100
		BHSD460M	Music-IV	0	0	0	2	100	-	100
			Total	20						

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Semester-VII/VIII **CAY 2028-29 (160 Credits 2025-26 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	BEEA701C/801C	Power System – IV	3	3	0	0	50	50	100
2.	PCC	BEEA702C/802C	High Voltage Engineering	3	3	0	0	50	50	100
3.	PEC	BEEX703C/803C	Professional Elective Course-III	3	3	0	0	50	50	100
4.	PEC	BEEX704C/804C	Professional Elective Course-IV	3	3	0	0	50	50	100
5.	HSMC	BEEA705C/805C	Research Methodology and IPR	3	3	0	0	50	50	100
6.	Proj	BEEA706P/806P	Project Work	9	0	0	--	50	50	100
			Total	24						

Semester-VIII/VII **CAY 2028-29 (160 Credits 2025-26 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	INT	BEEA801I/701I	Internship	10	0	0	--	50	50	100
2.	AEC	--	MOOCs*	3	--	--	--	--	--	--
3.	OEC	--	MOOCs*	3	--	--	--	--	--	--
			Total	16						

Semester 7 & 8 are flippable (swapped)

Criteria for Bachelor Degree: A student has to earn a minimum of 160 credits for award of Bachelor of Engineering (B.E) at the end of fourth year.

Criteria for Bachelor Degree (Honors): A student has to earn a minimum of 178 [160 + 18 (online)] credits for award of Bachelor of Engineering (B.E honors) at the end of fourth year.

Criteria for Bachelor Degree (with minor degree): A student has to earn a minimum of 178 [160 + 18* (blended)] credits for award of Bachelor of Engineering (B.E) with major and minor streams at the end of fourth year.

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Department of Electrical and Electronics Engineering

Semester-5

List of subjects for Professional Elective Course – I (Sem-V)		
1.		Electrical Machine Design
2.		Electrical Engineering Materials
3.		Testing and Commissioning of Electrical Equipment
4.		Data Base management Systems
5.		Operation Research
6.		Field Theory

List of subjects for Open Elective Course I		
1.		Electric Vehicle
2.		Fundamentals of Wind Energy Conversion System

Semester-6

List of subjects for Professional Elective Course – II (Sem-VI)		
1.		Integration of Distributed Generation
2.		Automotive Electronics
3.		Intelligent Instrumentation
4.		VLSI Design
5.		Electric Machine Drives
6.		Modern Control Theory

List of subjects for Open Elective Course II		
1.		Electrical Safety for Engineers
2.		Energy Storage Systems

Semester-7

List of subjects for Professional Elective Course – III (Sem-VII)		
1.		Smart Grids
2.		Electric Vehicles
3.		Solar Photovoltaic System Design
4.		Reactive Power Management
5.		Power System Planning
6.		HVDC Transmission

List of subjects for Professional Elective Course – IV (Sem-VII)		
1.		Flexible AC Transmission Systems
2.		Battery Management Systems
3.		Energy Conservation, Audit and DSM
4.		Energy Efficient Motors
5.		Wind Energy Conversion Systems
6.		AI Applications to Power Systems

Annexure 11

Syllabus for B.E. I Year (I/II – Semester) for Academic Year 2025 – 2026

(For students admitted to I year in 2025-26)

Basic Electrical Engineering	
Course Code:	**Credits: 03 (3:0:0:0)**
Teaching Hours/Week: 3:0:0:0	**Total Hours: 40 hours Theory**
CIE Marks: 50	**SEE Marks: 50**

Unit-1 (10 Hours)
DC circuits: Ohm's law and Kirchhoff's laws, analysis of series, parallel and series-parallel circuits. Power and energy. Numerical. **Electrostatics:** Coulombs law, definitions of absolute and relative permittivity, electric field, electric flux, electric field strength, flux density. Capacitor: Expression of parallel plate capacitor, factors affecting capacitance, capacitors in series and capacitors in parallel, energy stored in an electrostatic field. Numerical. **Electromagnetism:** Electromagnets-direction of flux produced, right-hand rule, definition-magnetic circuit, mmf, magnetic field strength, free space and relative permeability, reluctance, permeance, useful and leakage flux, series circuits and parallel circuits.
Unit-2 (10 Hours)
Electromagnetic Induction: Fundamentals of Electromagnetism, Faraday's Laws of Electromagnetic Induction, Lenz's Law, Flemings rules, statically and dynamically induced EMF; concepts of self and mutual inductance, coils connected in series- adding and opposing, Coefficient of Coupling, Comparison of electric and magnetic circuits, Energy stored in magnetic field. Numerical. Force experienced by a current-carrying conductor placed in the magnetic field. Fleming's left-hand rule. Force between conductors carrying current in the same and in the opposite directions. Numerical.
Unit-3 (10 Hours)
Single-phase AC circuits: Generation of sinusoidal voltage, frequency of generated voltage, average value, RMS value, form factor and peak factor of sinusoidal voltage and currents. Phasor representation of alternating quantities. Analysis of R, L, C, R-L, R-C and R-L-C circuits with phasor diagrams, Real power, reactive power, apparent power, and Power factor. Numerical. **Three-phase AC circuits**: Necessity and advantage of 3-phase system. Generation of 3-phase power. Definition of phase sequence. Balanced supply and balanced load. Relationship between line and phase values of balanced star and delta connections. Power in balanced 3-phase circuits. Measurement of 3-phase power by 2-wattmeter method. Numerical.
Unit-4 (10 Hours)
Domestic Wiring: Service mains – overhead and underground. Types of wiring: Exposed to open space – wooden batten wiring and casing and capping. Concealed wiring: conduit wiring. Wiring for two-way and three-way control of load. **Domestic Electricity Bill:** Power-rating of household connected loads. Sanctioned Load. Practical unit of measuring energy, energy expressed for commercial purposes - Unit, its definition. Electricity bill -Tariff method considered: two-part tariff. Particulars considered for billing: sanctioned load and units consumed. Calculation of electricity bill for domestic consumers. **Equipment Safety Measures:** Working principles of fuse and miniature circuit breaker

(MCB), the merits and demerits of fuse and MCB.
Personal safety measures: Electric shock, possible effects of shocks. Safety precautions to avoid personal shock while dealing with electricity. Permanent measure: Earthing: Pipe and plate.

References:

Text Books:

1. Edward Hughes, "Electrical and Electronic Technology", Pearson Publications, 10th Edition, 2010
2. B. L Theraja, "Fundamentals of Electrical Engineering and Electronics", S. Chand Publications, 27th Edition, 2008

Reference Books:

1. D C Kulshreshth, "Basic Electrical Engineering", Tata McGraw Hill, 1st Edition 2019.
2. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill 4th edition, 2019.
3. V. K. Mehta, Rohit Mehta, "Principles of Electrical Engineering & Electronics", S. Chand and Company Publications, 2nd edition, 2015.
4. A K Sawhney, "Electrical and electronic measurements and instrumentation", A K Sawhney, Dhanapat Rai and Co. edition, January 2015.
5. Rajendra Prasad, "Fundamentals of Electrical Engineering", PHI Learning, 2nd Edition, 2009
6. V. N. Mittle & A. Mittal, "Basic Electrical Engineering", Tata McGraw-Hill Education, 2005
7. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering", 2nd Edition, Pearson Publications, 2017.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply the fundamental laws of DC circuits, electrostatics, and electromagnetism to analyze and solve basic electrical problems involving resistive, capacitive, and magnetic circuits.
2. Apply the laws of electromagnetic induction and magnetic force to analyze induced EMF, inductance, and the interaction of current-carrying conductors in magnetic fields
3. Apply the concepts of single-phase and three-phase AC circuits using phasor methods to calculate voltage, current, power, and power factor under balanced load conditions.
4. Apply the concepts of domestic wiring, electricity billing, and electrical safety to identify types of household wiring, calculate energy consumption and electricity bills, and follow safe practices in handling electrical equipment

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	1	1	1								1	3		1
2	CO-2	3	2	2	2								1	3		1
3	CO-3	3	3	2	2								1	3	1	1
4	CO-4	3	3	1	3		1		1		1		1	3		1

Syllabus for B.E. I Year (I/II – Semester) for Academic Year 2025 – 2026

(For students admitted to I year in 2025-26)

Introduction to Electrical Engineering	
Course Code:	**Credits: 03 (3:0:0:0)**
Teaching Hours/Week: 3:0:0:0	**Total Hours: 40 hours Theory**
CIE Marks: 50	**SEE Marks: 50**

Unit-1 (10 Hours)
DC Circuits: Ohm's law and its limitations, KCL & KVL, series, parallel, series-parallel circuits. Simple Numerical. **Electromagnetism:** Faraday's laws of electromagnetic induction, Lenz's law, Fleming's rules, statically and dynamically induced emf, concepts of self and mutual inductance, coefficient of coupling, energy stored in magnetic field, Numericals.
Unit-2 (10 Hours)
Single Phase AC Circuits: Generation of AC voltage/current. Definitions: time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor. Vector representation of alternating quantity: Lag, lead and in phase quantities. Voltage and current relationship in R, L, and C circuits, concept of impedance, analysis of R-L, R-C, R-L-C series circuits, active power, reactive power and apparent power, concept of power factor, Numericals. **Three Phase AC Circuits:** Generation of three phase AC quantity, advantages and limitations, star and delta connection, relationship between line and phase quantities, Numericals.
Unit-3 (10 Hours)
DC Generator: Principle of operation, constructional details, induced emf expression, types of generators. Relation between induced emf and terminal voltage. Numerical. **DC Motor:** Principle of operation, back emf and its significance, Types of motors, Numericals. **Transformers:** Principle of operation, Construction and Types of single-phase transformers, EMF equation, losses. Efficiency and condition for maximum efficiency, Numericals. **Three-phase induction Motors:** Concept of rotating magnetic field, Principle of operation, Constructional features of squirrel cage and slip ring induction motor. Slip and its significance, Numericals.
Unit-4 (10 Hours)
Power Generation: Hydro, Thermal, Nuclear power plants: Block diagram, Operation, Factors to be considered for site selection, Advantages and disadvantages. **Domestic Wiring:** Types of wiring, Two way and three way control of loads. Calculation of electricity bill for domestic consumers. **Electrical Safety:** Electric Shock, effect of shock on body, Factors affecting the impact of electric shock on human body, Safety Precautions to avoid shock, Earthing and its types.
Reference books: 1. B.L Theraja, "Fundamentals of Electrical Engineering and Electronics", S. Chand Publications, 27th Edition, 2014. 2. D C Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 10th Edition, 2019.

3. Edward Hughes, "Electrical and Electronic Technology", Pearson Publications, 10th Edition, 2010.
4. Rajendra Prasad, "Fundamentals of Electrical Engineering", 2nd Edition, PHI Learning, 2009.
5. V.N.Mittle&A.Mittal, "Basic Electrical Engineering", Tata McGraw-Hill Education, 2005.

Course Outcomes:

After completion of the course the students shall be able to,

1. Apply Ohm's law, KCL, and KVL to analyze DC circuits, explain the principles of electromagnetic induction and related laws with numerical applications.
2. Analyze AC circuit parameters and evaluate voltage, current, power relationships in single-phase and three-phase systems.
3. Describe the operation of DC machines, transformers, and three-phase induction motors, and compute EMF, slip, losses, and efficiency
4. Illustrate basic electrical power generation methods, identify domestic wiring systems, and implement electrical safety practices and billing calculations.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	3	2	2	1					1	2	3	2	
2	CO-2	3	3	2	2	2					1	2	3	2	
3	CO-3	3	2	2	2	2					1	2	3	2	
4	CO-4	3	2	1	1	1					2	3	2	2	

Syllabus for B.E. I Year (I/II – Semester) for Academic Year 2025 – 2026

(For students admitted to I year in 2025-26)

	Basic Electrical Engineering Lab	**01 - Credits (0 : 0 : 2)**
Hours/Week : 02		**CIE Marks : 50**
Total Hours : 26		**SEE Marks : 50**

Experiments

1. Verification of Ohm's law and Kirchhoff's laws.
2. Measurement of resistance using voltmeter-ammeter method. Verification of resistance value using multimeter.
3. Measurement of resistance, inductance, impedance and power factor using voltmeter, ammeter and wattmeter in single-phase AC circuits.
4. Measurement of three-phase power of a resistive-inductive (RL) load by two wattmeter method, when the load is (a) star connected and (b) delta connected. Calculation of resistance, reactance, impedance and power factor.
5. Wiring an appropriate electric circuit, understanding the basic principle used for 2-way and 3-way control of load.
6. Creation of short circuit to determine the time taken by a fuse of different length. Documenting the test data and the conclusions.
7. Trouble shooting experiments in simple DC circuits. The trouble may be due to loose connection, faulty component leading to open circuits or short circuits. Detection of fault and the reasons for that and conclusion.
8. Measurement of voltage between line and neutral, ground and line, ground and neutral in respect of healthy and unhealthy 3-pin socket. Conclusions arrived for the faulty wiring.
9. A 12 V battery is available. It is required to obtain 3 V from the battery to charge a mobile. Create a circuit to obtain the required voltage. Specify all the ratings of the components used.
10. Only three ammeters and standard resistance are available in the laboratory. Using the same measure the single phase power consumed by an inductive load.
11. Only three voltmeters and standard resistance are available in the laboratory. Using the same measure the single phase power consumed by an inductive load.

Reference books:

1. V. K. Mehta, Principles of Electrical Engineering. New Delhi, India: S. Chand & Company Ltd.
2. B. L. Theraja, Basic Electrical Technology. New Delhi, India: S. Chand & Company Ltd.
3. A. K. Sawhney, Electrical Measurements and Instrumentation. New Delhi, India: Dhanpat Rai & Sons.
4. D. P. Kothari and I. J. Nagrath, Basic Electrical Engineering. New Delhi, India: Tata McGraw-Hill.
5. J. B. Gupta, Fundamentals of Electrical Engineering. New Delhi, India: Katson Publishing.

Learning Resources:

Web links and Video Lectures (e-Resources):

(1) https://bes-iitr.vlabs.ac.in/List%20of%20experiments.html
[Virtual Labs, an ministry of education (MOE) Govt. of India Initiative]

Course Outcomes:

After completion of the course the students will be able to:

1. Measure key electrical parameters such as resistance, inductance, impedance, power, and power factor with standard methods.
2. Design and perform experiments to solve practical open-ended electrical problems.
3. Analyse experimental data from non-routine method to arrive at a solution.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO-1	3	2		2	2							3	2	3
2	CO-2	2	3	3	3	2				2	1		3	3	3
3	CO-3	2	3	2	3	2					1		3	2	3

Annexure 12

List of Organizations to be Approved for Internship

Sl.	Name of the Internship Organization
1.	ExaLeap Semiconductor Private Limited, Bengaluru
2.	AG Electro Services, Karad Maharastra
3.	Central Manufacturing Technology Institute, Bengaluru
4.	Mysore Electrical Industries Limited, Bengaluru
5.	Krishi Tharanga, Vijaypura
6.	Indian Institute of Information Technology, Dharwad
7.	S K High Voltages, Bangalore
8.	Government Tool Room & Training Centre, Hubballi
9.	Elmeasure India Pvt Ltd, Bangalore
10.	Thinqtechno Systems Pvt. Ltd., Bagalkote
11.	Sunshubh Technovations Pvt. Ltd., Hubli
12.	Tata Electronics Systems Solutions, Bangalore
13.	TATA Advanced Systems Limited, Bangalore
14.	Mukund Sumi Special Steel Ltd
15.	Power Research and Development Consultant Pvt. Ltd.
16.	HESCOM - Hubli Electricity Supply Company Limited
17.	Shanthala Power Limited, Hubballi
18.	Flensburg University of Applied Sciences
19.	Saaketh Electrocircuit Private Limited, Pune

Annexure 13

List of NPTEL Courses for Approval: 2022-23 Admitted Batch

Ability Enhancement Courses

Sl.	Title of the Course	Host Organisation	No. of Weeks
1	Sensors and Actuators	IISc Bangalore	12
2	Phase-Locked Loops	IIT Madras	12
3	Optical Engineering	IIT Madras	12
4	VLSI Design Flow: RTL to GDS	IIIT Delhi	12
5	Analog VLSI Design	IIT Kanpur	12
6	Pattern Recognition and Application	IIT Kharagpur	12
7	Principles and Techniques of Modern Radar Systems	IIT Kharagpur	12
8	Modelling and TCAD Simulation of Solar PV Cell	IIT Kharagpur	12
9	Charging Infrastructure	IIT Roorkee	12
10	Semiconductor Devices and Circuits	IISc Bangalore	12
11	Electronic Systems for Cancer Diagnosis	IISc Bangalore	12
12	Fabrication Techniques for MEMs-based Sensors: Clinical Perspective	IISc Bangalore	12
13	Electrical Equipment and Machines: Finite Element Analysis	IIT Bombay	12
14	Signal Processing for mm Wave Communication for 5G and Beyond	IIT Kharagpur	12
15	Control and Tuning Methods in Switched Mode Power Converters	IIT Kharagpur	12
16	Microsensors and Nano sensors	IIT Guwahati	12
17	Fiber Optic Communication Technology	IIT Madras	12
18	Linear Systems Theory	IIT Madras	12

Open Elective Courses

Sl.	Title of the Course	Host Organisation	No. of Weeks
1	Air Pollution and Control	IIT Roorkee	12
2	Cloud Computing	IIT Kharagpur	12
3	Water and Waste Water Treatment	IIT Roorkee	12
4	Blockchain and its Applications	IIT Kharagpur	12
5	Electronic Waste Management - Issues and Challenges	IIT Kharagpur	04
6	Data Base Management System	IIT Kharagpur	08
7	Digital Design with Verilog	IIT Guwahati	12
8	System Design Through Verilog	IIT Guwahati	08

8	Embedded Systems Design	IIT Kharagpur	12
9	Neural Science for Engineers	IISc Bangalore	12
10	Machine Learning for Engineering and science applications	IIT Madras	12
11	Waste water Treatment and Recycling	IIT Kharagpur	12
12	Mental Health and Wellbeing	IIT Kanpur	12
13	Municipal Solid Waste Management	IIT Guwahati	12
14	Integrated Waste Management for a Smart City	IIT Kharagpur	12
15	Remote Sensing for Natural Hazard Studies	IIT Guwahati	12
16	Sustainable Groundwater Management	IIT Madras	12
17	Artificial Intelligence: Search Methods for Problem Solving	IIT Madras	12
18	Programming In Java	IIT Kharagpur	12
19	Responsible & Safe AI Systems	IIIT Hyderabad and IIT Madras	12
20	Design & Implementation of Human-Computer Interfaces	IIT Guwahati	12
21	Ethical Hacking	IIT Kharagpur	12
22	Programming in Modern C++	IIT Kharagpur	12
23	Artificial Intelligence: Concepts and Techniques	IISc Bangalore	12
24	Understanding Incubation and Entrepreneurship	IIT Bombay	12
25	Finite Element Method: Variational Methods to Computer Programming	IIT Guwahati	12
26	Engineering Aspects of Biofuels and Biomass Conversion Technologies	IIT-ISM Dhanbad	12
27	Hydrogen Energy: Production, Storage, Transportation and Safety	IIT Bombay	12
28	Risk-Based Engineering	Homi Bhabha National Institute (HBNI)	12
29	HR Analytics	IIT Roorkee XLRI Jamshedpur	12

List of NPTEL Courses for Approval: 2023-24 Admitted Batch

Ability Enhancement Courses

Sl.	Title of the Course	Host Organisation	No. of Weeks
1	Sensors and Actuators	IISc Bangalore	12
2	Phase-Locked Loops	IIT Madras	12
3	Optical Engineering	IIT Madras	12
4	VLSI Design Flow: RTL to GDS	IIIT Delhi	12
5	EV - Vehicle Dynamics and Electric Motor Drives	IIT Delhi	12
6	Analog VLSI Design	IIT Kanpur	12
7	Pattern Recognition and Application	IIT Kharagpur	12
8	Principles and Techniques of Modern Radar Systems	IIT Kharagpur	12
9	Modelling and TCAD Simulation of Solar PV Cell	IIT Kharagpur	12
10	Charging Infrastructure	IIT Roorkee	12
11	Semiconductor Devices and Circuits	IISc Bangalore	12
12	Electronic Systems for Cancer Diagnosis	IISc Bangalore	12
13	Fabrication Techniques for MEMs-based Sensors: Clinical Perspective	IISc Bangalore	12
14	Electrical Equipment and Machines: Finite Element Analysis	IIT Bombay	12
15	Signal Processing for mm Wave Communication for 5G and Beyond	IIT Kharagpur	12
16	Control and Tuning Methods in Switched Mode Power Converters	IIT Kharagpur	12
17	Microsensors and Nano sensors	IIT Guwahati	12
18	Fiber Optic Communication Technology	IIT Madras	12
19	Linear Systems Theory	IIT Madras	12

Open Elective Courses

Sl.	Title of the Course	Host Organisation	No. of Weeks
1	Air Pollution and Control	IIT Roorkee	12
2	Cloud Computing	IIT Kharagpur	12
3	Water and Waste Water Treatment	IIT Roorkee	12
4	Blockchain and its Applications	IIT Kharagpur	12
5	Electronic Waste Management - Issues and Challenges	IIT Kharagpur	04
6	Data Base Management System	IIT Kharagpur	08
7	Digital Design with Verilog	IIT Guwahati	12

8	System Design Through Verilog	IIT Guwahati	08
8	Embedded Systems Design	IIT Kharagpur	12
9	Neural Science for Engineers	IISc Bangalore	12
10	Machine Learning for Engineering and science applications	IIT Madras	12
11	Waste water Treatment and Recycling	IIT Kharagpur	12
12	Mental Health and Wellbeing	IIT Kanpur	12
13	Municipal Solid Waste Management	IIT Guwahati	12
14	Integrated Waste Management for a Smart City	IIT Kharagpur	12
15	Remote Sensing for Natural Hazard Studies	IIT Guwahati	12
16	Sustainable Groundwater Management	IIT Madras	12
17	Artificial Intelligence: Search Methods for Problem Solving	IIT Madras	12
18	Programming In Java	IIT Kharagpur	12
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21	Ethical Hacking	IIT Kharagpur	12
22	Programming in Modern C++	IIT Kharagpur	12
23	Artificial Intelligence: Concepts and Techniques	IISc Bangalore	12
24	Understanding Incubation and Entrepreneurship	IIT Bombay	12
25	Finite Element Method: Variational Methods to Computer Programming	IIT Guwahati	12
26	Engineering Aspects of Biofuels and Biomass Conversion Technologies	IIT-ISM Dhanbad	12
27	Hydrogen Energy: Production, Storage, Transportation and Safety	IIT Bombay	12
28	Risk-Based Engineering	Homi Bhabha National Institute (HBNI)	12
29	HR Analytics	IIT Roorkee XLRI Jamshedpur	12

Annexure 14

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Panel of Examiners for the Academic Year 2025-26

Sl.	Name	Designation
1.	Dr. A S Jadhav	Asst. Professor Dept. of E&E, BLDEA's Engg College Vijayapur C: 7411044185
2.	Dr. Veeresh G Mathad	Asso. Prof, Dept. of Electrical Engg, Dr. A D Shinde College of Engineering, Bhadgaon, Gadhinglaj, Kolapur Cell: 7795737672
3.	Prof. Pradeep Vibhuti	Asst. Prof, Dept. of E&E SDMCET, Dharwad C: 9611828528
4.	Prof. A. K. Kulkarni	Asst. Prof, Dept. of E&E TCE, Gadag 8147406474
5.	Mr. Kubera U	Assistant Professor Dept. of E&E SJB Institute of Technology, Bengaluru C: 9986701333
6.	Prof. Shriranga Kulkarni	Asst. Professor Dept. of E&E BLDEA's Engg College Vijayapur C: 9739061339
7.	Prof. Aishwarya Kamatagi	Asst. Professor, Dept. of E&E SECAB Engg college, Vijayapur C: 8310969230
8.	Mr. Iranna Makarabbi	Assistant Professor Dept. of E&E, SKSVMCET, Laxhmeshwar C: 8867701426
9.	Prof. Mahant Kattimani	Asst. Professor, E&EE Dept. TCE, Gadag C: 9513566916
10.	Prof. H. A. Umachagi	Asst. Professor Dept. of E&E BLDEA's Engg College Vijayapur Cell: 9901780578,

11.	Prof A S Melinmani	Asst. Professor, E&EE Dept. Basava Engg College Jalaki C: 9686477453
12.	Prof. Manjunath Hombal	Asst. Prof Dept. of E&EE, SKSVMACET, Lakshmeshwar Cell: 9886178019
13.	Prof. Rashmi Pawar	Asst. Professor Dept. of E&E, BLDEA's Engg College Vijayapur C: 9535122850
14.	Prof. Jagadeesh G. Shivanagutti	Asst Prof, Dept. of E&E, TCE, Gadag Cell : 99864 49371
15.	Prof. Santhosha B M	Assistant professor Department of E&E , BITM, Bellary, 583104 Cell: 9611334743
16.	Prof. Mohammad Anwar	Asst. Professor, Department of E&E , BITM, Bellary, 583104 C:9620736024
17.	Prof. Hanamanth Reddy	Asst. Professor, Department of E&E , RYMEC, Bellary, 583104 C: 9739316173
18.	Prof. Vinay Bagali	Asst. Professor, Dept. of E&E BLDE CET Vijayapura C: 9738443513
19.	Dr. Linganagouda R	Asst. Professor, Department of E&E , RYMEC, Bellary, 583104 C: 9844580222
20.	Prof. Prashant Kadi	Asst. Professor, Dept. of E&E BLDE CET Vijayapura C: 8867187561
21.	Prof. Vinod Jiddi	Asst. Professor Dept. of E&E BLDEA's Engg College Vijayapur Cell: 8904589697

BoS Members

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Members of Board of Studies in E&EE (2024-25)

Sl.	Member Details	Designation and Organization	Contact Details	BoS Designation	Specialization
1	**Dr. R. L. Naik**	Professor and HoD Dept. of Electrical & Electronics Engg., Basaveshwar Engineering College, Bagalkot, Karnataka.	9986424111 naikrup1774@gmail.com becbgkee.hod@gmail.com	**Chairman**	Power Electronics and Multilevel Inverters
2	**Dr. Nagendrappa H.**	Associate Professor Dept. of Electrical & Electronics Engg., National Institute of Technology Karnataka, Surathkal	9483830071 nagendrappa@nitk.edu.in nagendrappa@gmail.com	**VTU Nominee**	High-frequency soft-switching converters, Grid integration of renewable energy systems, Electric vehicle (EV) chargers and BMS
3	**Dr. Arunkumar Patil**	Assistant Professor Dept. of Electrical & Electronics Engg., Central University of Karnataka, Kalaburagi.	9449291199 arunkumarpatil@cuk.ac.in	**Member** Subject Expert Nominated by BEC Academic Council	Power systems, Renewable Energy Systems, WAMS, AI and Data Science
4	**Dr. Animesh Kumar Sahoo**	Assistant Professor Dept. of Electrical and Electronics Engg. Indian Institute of Technology Dharwad - 580 011	8917224312 animesh.sahoo@iitdh.ac.in	**Member** Subject Expert Nominated by BEC Academic Council	Renewables, Grid-tie Inverters Control, Power Electronic Systems Grid Forming Technology, Microgrids

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Department of Electrical and Electronics Engineering

Members of Board of Studies in E&EE (2024-25)

5	 **Mr. Sreekant Kollur**	Engineering Specialist Senior 2 FedEx TowerD 1005, Indis Viva City Hyderabad-500084 Telangana, India	8328367648 shrikant.ti@gmail.com	**Member** Meritorious Alumni Nominated by Principal	Digital Electronic Circuits, Firmware, IOT systems development, C/C++, Python, RTOS, Assembly, and advanced embedded technologies
6	 **Mr. Prasad Jigajinni**	Advanced Lead Engineer Wabtec Corporation Bengaluru, Karnataka, India	9945378422 prasad_ee@yahoo.com	**Member** Industry Representative Nominated by BEC Academic Council	Digital Systems, Electrical Design, Railroad Equipment Manufacturing
	Internal Members				
8	 **Mr. R. S. Allurkar**	Assoc. Professor Dept. of E&EE, BEC	9986590894 allurkarsir@gmail.com	Member	Signal processing and Control systems
9	 **Mr. S. G. Nayak**	Asst. Professor Dept. of E&EE, BEC	9738681084 shivakumarnayak8@gmail.com	Member	Power Electronics

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Members of Board of Studies in E&EE (2024-25)

10	**Smt. S. S. Tambakad**	Asst. Professor Dept. of E&EE, BEC	9900489841 sunita_raj19@yahoo.co.in	Member	Power and Energy Systems
11	**Dr.S.Y.Goudappanavar**	Asst. Professor Dept. of E&EE, BEC	9916377743 sangmesh024@gmail.com	Member	WECS integration to Microgrids
12	**Mr. M. L. Chikkadesai**	Asst. Professor Dept. of E&EE, BEC	9480780580 mahantesh.chikkadesai@gmail.com	Member	Power and Energy Systems
13	**Mr. S. S. Kandagal**	Asst. Professor Dept. of E&EE, BEC	9741988498 sskandagal02@gmail.com	Member	Power and Energy Systems

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Members of Board of Studies in E&EE (2024-25)

14	**Mr. B. S. Hadapad**	Asst. Professor Dept. of E&EE, BEC	96328 95082 hadapad.basavaraju@gmail.com	Member	Power and Energy Systems
	Student Representatives (For the Academic Year 2024-2025)				
13	**Mr. Kathik Bairadar**	7th Semester, E&EE 2BA22EE017	8431446982 kartikbiradar39@gmail.com	Student Member	Electrical and Electronics
14	**Ms. Ashwini R Bidaralli**	7th Semester, E&EE 2BA22EE012	6360706970 bidaralliashwini@gmail.com	Student Member	Electrical and Electronics
15	**Ms. Nanditha G Hiremath**	5th Semester, E&EE 2BA23EE026	7892847025 talewad.sanjana@gmail.com	Student Member	Electrical and Electronics

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Members of Board of Studies in E&EE (2024-25)

16	**Mr. Prathamesh Mutalikdesai**	5th Semester, E&EE 2BA23EE032	6363209541 vijaykumarpurutageri@gmail.com	Student Member	Electrical and Electronics
	Member Secretory				
17	**Dr. Basanagouda Ronad**	Assoc. Professor Dept. of E&EE, BEC	9449760427 basugouda.ronad@gmail.com basugouda.ronad@ieee.org	**Member Secretory**	Renewable Energy – Solar PV IPs for Agriculture

HoD-EE and Chairman BoS

Principal

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

21st Board of Studies Meeting in E&EE

30th August 2025 (Saturday) **Time: 10.00 AM – 12.00 Noon** **Venue: EE Seminar Hall**

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

21st Board of Studies Meeting in E&EE

30th August 2025 (Saturday) **Time: 10.00 AM – 12.00 Noon** **Venue: EE Seminar Hall**

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