Programme Report

18-22 May 2026

Outcome-Based Curriculum Development for Electrical and Electronics Engineering

Conducted at
Nepal Engineering Council, Kathmandu, Nepal

By

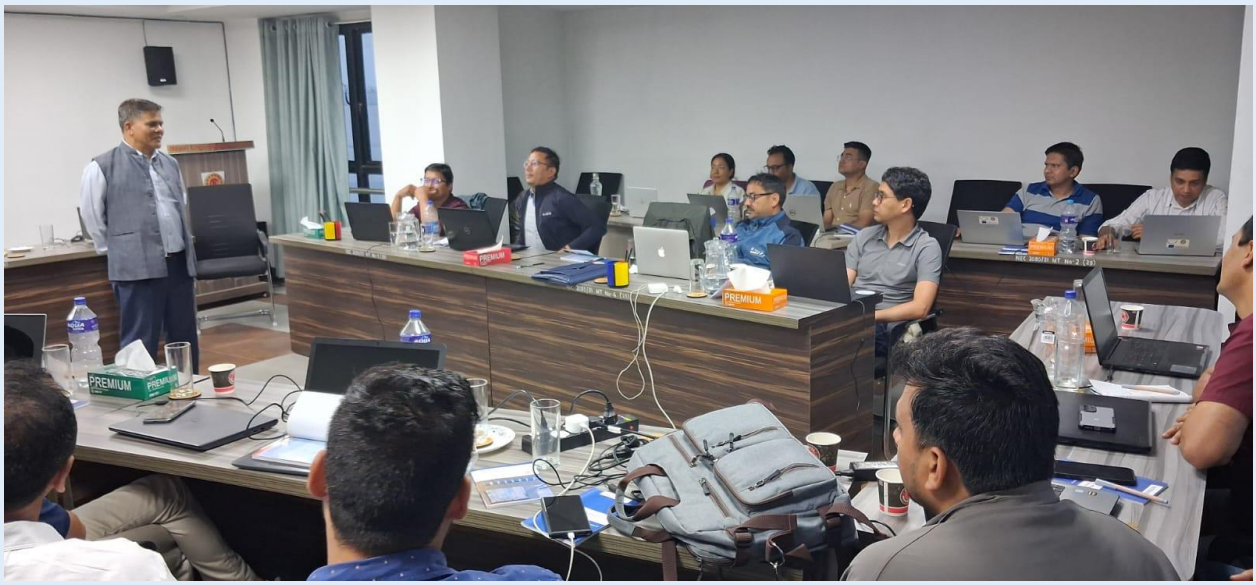
National Institute of Technical Teachers' Training and Research, Bhopal
(Ministry of Education, Government of India)

In collaboration with

Nepal Engineering Council, Kathmandu, Nepal

Coordinator: **Dr A. S. Walkey**, Professor and Head,
Department of Electrical and Electronic Engineering, NITTTR, Bhopal
Faculty: **Dr Sandip S. Kedar**, Professor and Head, Department
of Educational Technology, NITTTR, Bhopal

HIGHLIGHTS FROM THE NEC, KATHMANDU TRAINING PROGRAMME




PREMIUM
NEC 2080/81 MT No:8 (29)


नेपाल इन्जिनियरिङ्ग परिषद्
NEPAL ENGINEERING COUNCIL
www.nec.gov.np
Nepal Engineering Council


नेपाल इन्जिनियरिङ्ग परिषद्
NEPAL ENGINEERING COUNCIL
PREMIUM
AQUAVESS


PREMIUM

Programme Report

Programme Code: NC-CONSNEP-28/26-27
Programme Title: Outcome-Based Curriculum Development for Electrical and Electronics Programmes
Duration: 18 to 22 May 2026
Venue: Nepal Engineering Council, Kathmandu, Nepal

1. Background

The global engineering education landscape is increasingly defined by internationally benchmarked quality frameworks, with **Outcome-Based Education (OBE)** at its core, making Nepal's pursuit of Washington Accord membership under the International Engineering Alliance (IEA) a mandatory driver for curriculum reform. To address this, a formal **Memorandum of Understanding (MOU)** was signed on **March 11, 2026**, between **NITTTR Bhopal** and the **Nepal Engineering Council (NEC)**, initiating a comprehensive capacity-building programme designed to bridge the gap between theoretical OBE principles and their practical implementation. Recognizing that faculty are the primary agents of change, this "Training of Trainers" initiative focuses on equipping educators with the expertise to articulate Outcome-Based Curriculum for Undergraduate Engineering Programmes.

This report marks the completion of **Phase 1**, which successfully localized these global standards to the Nepalese context, culminating in the critical redesign of the **BE Electrical and Electronics Engineering programme structure** and the finalization of **course curriculum detailing format**. By achieving these deliverables, the programme has established a robust foundation for meeting Washington Accord benchmarks, while simultaneously strengthening the Indo-Nepal academic partnership and ensuring that Nepal's engineering education is positioned to achieve credible, internationally recognized standards.

2. Programme Outcomes

As outlined in the MOU, it is expected that the participants on completion of the programme will be able to:

a) Explain principles of OBE.
b) Interpret graduate attributes/ POs, knowledge and attitude profiles.
c) Develop a programme structure for an identified programme.
d) Formulate course outcomes.
e) Review the format for course curriculum detailing.

The above have been successfully achieved on completion of the programme. (Refer Annexure 3 and Annexure 4). The detailed programme brief along with the training schedule that was implemented is given in ***Annexure 1***

3. Implementation Methodology: Phase 1

Phase 1 of the programme was strategically designed for in-country delivery to ensure contextual relevance and maximum faculty participation. A total of 20 faculty members from the following five universities participated in the programme.

1) Kathmandu University, Nepal
2) Manmohan Technical University, Nepal
3) Pokhara University, Pokhara, Nepal
4) Tribhuvan University, Nepal
5) Purbanchal University, Nepal

The programme was conducted at Nepal Engineering Council, Kathmandu, Nepal. The details of participants are given in ***Annexure 2.*** During the training, a participatory approach was followed that include Input cum discussion, Hands-on Exercises/ Group work, Presentations, and Tasks

4. Key Deliverables Achieved

The Phase 1 intervention was intensive and result-oriented, culminating in two specific technical outputs that will be the foundation of Phase 2 to be conducted at NITTTR, Bhopal, India.

A. Redesign of the BE Electrical and Electronics Engineering Programme Structure

The participants successfully mapped the Electrical and Electronics Engineering curriculum against the IEA Graduate Attributes and Programme Outcomes as outlined by Nepal Engineering Council. This involved:

- Identifying existing curriculum gaps
- Reviewing existing course structures.
- Formulating Programme Educational Objectives (PEOs)
- Formulating Programme Specific Outcomes (PSOs)
- Integrating components as mentioned in the knowledge and attitude profile into the revised programme structure.

The first draft of the programme structure for the five Universities offering Undergraduate Programme in Electrical and Electronics Engineering is given in ***Annexure 3.*** The unique features of the revised programme include the following:

- Open electives and the capstone/ major project are introduced to facilitate interdisciplinary collaboration for solving complex engineering problems.
- Inclusion of emerging technologies and industry demand courses.
- Courses related to humanities, social sciences and management (such as Project Engineering and Management, Engineering Economics, Engineering Profession and Society, Technology, Environment & Society, Professional Practice and Ethics) are introduced for students' holistic development.
- Existing course titles are updated to make them more suitable for today's Electrical and Electronics and allied Engineering context.
- Multiple engineering projects are incorporated to facilitate the development of a project addressing societal needs.

B. Finalization of the Course Curriculum Detailing Format

To ensure uniformity across all Universities, a "Course Detailing Format" aligned to Outcome-Based philosophy was proposed by NITTTR, Bhopal. This was thoroughly discussed and was accepted by all the participants. One course detailing was attempted by participants from each university. The outcome of each university is given in ***Annexure 4.***

5. Strategic Significance of Phase 1 Training

This collaboration marks a pivotal step in strengthening the Indo-Nepal academic partnership. By accepting the outcome-based curriculum framework and building local faculty capacity, this initiative provides the essential foundation for Nepal's successful and credible bid for Washington Accord membership.

Phase 1 has successfully transitioned the theoretical mandate of the NEC into a practical, implementable roadmap. The first draft of the BE Electrical and Electronic and allied Engineering Programme Structure (Total Seven UG Programmes) will be carried forward into Phase 2 at NITTTR, Bhopal, where faculty will gain exposure to design course curriculum and the rubrics.

राष्ट्रीय तकनीकी शिक्षक प्रशिक्षण एवं अनुसंधान संस्थान, भोपाल

(सम-विश्वविद्यालय-विशिष्ट श्रेणी)

National Institute of Technical Teachers' Training & Research, Bhopal

(Deemed -to -be University under Distinct Category)

Programme Brief

Programme Code: NC-CONSNEP-28/26-27

Programme Title: Outcome-Based Curriculum Development for Electrical and Electronics Programme

Duration: 18 to 22 May 2026

Venue: NEC Nepal building at Kathmandu, Nepal

1. Rationale:

The global engineering education landscape is increasingly governed by internationally benchmarked quality frameworks, with Outcome-Based Education (OBE) at their core. Nepal's pursuit of Washington Accord membership under the International Engineering Alliance (IEA) has made the adoption of OBE not just desirable but mandatory.

In this view, as per the Memorandum of Understanding (MOU) between NITTTR, Bhopal, Deemed to be University under Distinct Category (Ministry of Education, Government of India) and the Nepal Engineering Council (NEC) signed on 11/03/2026, capacity-building programmes on "*Outcome-Based Curriculum Development for the engineering faculty of Nepal" are planned to* be conducted.

The Washington Accord requires that member institutions demonstrate measurable graduate competencies aligned with global engineering standards. Engineering colleges under the Nepal Engineering Council (NEC) must therefore redesign their curricula in conformity with OBE principles. This transformation involves articulating Programme Educational Objectives (PEOs), Programme Outcomes (POs), and Course Outcomes (COs). However, such reform cannot succeed without first building the capacity of faculty, who are the primary implementers of any curriculum change. Recognising this gap, NITTTR Bhopal — a premier institution under the Ministry of Education, Government of India, has been entrusted to undertake the task of Training of Trainers for faculty of Nepal.

NITTTR Bhopal brings decades of expertise in technical teacher training, curriculum development, and academic quality assurance to this assignment. The proposed series of training programmes is designed to bridge the knowledge and skill gap among faculty regarding OBE concepts and their practical application in curriculum design. It will also cover constructive alignment, outcome formulation, OBE-driven pedagogy, and outcome-based assessment strategies.

The proposed training initiative will be delivered in two phases, each of five days' duration. The first phase will comprise four programmes to be conducted at different locations across Nepal, while the second phase will host four programmes at NITTTR, Bhopal. NEC, Nepal, will identify and depute faculty members from various disciplines of engineering colleges to participate as trainees. This two-phase structure is deliberately designed to ensure both contextual relevance through in-

country delivery and international academic exposure through the India-based component, thereby maximising the overall learning impact of the training initiative.

At the end of the training programmes, the participants will be able to redesign existing course curricula to meet Washington Accord benchmarks. The programme is structured to be intensive yet practical, ensuring faculty are updated with ready-to-implement curriculum reform aspects. This collaboration between NITTTR Bhopal and NEC, Nepal, represents a significant step in strengthening Indo-Nepal academic partnerships. It reflects a shared commitment to elevate engineering education quality in Nepal to internationally recognised standards. This training initiative will serve as the foundation for Nepal's credible and successful bid for Washington Accord membership.

Phase 1 of Training:

This Capacity Development Programme on "Outcome-Based Curriculum Development" Phase 1 aims to equip faculty with the knowledge and skills needed to design curriculum structures that integrate the principles and practices of outcome-based education, in alignment with IEA standards.

2. Programme Outcomes:

f) Explain principles of OBE.
g) Interpret graduate attributes/ POs, knowledge and attitude profiles.
h) Develop a programme structure for an identified programme.
i) Formulate course outcomes.
j) Review the format for course curriculum detailing.

3. Programme Contents

- Concepts and principles of Outcome-Based Education (OBE).
- Three pillars of OBE: Outcome-Based Curriculum, Outcome-Based Teaching and Learning, Outcome-Based Assessment.
- Graduate Attributes, introduction to GAPC, Knowledge and Attitude profile.
- Domains of learning.
- Outcome-Based Curriculum Development approach.
- Components of Outcome-Based Curriculum.
- Writing course outcomes.
- Draft Course Curriculum format.

4. Instructional Strategy:

- Input cum discussion
- Hands-on Exercises/ Group work
- Presentations, Assignments, Tasks

5. **Target Group:** Faculty members of Faculty of Electrical and Electronics Engineering from different universities of Nepal.

6. Coordinator & Faculty details:

a. **Dr. A. S. Walkey, Professor and Head, Dept. of Electrical & Electronics Engineering, NITTTR Bhopal**
Tel. No. (O): + 91 (755) 2661600 – 02 Extn. 361
Mobile No: 8989792155
E-mail ID: aswalkey@nitttrbpl.ac.in

b. **Dr. Sandip S. Kedar, Professor and Head, Dept. of Educational Technology, NITTTR Bhopal**
Tel. No. (O): + 91 (755) 2661600 – 02 Extn. 406
Mobile No: 9425007408
E-mail ID: sskedar@nitttrbpl.ac.in

7. Tentative Schedule:

Date	Session I (10.00 AM to 11.15 AM)	Session II (11.45 AM to 01.00 PM)	Session III (02.00 PM to 03.15 PM)	Session IV (03.45 PM to 05.00 PM)
18-05-2026	• Registration • Inaugural Session • Introduction to Programme Brief	• Concepts and Principles of OBE • OBC, OBTL and OBA Frameworks • Architecture of OBE	• Introduction to GAPC and International Accords • Programme outcomes/ Graduate Attributes for Engineers	Knowledge and Attitude Profiles in OBE
19-05-2026	Domains of Learning	Outcome-Based Curriculum Development Approach	**Task-1:** Identify Existing Curriculum Gaps	• Programme Structure • Components of an Outcome-Based Curriculum
20-05-2026	**Task-2:** Develop Programme Structure for the identified Programme	Continued	Presentation and feedback on Draft Programme Structure	Sample Course Detailing Format
21-05-2026	Course Outcomes	**Task-3:** Formulate COs and create CAM for the selected Course(s)	Continued	Presentation and feedback of COs
22-05-2026	• Review and finalise the course curriculum format • Develop draft course curriculum for sample course(s)		Presentation and Feedback	Valedictory and Phase 1 Wrap-up

Short-Term Training Programmes (2026-2027)
Participant List (All) for Programme Code (NC-CONSNEP-28)
Outcome-Based Curriculum Development for Electrical and Electronics Programmes
NEC, Kathmandu, Nepal from 18-05-2026 to 22-05-2026

SN	Regd Id	Participant Name	Org. Name	Designation	Email	Mobile No
1.	3351	Amit Kumar Rauniyar	Advanced College of Engineering and Management, **Tribhuvan University**, Kathmandu	Senior Assistant Professor	amitkumar.rauniyar@acem.edu.np	9860308141
2.	3346	Rabin Shrestha	Advanced College of Engineering and Management, **Tribhuvan University**, Kathmandu	Asst Professor	rabin@acem.edu.np	9869097447
3.	3357	Narayan Adhikari Chhetri	Himalaya College of Engineering, **Tribhuvan University**, Lalitpur	Sr Lecture	narayan422@gmail.com	9843201574
4.	3352	Naresh Khatri	Khwopa College of Engineering, **Tribhuvan University**, Bhaktapur, Nepal	Senior Lecturer	nareshkht@gmail.com	9851174495
5.	3345	Rakesh Gwachha	Khwopa College of Engineering, **Tribhuvan University**, Bhaktapur, Nepal	Senior Lecturer	gwachharg@gmail.com	9851185948
6.	3358	Chaitya Shova Shakya	**Tribhuvan University**, Kathford International College of Engineering and Management, Balkumari, Lalitpur	Senior Lecturer	chaitya.shakya@gmail.com	9849451159
7.	3347	Ganesh Ram Dhonju	Khwopa Engineering College, **Purbanchal University**, Bhaktapur	Senior Lecturer	gr.dhonju@gmail.com	9841791184
8.	3359	Ashim Panta	Nepal Polytechnic Institute, **Purbanchal University**	Assistant Professor	ashimkumarpanta@gmail.com	9855070759
9.	3362	Basanta Paudyal	**Purbanchal University** School of Engineering, Biratnagar	Lecturer	basantapaudyalmail@gmail.com	9842095247

10.	3348	Md Zaid	**Purbanchal University** School of Engineering, Biratnagar	Asst lecturer	zaideeuet@gmail.com	9818708807
11.	3355	Anup Thapa	School of Engineering, **Kathmandu University**, Dhulikhel, Nepal	Associate Professor	anup.thapa@ku.edu.np	9851116884
12.	3354	Ram Kaji Budhathoki	School of Engineering, **Kathmandu University**, Dhulikhel, Nepal	Professor	ram.budhathoki@ku.edu.np	9851183818
13.	3356	Samundra Gurung	School of Engineering, **Kathmandu University**, Dhulikhel, Nepal	Assistant Professor	samundra.gurung@ku.edu.np	9861558767
14.	3361	SHAILENDRA KUMAR JHA	School of Engineering, **Kathmandu University**, Dhulikhel, Nepal	ASSOCIATE PROFESSOR	shailendra@ku.edu.np	9841273521
15.	3353	KHEM NATH KHATIWADA	School of Engineering, **Manmohan Technical University**, Morang, Nepal	Lecturer	aashnakhatiwada@gmail.com	9765409900
16.	3349	Sagun Paudyal	School of Engineering, **Manmohan Technical University**, Morang, Nepal	Lecturer	sagunn2052@gmail.com	9841401366
17.	3350	Ananta Adhikari	School of Engineering, **Pokhara University**, Pokhara	Assistant Professor	anantaadhikari07@gmail.com	9841470706
18.	3344	Purna Bahadur Pun	School of Engineering, **Pokhara University**, Pokhara	Assistant Professor	purna.pun435@gmail.com	9815429761
19.	3343	Rammani Adhikari	School of Engineering, **Pokhara University**, Pokhara	Assistant Professor	rma.tbi@gmail.com	9856022228
20.	3360	Sanjeev Thapa	School of Engineering, **Pokhara University**, Pokhara	Asst Professor	sanjeev1.thapa@gmail.com	9856061311

NATIONAL INSTITUTE OF TECHNICAL TEACHERS' TRAINING & RESEARCH, SHAMLA HILLS, BHOPAL MADHYA PRADESH

Name of Programme :Outcome Based Curriculum Development for Electrical and Electronics Programmes
Course Code :NC-CONSNEP-28/2026-2027
Duration :18-05-2026 To 22-05-2026
Venue :~~Purbanchal University, Nepa~~ NEC, Kathmandu, Nepal
Co-ordinator A.S. Walkey

Attendance Sheet

SI. No.	Name of the Participant Organization	Arrival (Date, Time & Sign)	Departure (Date, Time & Sign)	Day 1 (18-05-2026)	Day 2 (19-05-2026)	Day 3 (20-05-2026)	Day 4 (21-05-2026)	Day 5 (22-05-2026)	Qualified for Certificate (Yes/No)
1	KHEM NATH KHATIWADA SCHOOL OF ENGINEERING, MANMOHAN TECHNICAL UNIVERSITY, MORANG, NEPAL								
2	Amit Kumar Rauniyar Advanced College of Engineering and Management, Tribhuvan University, Kathmandu								
3	Ananta Adhikari School of Engineering, Pokhara University, Pokhara								
4	Anup Thapa School of Engineering, Kathmandu University, Dhulikhel, Nepal								
5	Ashim Panta Nepal Polytechnic Institute, Purbanchal University								

Note: The original copy of this attendance sheet(dully signed by course coordinator) will be sent on the last day of training till 11.30 AM to POC for issuing certificate .

(A.S. Walkey)
Course Coordinator(NC-CONSNEP-28/2026-2027)

Sl. No.	Name of the Participant Organization	Arrival (Date, Time & Sign)	Departure (Date, Time & Sign)	Day 1 (18-05-2026)	Day 2 (19-05-2026)	Day 3 (20-05-2026)	Day 4 (21-05-2026)	Day 5 (22-05-2026)	Qualified for Certificate (Yes/No)
6	Basanta Paudyal Purbanchal University School of Engineering, Biratnagar								
7	Chaitya Shova Shakya Tribhuvan Purbanchal University, Kathford International College of Engineering and Management, Balkumari, Lalitpur								
8	Ganesh Ram Dhonju Khwopa Engineering College,Purbanchal University, Bhaktapur								
9	Rakesh Gwachha Khwopa College of Engineering, Tribhuvan University, Bhaktapur, Nepal								
10	Narayan Adhikari Chhetri Himalaya College of Engineering, Tribhuvan University, Lalitpur								

Note: The original copy of this attendance sheet(dully signed by course coordinator) will be sent on the last day of training till 11.30 AM to POC for issuing certificate .

(A.S. Walkey)
Course Coordinator(NC-CONSNEP-28/2026-2027)

Sl. No.	Name of the Participant Organization	Arrival (Date, Time & Sign)	Departure (Date, Time & Sign)	Day 1 (18-05-2026)	Day 2 (19-05-2026)	Day 3 (20-05-2026)	Day 4 (21-05-2026)	Day 5 (22-05-2026)	Qualified for Certificate (Yes/No)
11	Naresh Khatri Khwopa College of Engineering , Tribhuvan University, Bhaktapur, Nepal								
12	Purna Bahadur Pun School of Engineering, Pokhara University, Pokhara								
13	Rabin Shrestha Advanced College of Engineering and Management, Tribhuvan University, Kathmandu								
14	Ram Kaji Budhathoki School of Engineering, Kathmandu University, Dhulikhel, Nepal								
15	Rammani Adhikari School of Engineering, Pokhara University, Pokhara								

Note: The original copy of this attendance sheet(dully signed by course coordinator) will be sent on the last day of training till 11.30 AM to POC for issuing certificate .

(A.S. Walkey)
Course Coordinator(NC-CONSNEP-28/2026-2027)

Sl. No.	Name of the Participant Organization	Arrival (Date, Time & Sign)	Departure (Date, Time & Sign)	Day 1 (18-05-2026)	Day 2 (19-05-2026)	Day 3 (20-05-2026)	Day 4 (21-05-2026)	Day 5 (22-05-2026)	Qualified for Certificate (Yes/No)
16	Sagun Paudyal School of Engineering, Manmohan Technical University, Morang, Nepal								
17	Samundra Gurung School of Engineering, Kathmandu University, Dhulikhel, Nepal								
18	Sanjeev Thapa School of Engineering, Pokhara University, Pokhara								
19	SHAILENDRA KUMAR JHA School of Engineering, Kathmandu University, Dhulikhel, Nepal								
20	Md Zaid Purbanchal University School of Engineering, (Birat Nagar) Biratnagar (No Space)								

Note: The original copy of this attendance sheet(dully signed by course coordinator) will be sent on the last day of training till 11.30 AM to POC for issuing certificate .

(A.S. Walkey)
Course Coordinator(NC-CONSNEP-28/2026-2027)

Annexure 3

Revised Programme Structure for Undergraduate Programmes in Electrical and Electronics and Allied Engineering of

1. Tribhuvan University
2. Purbanchal University
3. Kathmandu University
4. Manmohan Technical University
5. Pokhara University

Task – 2

Title – Design & Development of Programme Structure with Teaching & Examination Scheme for the Identified Programme

Name of the University – Tribhuvan University

Programme Title – Bachelors of Electrical Engineering

1. Introduction:

The Department of Electrical Engineering is one of the major academic departments under the Institute of Engineering (IOE), Nepal's premier engineering institution. The department is dedicated to producing competent electrical engineers capable of contributing to power systems, renewable energy, industrial automation, smart grids, electric transportation, and sustainable energy technologies.

The department has played a vital role in supplying skilled manpower for Nepal's hydropower development, electrification projects, transmission systems, industrial sectors, and emerging clean energy technologies.

The department emphasizes:

- Strong theoretical foundations in electrical engineering,
- Practical laboratory-based learning,
- Research and innovation,
- Industry-oriented projects,
- Renewable and sustainable energy applications,
- Professional ethics and engineering practices.

It aims to prepare graduates who can work effectively in government organizations, industries, power utilities, research institutions, consultancy sectors, and higher education.

Background and Historical Development

The Department of Electrical Engineering evolved after the establishment of IOE in 1972 through the integration of several technical institutions under Tribhuvan University. With Nepal's growing demand for electrical energy, hydropower expansion, industrial development, and modernization, the department gradually expanded its academic and research activities.

Initially focused on traditional electrical power engineering, the department now incorporates modern areas such as:

- Renewable Energy Systems,
- Power Electronics and Drives,
- Smart Grid Technologies,

- Industrial Automation,
- Electric Vehicles,
- Energy Management,
- Control Systems,
- High Voltage Engineering.

The department continuously updates its curriculum to align with modern engineering practices and international academic standards.

Courses Offered

The department offers undergraduate and postgraduate programs in electrical engineering and related fields. The Bachelor of Electrical Engineering is a four-year undergraduate program divided into eight semesters.

Major course areas include:

- Electric Circuits
- Electrical Machines
- Power Systems
- Power Electronics
- Control Systems
- High Voltage Engineering
- Instrumentation
- Renewable Energy Systems
- Microprocessors
- Electrical Installation
- Industrial Automation
- Energy Management
- Transmission and Distribution
- Project Work and Industrial Training

The curriculum combines theoretical classes, laboratory experiments, project-based learning, seminars, and field visits.

Credit System

The Department of Electrical Engineering follows the semester-based credit system adopted by IOE and Tribhuvan University.

Undergraduate Credit Structure

Duration: 4 years (8 semesters)

Each semester includes theory, tutorials, practicals, and project work. Most subjects carry 3–4 credits depending on lecture and laboratory hours. Laboratory and project-based courses are assigned separate practical credits.

Students are evaluated through:

- Internal assessments,
- Assignments,
- Practical examinations,
- Semester final examinations,
- Project evaluations.
- Postgraduate Credit System

Eligibility Criteria

For Bachelor of Electrical Engineering students seeking admission must fulfill IOE entrance eligibility requirements.

Candidates are eligible if they have:

- Completed 10+2 Science (Physical Group),
- Biological Science with additional Mathematics,
- Diploma in Engineering or equivalent recognized by TU,
- Secured minimum required academic percentage/grade,
- Passed the IOE entrance examination conducted by the Institute of Engineering.

Graduates from the Department of Electrical Engineering have opportunities in:

- Hydropower companies,
- Nepal Electricity Authority,
- Renewable energy industries,
- Manufacturing and automation industries,
- Telecommunication sectors,
- Electric vehicle industries,
- Research and development organizations,
- Consulting firms,
- Academic institutions.

2. Vision & Mission Statements of the University:

Vision of University

"To be a globally recognized center of academic excellence, research, and innovation, leading Nepal's transformation into a knowledge-based society by providing inclusive, high-quality, and affordable higher education."

Mission of University

- Shifting theory-oriented education to modern, technology-driven pedagogical approaches, ensuring that undergraduate programs meet international quality standards and directly align with global career trends.
- To establish world-class research centers, enhance interdisciplinary doctoral and postdoctoral research, and incentivize knowledge creation that addresses real-world industrial, economic, and technological challenges facing the nation.
- To advance comprehensive digital transformation, structural decentralization, and professional transparency across administrative and examination systems, graduating ethically grounded leaders capable of driving sustainable national and global progress.

3. Vision & Mission Statements of the Department

Vision of Department

To be a center of academic excellence in electrical engineering, recognized for producing innovative, ethically grounded, and technically competent professionals capable of leading the transformation toward smart, sustainable, and resilient energy systems.

Mission of Department

- Provide a demanding, constantly changing curriculum based on advanced electrical engineering principles and fundamental sciences, equipping students with excellent analytical, simulation, and design skills.

- Cultivate a culture of practical learning, research, and technical innovation through exposure to contemporary laboratories, industrial internships, and collaborative project executions that tackle current engineering challenges.

- Develop the fundamental professional abilities needed to succeed in internationally competitive settings, such as project management, cooperative cooperation, effective communication, and an entrepreneurial mentality.

- Prepare graduates to create clean energy and intelligent automation solutions for the good of society by instilling a strong sense of professional ethics, social responsibility, and a dedication to environmental sustainability.

4. Programme Educational Objectives (PEOs):

- ❖ Graduates will be able to establish themselves as successful electrical engineering professionals capable of analyzing, designing, and optimizing complex engineering problems related to electrical domains.
- ❖ Graduates will be able to lead or collaborate in interdisciplinary teams to carry out engineering projects from conception to commissioning through their excellent leadership, effective communication, and good project management skills.
- ❖ Graduates will practice engineering concerned to environmental sustainability, social responsibility, and high ethical standards.
- ❖ Graduates will also regularly update their knowledge base through professional development, certifications, and higher education as a part of lifelong learning.

5. Programme Outcomes (POs): - As per NEC

PO-1 **Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing and engineering fundamentals, and an engineering specialization as specified in Knowledge and Attitude Profiles (KA1 to KA4) respectively to develop solutions to complex engineering problems.

PO-2 **Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences with holistic considerations for sustainable development (KA1 to KA4).

PO-3 **Design/development of solutions:** Design creative solutions for complex engineering problems and design systems, components or processes to meet identified needs with appropriate consideration for public health and safety, whole- life cost, net zero carbon as well as resources, cultural, societal, and environmental considerations as required (KA5)

PO-4 **Investigation:** Conduct investigations of complex engineering problems using research methods including research-based knowledge, design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions (KA8). Complex engineering problems are referred to as the problems:

- that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline as against problems given at the end of chapters in a typical textbook that can be solved using simple engineering theories and techniques;
- that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions;
- that require consideration of appropriate constraints / requirements not explicitly given in the problem statement such as cost, power requirement, durability, product life, etc.;
- which need to be defined (modelled) within appropriate mathematical framework; and
- that often require use of modern computational concepts and tools, for example, in the design of an earthquake resistant building.

PO-5 **Modern Tool Usage:** Create, select and apply, and recognize limitations of appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering problems (KA2 and KA6)

PO-6 **The Engineer and the Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practices (KA7).

PO-7 **Ethics:** Apply ethical principles and commit to professional ethics and norms of engineering practice and adhere to relevant national and international laws. Demonstrate an understanding of the need for diversity and inclusion (KA9)

PO-8 **Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse and inclusive teams and in multidisciplinary, face- to-face, remote and distributed settings (KA9)

PO-9 **Communication:** Communicate effectively and inclusively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, making effective presentations, taking into account cultural, language, and learning differences.

PO-10 **Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO-11 **Lifelong learning:** Recognize the need for, and have the preparation and ability for:

- independent and life-long learning,
- adaptability to new and emerging technologies, and
- critical thinking in the broadest context of technological change (KA8)

Knowledge and Attitude Profiles (KAs)

KA-1 **Natural and social science:** A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

KA-2 **Mathematics:** Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

KA-3 **Engineering fundamentals:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

KA-4 **Specialist knowledge:** Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

KA-5 **Engineering design & operations:** Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

KA-6 **Engineering practice:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

KA-7 **Role of Engineering in society:** Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

KA-8 **Research literature:** Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

KA-9 **Ethics and conduct:** Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

6. Programme Specific Outcomes (PSOs):

PSO-1 Design and implement efficient solar PV systems integrated with electrical grids.

PSO-2 Implement electric cooking system design using modern electrical appliances and energy efficient control methods

PSO-3 Design testing mechanism for electrical machine condition monitoring and fault diagnostics

7. Total Programme Structure with Teaching and Examination Scheme (Semester Wise):

1.	**Title of UG Engg./ Tech. Programme**	:	Electrical Engineering
2.	**Duration of Programme**	:	Four Years
3.	**Entry Qualification**	:	Proficiency Certificate Level (PCL), Higher Secondary Level (+2), A-Level, Engineering Diploma Level, or an equivalent
4.	**Total Marks**	:	5825
5.	**Total Credits**	:	147
6.	**Total Number of Courses**	:	45
7.	**Qualification Awarded BE/ B.Tech.**	:	Credits

8. Summary of Credits and Marks:

Year	Semester	Credits	Total Marks
Year -1	Semester -I	**18**	**725**
	Semester - II	**16**	**700**
Total			
Year -2	Semester -III	**18**	**675**
	Semester - IV	**21**	**850**
Total			
Year -3	Semester -V	**22**	**875**
	Semester- VI	**19**	**800**
Total			
Year -4	Semester -VII	**22**	**800**
	Semester - VIII	**11**	**400**
Total			
Grand Total		**147**	**5825**

8. Suggested Category wise Courses:

S. No.	Course Category	Abbreviations	Number of Courses	Total Credits
1.	Applied Science Courses	ASC	7	22
2.	Engineering Science Courses	ESC	6	17
3.	Programme Core Courses	PCC	25	76
4.	Programme Elective Courses	PEC	3 (10)	9 (30)
5.	Open Electives Courses	OEC		
6.	Humanities, Social Science and Management Courses	HSC	4	12
7.	Project, Internship and Industrial Training	PI	Minor+ Major+ Internship (10 Weeks)	11
Total				**147**

UG Engg. /Tech. Programme in Bachelors in Electrical Engineering **Semester - I**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	ASC 101	**ASC**	Engineering Mathematics I	3	3	2	-	5	40	60	-		100
	ASC 102	**ASC**	Engineering Physics	4	4	1	2	7	40	60	25		125
	ESC 101	**ESC**	Computer Programming	3	3	1	3	7	40	60	50		150
	ESC 102	**ESC**	Electrical Engineering Drawing	2	2	-	4	6	20	30	50		100
	ESC 103	**ESC**	Applied Mechanics	3	3	2	-	5	40	60	-		100
	PCC 101	**PCC**	Electric Circuit I	3	3	1	3	7	40	60	50		150
			Total	**18**				**37**					**725**

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Bachelors in Electrical Engineering **Semester - II**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	ASC 103	**ASC**	Engineering Mathematics II	3	3	2	-	5	40	60	-		100
	ASC 104	**ASC**	Engineering Chemistry	3	3	1	3	7	40	60	25		125
	PCC 102	**PCC**	Electronics Circuits	3	3	1	3	7	40	60	50		150
	ESC 104	**ESC**	Advanced Computer Programming	3	3	1	3	7	40	60	50		150
	PCC 103	**PCC**	Electric Circuit II	3	3	1	1.5	5.5	40	60	25		125
	PCC 104	**PCC**	Electrical Installation Workshop	1	-	-	3	3	-	-	30		50
			Total	**16**				**34.5**					**700**

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Bachelors in Electrical Engineering **Semester - III**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	ASC 201	**ASC**	Engineering Mathematics III	3	3	2		5	40	60			100
	PCC 201	**PCC**	Instrumentation and Measurement	3	3	1	1.5	5.5	40	60	25		125
	PCC 202	**PCC**	Electrical Machine I	3	3	1	1.5	5.5	40	60	25		125
	PCC 203	**PCC**	Electrical Engineering Material	3	3	1		4	40	60			100
	PCC 204	**PCC**	Power System Analysis I	3	3	1		4	40	60			100
	ESC 201	**ESC**	Logic circuit	3	3	1	1.5	5.5	40	60	25		125
			Total	**18**				**29.5**					**675**

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Bachelors in Electrical Engineering **Semester - IV**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	HSC 201	**HSC**	Communication English	3	3	0	1	4	40	60	25		125
	ASC 202	**ASC**	Numerical Methods	3	3	1	3	7	40	60	50		150
	ASC 203	**ASC**	Probability and Statistics	3	3	1	0	4	40	60			100
	PCC 205	**PCC**	Microprocessors and Microcontrollers	3	3	1	3	7	40	60	50		150
	PCC 206	**PCC**	Control System	3	3	1	1.5	5.5	40	60	25		125
	PCC 207	**PCC**	Power System Analysis II	3	3	1	1.5	5.5	40	60	25		125
	PCC 208	**PCC**	Electric Machine II	3	3	1	1.5	5.5	20	30	25		75
			Total					**38.5**					**850**

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Bachelors in Electrical Engineering **Semester - V**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	PCC 301	**PCC**	Digital Signal Processing and Application	3	3	1	1.5	5.5	40	60	25		125
	ESC 301	**ESC**	Engineering Thermodynamics and Heat Transfer	3	3	1	1.5	5.5	40	60	25		125
	HSC 301	**HSC**	Project Engineering and Management	3	3	1		4	40	60	-		100
	PCC 302	**PCC**	Power Electronics	3	3	1	1.5	5.5	40	60	25		125
	PCC 303	**PCC**	Digital Control System	3	3	1	1.5	5.5	40	60	25		125
	PCC 304	**PCC**	Switchgear and Protection	4	4	1	1.5	6.5	40	60	25		125
	PCC 305	**PCC**	Electric Machine Design	3	3		3	6	40	60	50		150
			Total	**22**				**38.5**					**875**

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Bachelors in Electrical Engineering **Semester - VI**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	HSC 302	**HSC**	Engineering Economics	3	3	1	-	4	40	60	-		100
	PCC 306	**PCC**	Industrial Instrumentation and Automation	3	3	1	3	7	40	60	50		150
	PCC 307	**PCC**	Industrial Electrification	3	3	1	2	6	40	60	25		125
	PCC 308	**PCC**	Electrical Drives	3	3	1	1.5	5.5	40	60	25		125
	PCC 309	**PCC**	Electric Power Distribution System	3	3	1	2	6	40	60	25		125
			Minor Project	1	-	-	0	-	-	-	50		50
	PCC 310	**PCC**	Program Elective Courses I	3	3	2	1	6	40	60	25		125
			Total	**19**				**34.5**					**800**

Program Elective Courses I: 1. Electricity Market 2. Hydroelectric Machines and Systems 3. Advance Power Electronics and 4. Wind Energy Conversion Systems

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. Programme in Bachelors in Electrical Engineering **Semester - VII**

Board of Studies	Course Code	Course Category	CourseTitles		Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
						L	T	P	Total Hours (L+T+P)	Theory		Practical		
										ISA	ESA	ISA	ESA	
	PCC401	**PCC**	Power Plant Engineering		4	4	1	3	8	40	60	50		150
	PCC 402	**PCC**	Power System Operation and Control		4	4	1	1.5	6.5	40	60	25		125
	PCC 403	**PCC**	High Voltage Engineering		3	3	1	-	4	40	60	-		100
	PCC 404	**PCC**	Transmission System Design		3	3	1	2	6	40	60	25		125
	PCC 405	**PCC**	Program Elective Courses II		3	3	2	1	6	40	60	25		125
	PCC 406	**PCC**	Program Elective Courses III		3	3	2	1	6	40	60	25		125
			Project I		2	-	-	0	-	-	-	50		50
			Total		**22**				**36.5**					**800**

Program Elective Courses II: 1. Electrical Energy System Management 2. Reliability Engineering 3. Applied Photovoltaic Engineering 4. Digital Protection

Program Elective Courses III: 1. Smart Grids and Microgrids 2. Energy Audit and Safety Engineering 3. Electrical Machine Condition Monitoring and Fault Diagnostics

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Bachelors in Electrical Engineering **Semester - VIII**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	HSC 401	**HSC**	Engineering Profession and Society	3	3	-	-	3	40	60	-		100
			Internship (10-weeks)	4	-	-	-	-	-	-	100	50	150
			Project II	4	-	-	-	-	-	-	100	50	150
			Total	**11**				**3**					**400**

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

Task – 2

Title – Design & Development of Programme Structure with Teaching & Examination Scheme for UG Engg. Programme in Electronics, Communication and Information

Name of the University - Tribhuvan University (TU)

Programme Title – Electronics, Communication and Information Engineering (BEI)

1. Introduction:

The Bachelor in Electronics, Communication and Information Engineering (BEI) program under Tribhuvan University is a comprehensive undergraduate engineering degree designed to develop strong foundations in electronics, communication systems, and modern information technologies. It integrates core principles of electronic engineering with contemporary advancements in computing and data-driven systems. The program is structured to produce graduates who can understand, design, and implement complex engineering solutions that span both hardware and software domains.

The Electronics, Communication and Information Engineering curriculum is designed to align with global engineering standards while addressing national technological needs. It emphasizes key areas such as digital and analog electronics, signal processing, communication systems, embedded systems, networking, and information technology. This multidisciplinary approach ensures that students are not limited to a single domain but are capable of working across interconnected technological ecosystems, which is essential in today's rapidly evolving engineering landscape.

A major strength of the Electronics, Communication and Information Engineering program lies in its strong balance between theoretical rigor and practical implementation. Students gain hands-on experience through well-equipped laboratories, project-based learning, and industrial exposure opportunities. The program encourages innovation through design projects, research activities, and capstone engineering projects that simulate real-world challenges. This practical orientation significantly enhances problem-solving ability, technical confidence, and system-level thinking among graduates.

In addition, the Electronics, Communication and Information Engineering programme emphasizes artificial intelligence integration in communication systems, wireless and mobile networking, and smart embedded solutions to address emerging technological and industrial demands. Graduates are well-positioned for diverse career pathways including telecommunications, software and hardware industries, research institutions, and higher

studies. The program is highly relevant to emerging industry trends such as Internet of Things (IoT), artificial adaptability and forward-looking curriculum make it a strong platform for producing engineers who are not only technically competent but also capable of contributing to innovation and national digital transformation.

2. Vision & Mission Statements of the University:

Vision Statement of the University

The vision of TU is to be one of the best technically innovative engineering colleges and prove oneself as a world-class institution in Nepal. Our aim is to provide academic as well as professional qualifications that strike a balance between theory and its practical application, and that maximize the future prospects of our students and graduates.

Mission Statement of the University

- Produce professionally competent, technically sound, proactive and ethical leaders who can manage the global workforce having diversified work groups with high adaptations to various cultures.
- Set university ways of educational vibe to establish itself as a world class institution through continuing education, faculty and staff development and corporate research and consultancy.
- Develop long term relations with other national and international educational institutions, corporates, research organizations, government and non-governmental organizations to foster a broad range of self-motivated learning environments.

3. Vision & Mission Statements of the Department:

Vision Statement of the Department

To become a center of excellence in Electronics, Communication and Information Engineering through quality education, innovation, research, and technological advancement for national and global development.

To become a center of excellence in Electronics and Information Engineering by producing innovative, ethical, globally competent, and socially responsible engineers capable of addressing emerging technological and societal challenges.

Mission Statement of the Department

To deliver quality education and practical engineering skills in electronics, communication, and information systems; promote innovation, research culture, and industry-academia collaboration; and prepare competent graduates capable of professional leadership, entrepreneurship, higher studies, and sustainable technological contribution.

To provide quality education in electronics, communication, computing, embedded systems, AI, IoT, and emerging technologies through outcome-based learning.

To promote research, innovation, entrepreneurship, and interdisciplinary project-based learning for solving real-world problems.

To strengthen collaboration with industry, academia, and society for practical exposure, skill development, and technological advancement.

To develop professional ethics, leadership, teamwork, communication skills, and lifelong learning attitudes among graduates.

To contribute to national development and sustainable technological growth through socially relevant engineering solutions.

4. **Programme Educational Objectives (PEOs):**

PEO-1: To produce competent graduates capable of pursuing successful professional careers, higher studies, research, innovation, and entrepreneurial opportunities in the fields of electronics, communication, and information engineering.

PEO-2: To develop engineering professionals who demonstrate ethical values, professionalism, effective communication, teamwork, leadership qualities, and social responsibility in multidisciplinary working environments.

PEO-3: To encourage graduates to engage in lifelong learning, research, technological innovation, and continuous professional development to contribute effectively in national and international engineering sectors.

5. Programme Outcomes (POs): - As per NEC

PO-1 **Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing and engineering fundamentals, and an engineering specialization as specified in Knowledge and Attitude Profiles (KA1 to KA4) respectively to develop solutions to complex engineering problems.

PO-2 **Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences with holistic considerations for sustainable development (KA1 to KA4).

PO-3 **Design/development of solutions:** Design creative solutions for complex engineering problems and design systems, components or processes to meet identified needs with appropriate consideration for public health and safety, whole- life cost, net zero carbon as well as resources, cultural, societal, and environmental considerations as required (KA5)

PO-4 **Investigation:** Conduct investigations of complex engineering problems using research methods including research-based knowledge, design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions (KA8). Complex engineering problems are referred to as the problems:

- that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline as against problems given at the end of chapters in a typical textbook that can be solved using simple engineering theories and techniques;
- that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions;
- that require consideration of appropriate constraints / requirements not explicitly given in the problem statement such as cost, power requirement, durability, product life, etc.;
- which need to be defined (modelled) within appropriate mathematical framework; and
- that often require use of modern computational concepts and tools, for example, in the design of an earthquake resistant building.

PO-5 **Modern Tool Usage:** Create, select and apply, and recognize limitations of appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering problems (KA2 and KA6)

PO-6 **The Engineer and the Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practices (KA7).

PO-7 **Ethics:** Apply ethical principles and commit to professional ethics and norms of engineering practice and adhere to relevant national and international laws. Demonstrate an understanding of the need for diversity and inclusion (KA9)

PO-8 **Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse and inclusive teams and in multidisciplinary, face-to-face, remote and distributed settings (KA9)

PO-9 **Communication:** Communicate effectively and inclusively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, making effective presentations, taking into account cultural, language, and learning differences.

PO-10 **Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply

these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO-11 **Lifelong learning:** Recognize the need for, and have the preparation and ability for:

- independent and life-long learning,
- adaptability to new and emerging technologies, and
- critical thinking in the broadest context of technological change (KA8)

Knowledge and Attitude Profiles (KAs)

KA-1 **Natural and social science:** A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

KA-2 **Mathematics:** Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

KA-3 **Engineering fundamentals:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

KA-4 **Specialist knowledge:** Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

KA-5 **Engineering design & operations:** Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

KA-6 **Engineering practice:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

KA-7 **Role of Engineering in society:** Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

KA-8 **Research literature:** Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

KA-9 **Ethics and conduct:** Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

6. Programme Specific Outcomes (PSOs):

PSO-1: Develop smart embedded and IOT systems for automation and real-world engineering applications.

PSO-2: Design and implement drone based systems for monitoring, communication, and intelligent engineering solutions.

PSO-3: Apply 3D printing and rapid prototyping technologies to develop innovative engineering products and solutions.

7. Total Programme Structure with Teaching and Examination Scheme (Semester Wise):

1.	**Title of UG Engg. Programme**	:	BE in Electronics, Communication and Information Engineering
2.	**Duration of Programme**	:	Four Years
3.	**Entry Qualification**	:	10+2 Science with at least grade - C in all subjects with Physics, Chemistry, and two papers of Mathematics (200 Marks) Proficiency Certificate Level (PCL) in Science with at least 45% marks in aggregate with Physics, Chemistry, and two papers of Mathematics (200 Marks) or equivalent 3 Years Engineering Diploma with at least 45% marks in aggregate or equivalent
4.	**Total Marks**	:	5600
5.	**Total Credits**	:	138
6.	**Total Number of Courses**	:	46
7.	**Qualification Awarded BE/ B.Tech.**	:	BE

8. Summary of Credits and Marks:

Year	Semester	Credits	Total Marks
Year -1	Semester -I	16	675
	Semester - II	19	800
Total		**35**	**1475**
Year -2	Semester -III	18	775
	Semester - IV	19	750
Total		**37**	**1525**
Year -3	Semester -V	18	725
	Semester- VI	17	675
Total		**35**	**1400**
Year -4	Semester -VII	17	675
	Semester - VIII	14	525
Total		**31**	**1200**
Grand Total		**138**	**5600**

8. Suggested Category wise Courses:

S. No.	Course Category	Abbreviations	Number of Courses	Total Credits
1.	Applied Science Courses	ASC	8	22
2.	Engineering Science Courses	ESC	12	34
3.	Programme Core Courses	PCC	17	53
4.	Programme Elective Courses	PEC	3	12
5.	Open Electives Courses	OEC		
6.	Humanities, Social Science and Management Courses	HSC	2	6
7.	Project, Internship and Industrial Training	PI	4	11
Total			**46**	**138**

UG Engg. Programme in Electronics, Communication and Information **Semester - I**

Board of Studies	Course Code	Course Category	Course Titles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	101	**ASC**	Foundations of Engineering Mathematics	3	3	2	-	5	40	60	-	-	100
	102	**ASC**	Engineering Physics	4	4	1	2	7	40	60	25	-	125
	101	**ESC**	Computer Programming	3	3	1	3	7	40	60	50	-	150
	102	**ESC**	Electronics Engineering Drawing	2	2	-	4	6	20	30	50	-	100
	101	**PCC**	Fundamental of Electrical and Electronics Engineering	3	3	1	3	7	40	60	50	-	150
	103	**ESC**	Engineering Fabrication and Prototyping Workshop	1	1	-	3	4	20	-	30	-	50
			Total	16	16	5	15	36	**180**	**270**	**175**		**675**

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Electronics, Communication and Information Engineering **Semester - II**

Board of Studies	Course Code	Course Category	Course Titles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	151	ASC	Advanced Engineering Mathematics	3	3	2	-	5	40	60	-	-	100
	151	ESC	Object Oriented Programming	3	3	1	3	7	40	60	50	-	150
	151	PCC	Electronic Device and Circuits	3	3	1	3	7	40	60	50	-	150
	152	PCC	Digital Logic	3	3	1	3	7	40	60	50	-	150
	152	ESC	Electrical Circuits and Machines	4	4	1	1.5	6.5	40	60	25	-	125
	152	ASC	Applied Chemistry	3	3	1	3	7	40	60	25		125
				19	19	7	13.5	39.5	240	360	200	-	800

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Electronics, Communication and Information Engineering **Semester - III**

Board of Studies	Course Code	Course Category	Course Titles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	201	ASC	Applied Engineering Mathematics	3	3	2	-	5	40	60	-	-	100
	201	HSC	Communication English	3	3	0	1	4	40	60	25	0	125
	201	ESC	Computer Graphics and Visualization	3	3	1	3	7	40	60	50	0	150
	201	PCC	Microprocessors and Microcontroller	3	3	1	3	7	40	60	50	0	150
	202	PCC	Advanced Electronics	3	3	1	1.5	5.5	40	60	25	0	125
	202	ESC	Control System	3	3	1	1.5	5.5	40	60	25	0	125
				18	18	6	10	34	240	360	175	-	775

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Electronics, Communication and Information **Semester - IV**
Engineering

Board of Studies	Course Code	Course Category	Course Titles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	251	**ASC**	Numerical Methods	3	3	1	3	7	40	60	50		150
	251	**ESC**	Discrete Structure	3	3	1	0	4	40	60	0	0	100
	251	**PCC**	Instrumentation	4	4	1	1.5	6.5	40	60	25	0	125
	252	**ESC**	Computer Organization & Architecture	3	3	1	1.5	5.5	40	60	25	0	125
	252	**PCC**	Electromagnetics	3	3	1	1.5	5.5	40	60	25	0	125
	253	**PCC**	Signals and Systems	3	3	1	1.5	5.5	40	60	25	0	125
				19	19	6	9	34	240	360	150	0	750

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Electronics, Communication and Information **Semester - V**
Engineering

Board of Studies	Course Code	Course Category	Course Titles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	301	ASC	Probability and Statistics	3	3	1	0	4	40	60			100
	301	ESC	Artificial Intelligence	3	3	1	1.5	5.5	40	60	25	0	125
	301	PCC	Filter Design	3	3	1	1.5	5.5	40	60	25	0	125
	302	PCC	Embedded Systems	3	3	1	1.5	5.5	40	60	25	0	125
	303	PCC	Propagation and Antenna	3	3	1	1.5	5.5	40	60	25	0	125
	301	PEC	Program Elective course I 1.BIOMEDICAL INSTRUMENTATION 2. QUANTUM COMPUTING 3. DATA SCIENCE 4. JAVA PROGRAMMING	3	3	2	1	6	40	60	25	0	125
				18	18	7	7	32	240	360	125	-	725

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Electronics, Communication and Information Engineering **Semester - VI**

Board of Studies	Course Code	Course Category	Course Titles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	351	**ESC**	ICT Project Management	3	3	1	0	4	40	60	0	0	100
	352	**ESC**	Engineering Economics	3	3	1		4	40	60			100
	351	**PCC**	Communication Systems	4	4	1	3	8	40	60	50	0	150
	352	**PCC**	Telecommunication and Computer Networks	3	3	1	3	7	40	60	50	0	150
	351	**PI**	Minor Project	1			0	0			50		50
	351	**PEC**	Program Elective Course II 1. SOFTWARE PROJECT MANAGEMENT 2. ANALYSIS OF ALGORITHM 3. AUDIO PROCESSING 4. ADVANCED PYTHON PROGRAMMING	3	3	2	1	6	40	60	25	0	125
				17	16	6	7	29	200	300	175	-	675

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Electronics, Communication and Information Engineering **Semester - VII**

Board of Studies	Course Code	Course Category	Course Titles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	401	**PCC**	RF and Microwave Engineering	3	3	1	1.5	5.5	40	60	25	0	125
	402	**PCC**	Robotics	3	3	1	1.5	5.5	40	60	25	0	125
	403	**PCC**	Digital Signal Processing	3	3	1	1.5	5.5	40	60	25	0	125
	401	**PEC**	Program Elective Course III 1. NETWORK SECURITY 2. INTERNET OF THINGS SYSTEMS 3. DATABASE MANAGEMENT 4. MANUFACTURING AND PRODUCTION PROCESS	3	3	2	1	6	40	60	25	0	125
	401	**PI**	Project I	2	0	0	0	0	0	0	50	0	50
	404	**PCC**	Wireless Communication	3	3	1	1.5	5.5	40	60	25	0	125
				17	15	1	1.5	28	40	60	75	-	675

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Electronics, Communication and Information Engineering **Semester - VIII**

Board of Studies	Course Code	Course Category	Course Titles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	451	HSC	Energy, Environment and Social Engineering	3	3	0	0	3	40	60	0	0	100
	451	PI	Internship**	4	0	0	0	0	0	0	100	50	150
	451	PEC	Program Open Elective Course IV 1. DISTRIBUTED AND CLOUD COMPUTING 2. CYBER SECURITY 3. FPGA-BASED DIGITAL SYSTEM DESIGN 4. AVIONICS 5. DIGITAL CONTROL SYSTEM	3	3	2	1	6	40	60	25	0	125
	452	PI	Project II	4	0	0	0	0	0	0	100	50	150
				14	6	4	4	9	160	240	375	100	525

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

Task – 2

Title – Design & Development of Programme Structure with Teaching & Examination Scheme for the Identified Programme

Name of the University – PURBANCHAL UNIVERSITY

Programme Title – BACHELOR IN ELECTRICAL ENGINEERING

1. **Introduction:** The Bachelor of Electrical Engineering (B.E. Electrical) programme of Purbanchal University is a four-year undergraduate programme designed to develop skilled, innovative, and professionally competent electrical engineers. The programme provides strong theoretical and practical knowledge in power systems, electrical machines, control systems, electronics, renewable energy, and industrial automation. It aims to prepare graduates capable of solving modern engineering problems, contributing to sustainable technological development, and meeting the demands of industries, research organizations, and society.

2. **Vision & Mission Statements of the University**:

Vision of Purbanchal University

"To develop this university as the model in fulfilling the national objectives of education." The aim is to address present issues and long-term sustainable development of the country by alleviating declining productivity of industries and agriculture, increasing population and unemployment, unsustainable development and erosion of natural resources, and environmental deterioration and increasing vulnerability against human welfare.

The university also emphasizes:

- Affordable and accessible education for all
- Academic excellence through research, teaching, and practical studies
- Focus on Industry-Technology, Agriculture-Forestry, Environment, Rural-Cultural Subsistence, and Sustainable Development as areas of academic excellence.

Mission of Purbanchal University

The mission of the university is to:

- Preserve, refine, invent, adopt, extend, and transmit knowledge
- Promote free inquiry and scholarly debate
- Contribute to the all-round development of rural people, their economy, and environment
- Promote socio-economic transformation through quality education suitable for sustainable development.

3. **Vision & Mission Statements of the Department:**

- To be a dynamic center of innovation and creativity, recognized for excellence in teaching, lifelong learning, professionalism, research, entrepreneurship, and global collaboration, contributing to the advancement and quality of life of society.
- To achieve academic excellence through research, teaching, and practical studies in specialized fields that contribute to the social, economic, and sustainable development of the nation.
- To establish the university as a center of academic excellence in the areas of Industry and Technology, Agriculture and Forestry, Environment and Rural Development, Cultural Preservation, and Sustainable Development.

4. Programme Educational Objectives (PEOs):

- Graduates will be able to demonstrate high technical competence in analyzing, designing, and manufacturing electrical systems. They will successfully apply their knowledge of core areas - such as power system analysis, electrical machines, power electronics, and control systems - to solve complex engineering problems.
- Graduates will be able to effectively integrate computing technologies, numerical methods, and modern engineering tools (rooted in their early programming and numerical analysis coursework) to model and optimize electrical engineering solutions.
- Graduates will be able to exhibit strong leadership, communication, and managerial skills necessary to manage engineering projects efficiently. They will navigate industrial electrification, safety management, and hazard analysis while upholding high professional and ethical standards.

5. Programme Outcomes (POs): - As per NEC

PO-1 **Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing and engineering fundamentals, and an engineering specialization as specified in Knowledge and Attitude Profiles (KA1 to KA4) respectively to develop solutions to complex engineering problems.

PO-2 **Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences with holistic considerations for sustainable development (KA1 to KA4).

PO-3 **Design/development of solutions:** Design creative solutions for complex engineering problems and design systems, components or processes to meet identified needs with appropriate consideration for public health and safety, whole- life cost, net zero carbon as well as resources, cultural, societal, and environmental considerations as required (KA5)

PO-4 **Investigation:** Conduct investigations of complex engineering problems using research methods including research-based knowledge, design of experiments, analysis and interpretation of data, and

synthesis of information to provide valid conclusions (KA8). Complex engineering problems are referred to as the problems:

- that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline as against problems given at the end of chapters in a typical textbook that can be solved using simple engineering theories and techniques;
- that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions;
- that require consideration of appropriate constraints / requirements not explicitly given in the problem statement such as cost, power requirement, durability, product life, etc.;
- which need to be defined (modelled) within appropriate mathematical framework; and
- that often require use of modern computational concepts and tools, for example, in the design of an earthquake resistant building.

PO-5 **Modern Tool Usage:** Create, select and apply, and recognize limitations of appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering problems (KA2 and KA6)

PO-6 **The Engineer and the Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practices (KA7).

PO-7 **Ethics:** Apply ethical principles and commit to professional ethics and norms of engineering practice and adhere to relevant national and international laws. Demonstrate an understanding of the need for diversity and inclusion (KA9)

PO-8 **Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse and inclusive teams and in multidisciplinary, face- to-face, remote and distributed settings (KA9)

PO-9 **Communication:** Communicate effectively and inclusively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, making effective presentations, taking into account cultural, language, and learning differences.

PO-10 **Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO-11 **Lifelong learning:** Recognize the need for, and have the preparation and ability for:

- independent and life-long learning,
- adaptability to new and emerging technologies, and
- critical thinking in the broadest context of technological change (KA8)

Knowledge and Attitude Profiles (KAs)

KA-1 **Natural and social science:** A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

KA-2 **Mathematics:** Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

KA-3 **Engineering fundamentals:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

KA-4 **Specialist knowledge:** Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

KA-5 **Engineering design & operations:** Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

KA-6 **Engineering practice:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

KA-7 **Role of Engineering in society:** Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

KA-8 **Research literature:** Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

KA-9 **Ethics and conduct:** Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

6. Programme Specific Outcomes (PSOs):

PSO-1: Develope electrical power systems encompassing transmission, distribution, and protection mechanisms, while utilizing advanced techniques to handle modern grid complexities and power system analysis.

PSO-2: Design and implement sustainable energy solutions by integrating renewable resources—such as solar photovoltaic, wind, and micro-hydro power—specifically addressing the challenges of both grid-connected systems and rural electrification.

PSO-3: Formulate engineering designs for traditional, synchronous, and special electrical machines, and develop comprehensive blueprints for industrial and building electrification schemes upholding safety standards.

Total Programme Structure with Teaching and Examination Scheme (Semester Wise):

1. **Title of UG Engg./ Tech. Programme** : Bachelor in Electrical Engineering
2. **Duration of Programme** : Four Years
3. **Entry Qualification** : 12 Pass or Diploma
4. **Total Marks** : 5600
5. **Total Credits** : 145
6. **Total Number of Courses** : 50
7. **Qualification Awarded**
   BE/ B.Tech. : BE

8. **Summary of Credits and Marks:**

Year	Semester	Credits	Total Marks
Year -1	Semester -I	21	775
	Semester - II	18	725
Total		39	1500
Year -2	Semester -III	17	675
	Semester - IV	18	725
Total		35	1400
sYear -3	Semester -V	19	725
	Semester- VI	20	775
Total		39	1400
Year -4	Semester -VII	19	675
	Semester - VIII	13	525
Total		32	1200
Grand Total		**145**	**5600**

7. Suggested Category wise Courses:

S. No.	Course Category	Abbreviations	Number of Courses	Total Credits
1.	Applied Science Courses	ASC	7	22
2.	Engineering Science Courses	ESC	13	39
3.	Programme Core Courses	PCC	18	55
4.	Programme Elective Courses	PEC	2	6
5.	Open Electives Courses	OEC	0	0
6.	Humanities, Social Science and Management Courses	HSC	6	15
7.	Project, Internship and Industrial Training	PI	3	8
Total			**50**	**145**

UG Engg. /Tech. Programme in ……. **Semester - I**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
Academic Council	BSH1001	ASC	CALCULUS & VECTOR	3	3	3	0	6	40	60	-	-	100
Academic Council	BSH1002	ASC	ENGINEERING PHYSICS	4	4	2	2	8	40	60	10	15	125
Academic Council	BSH1004	HSMC	ENGLISH FOR TECHNICAL COMMUNICATION	3	3	2	2	7	40	60	10	15	125
Academic Council	BCE1001	ESC	COMPUTER PROGRAMING	3	3	1	3	7	40	60	30	20	150
Academic Council	BCE1002	ESC	FUNDAMENTAL OF COMPUTING TECHNOLOGY	3	3	1	2	6	40	60	15	10	125
Academic Council	BME1001	ESC	ELECTRICAL ENGINEERING DRAWING	3	1	0	3	4	-	-	60	40	100
Academic Council	BME1002	ESC	ELECTRICAL WORKSHOP TECHNOLOGY	2	1	0	2	3	10	-	40	-	50
TOTAL				21	18	9	14	41	210	300	165	100	775

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in ……. **Semester - II**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
Academic Council	BSH2005	ASC	DIFFERENTIAL EQUATION	3	3	3	0	6	40	60	-	-	100
Academic Council	BSH2003	ASC	ENGINEERING CHEMISTRY	3	3	2	2	7	40	60	10	15	125
Academic Council	BCE2003	ESC	OBJECT ORIENTED PROGRAMMING	3	3	2	3	7	40	60	30	20	150
Academic Council	BEC2003	PCC	DIGITAL ELECTRONICS	3	3	1	3	7	40	60	25	-	125
Academic Council	BCI2003	ESC	APPLIED MECHANICS	3	3	2	0	5	40	60	-	-	100
Academic Council	BEL2003	ESC	BASIC ELECTRICAL	3	3	1	2	6	40	60	25	-	125
TOTAL				18	18	11	10	39	240	360	90	35	725

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in …… **Semester - III**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
Academic Council	BSH2008	ASC	LINEAR ALGEBRA	3	3	3	-	6	40	60	-	-	100
Academic Council	BME3009	ESC	FUNDAMENTALS OF THERMODYNAMICS AND HEAT	2	2	1	2/2	4	20	30	25	-	75
Academic Council	BEL3005	PCC	NETWORK ANALYSIS	3	3	1	3/2	5.5	40	60	10	15	125
Academic Council	BEC3007	PCC	ELECTRONICS CIRCUIT	3	3	1	3/2	5.5	40	60	25	-	125
Academic Council	BEL3006	PCC	ELECTRICAL ENGINEERING MATERIALS	3	3	2	-	5	40	60	-	-	100
Academic Council	BEC3006	PCC	MICROPROCESSOR	3	3	1	3	7	40	60	50	-	150
				17	17	9	7	33	220	330	110	15	675

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in ……. **Semester - IV**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
Academic Council	BSH4010	ASC	APPLIED MATHEMATICS	3	3	3	-	6	40	60	-	-	100
Academic Council	BEC4004	PCC	ELECTROMAGNETICS	3	3	1	3/2	5.5	40	60	25	-	125
Academic Council	BCE4013	ESC	NUMERICAL METHODS	3	3	1	3	7	40	60	25	-	125
Academic Council	BEL4007	PCC	ELECTRICAL MACHINE	3	3	1	3/2	5.5	40	60	10	15	125
Academic Council	BEL4008	PCC	POWER SYSTEM FUNDAMENTALS	3	3	1	3/2	5.5	40	60	10	15	125
Academic Council	BEL4009	PCC	INSTRUMENTATION	3	3	1	3/2	5.5	40	60	10	15	125
TOTAL				18	18	8	9	35	240	360	80	45	725

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in ……. **Semester - V**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
Academic Council	BSH5011	ASC	PROBABILITY & STATISTICS	3	3	2	2	7	40	60	-	-	100
Academic Council	BEC5015	PCC	ADVANCED INSTRUMENTATION	3	3	1	3/2	5.5	40	60	10	15	125
Academic Council	BEL5012	PCC	CONTROL SYSTEM ENGINEERING	3	3	1	3/2	5.5	40	60	10	15	125
Academic Council	BEL5013	PCC	ELECTIC MACHINE DESIGN	3	3	-	3	6	40	60	10	15	125
Academic Council	BEL5014	PCC	POWER SYSTEM ANALYSIS	3	3	1	3/2	5.5	40	60	10	15	125
Academic Council	BEL5015	PCC	SYNCHRONOUS & SPECIAL MACHINE	2	2	1	3/2	4.5	20	30	10	15	75
Academic Council	BSH5002	HSMC	RESEARCH METHODOLOGY	2	2	1	-	3	20	30	-	-	50
TOTAL				19	19	7	11	37	240	360	50	75	725

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in …….. **Semester - VI**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
Academic Council	BEL6016	PCC	POWER ELECTRONICS	3	3	1	3/2	5.5	40	60	10	15	125
Academic Council	BEL6017	PCC	POWER SYSTEM PROTECTION	3	3	1	3/2	5.5	40	60	10	15	125
Academic Council	BEL6018	PCC	DIGITAL CONTROL SYSTEM	3	3	1	3/2	5.5	40	60	10	15	125
Academic Council	BEL6019	PCC	INDUSTRIAL ELECTRIFICATION	3	3	0	2	5	40	60	10	15	125
Academic Council	BEL6024	PCC	SIGNAL ANALYSIS	3	3	1	3/2	5.5	40	60	10	15	125
Academic Council	BSH6001	HSMC	ENGINEERING ECONOMICS	3	3	1	0	4	40	60	-	-	100
Academic Council	BEC6019	HSMC	HAZARD ANALYSIS AND SAFETY MANAGEMENT	2	2	1	0	3	20	30	-	-	50
TOTAL				20	20	6	8	34	260	390	50	75	775

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in ……. **Semester - VII**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
Academic Council	BSH7005	HSMC	PROJECT MANAGEMENT FOR ENGINEERS	3	3	1	0	4	40	60	-	-	100
Academic Council	BEL7021	PCC	HIGH VOLTAGE ENGINEERING	3	3	1	0	4	40	60	-	-	100
Academic Council	BEL7022	PCC	UTILIZATION OF ELECTRICAL ENGINEERING	3	3	1	3/2	5.5	40	60	10	15	125
Academic Council	BEL7023	PCC	POWER TRANSMISSION & DISTRIBUTION DESIGN	3	3	1	3	7	40	60	10	15	125
Academic Council	BEG7009	HSMC	ENGINEERING PROFESSIONAL PRACTICE	2	2	1	0	3	20	30	-	-	50
Academic Council	BEL7800	PCE	ELECTIVE I	3	3	1	3/2	5.5	40	60	10	15	125
Academic Council	BEL7024	PI	ELECTRICAL ENGINEERING PROJECT	2	0	0	3	3	-	-	50	-	50
TOTAL				19	17	6	9	32	220	330	80	45	675

ELECTIVE I : RURAL ELECTRIFICATION/ RELIBILITY ENGINEERING/ ELECTRICAL ENERGY MANAGEMENT SYSTEM/ ENVIRONMENTAL ENGINEERING

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in ……. **Semester - VIII**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
Academic Council	BEL8025	PCC	POWER PLANT ENGINEERING	4	4	1	3	8	40	60	20	30	150
Academic Council	BEL88__	PCE	ELECTIVE II	3	3	1	3/2	5.5	40	60	10	15	125
Academic Council	BEL8026	PI	CAPSTONE PROJECT	3	0	0	6	6	-	-	40	60	100
Academic Council	BEL8027	PI	INTERNSHIP	3	3	1	-	4	60	40	-	-	100
TOTAL				13	10	3	10.5	23.5	140	160	70	105	475

ELECTIVE II : APPLIED PHOTOVOLTAIC ENGINEERING/ MICROHYDROPOWER ENGINEERING/ AGVANCED POWER SYSTEM ANALYSIS/ SOFT COMPUTING TECHNIQUES/ ENGINEERING LAWS & ENERGY POLICY

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

Task – 2

Title – Design & Development of Programme Structure with Teaching & Examination Scheme for the Identified Programme

Name of the University - Purbanchal University

Programme Title – Bachelor of Engg in Electronics Communication and Automation

1. **Introduction**: The Bachelor in Electronics, Communication, and Automation Engineering is an intensive, four-year undergraduate program designed meet the modern intersection of hardware design, global communication and industrial systems.

2. **Vision & Mission Statements of the University:**

Vision of University

To develop university as the model in fulfilling the national objectives of education'. The aim is to address the present issues and long term sustainable development of the country, by alleviating the declining productivity of industries and agriculture, the increasing population and unemployment, the unsustainable development and erosion of natural resources, and the environmental deterioration and increasing vulnerability against human welfare.

Mission statements

- To provide quality education, research, and practical learning that foster academic excellence, innovation, and professional competency.
- To develop the university as a model institution contributing to national educational objectives and sustainable development.
- To address contemporary and long-term national challenges related to industry, agriculture, employment, environmental sustainability, and natural resource management through knowledge, technology, and innovation.
- To promote entrepreneurship, creativity, and collaboration with national and international communities for social and economic transformation.
- To prepare responsible graduates capable of contributing to human welfare, environmental conservation, and sustainable national development.

3. **Vision & Mission Statements of the Department:**

Vision statements

To be a dynamic center of innovation and creativity, recognized for excellence in teaching, lifelong learning, professionalism, research, entrepreneurship, and global collaboration, contributing to the advancement and quality of life of society through advance knowledge of Industry and Technology.

Mission statements

- To deliver quality education through innovative teaching, practical learning, and research that foster academic excellence and lifelong learning.
- To promote professionalism, creativity, entrepreneurship, and ethical values among students to prepare competent graduates for national and global challenges.
- To strengthen research, innovation, and collaboration with national and international communities for the advancement of knowledge and technology.

4. Programme Educational Objectives (PEOs):

PEO1: Graduate will gain comprehensive skills in the field of electronics, communication and automation.

PEO2: Graduates will demonstrate proficiency in networking, database systems, and programming languages to address real-world computing challenges effectively.

PEO3: Graduates will possess the required competencies, innovative thinking, and decision-making skills to become successful entrepreneurs and professionals.

PEO4: Graduates will acquire competencies and adaptability in emerging fields of technology to address evolving challenges and pursue innovation, research, and professional growth.

Programme Outcomes (POs): - As per NEC

PO-1 **Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing and engineering fundamentals, and an engineering specialization as specified in Knowledge and Attitude Profiles (KA1 to KA4) respectively to develop solutions to complex engineering problems.

PO-2 **Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences with holistic considerations for sustainable development (KA1 to KA4).

PO-3 **Design/development of solutions:** Design creative solutions for complex engineering problems and design systems, components or processes to meet identified needs with appropriate consideration for public health and safety, whole- life cost, net zero carbon as well as resources, cultural, societal, and environmental considerations as required (KA5)

PO-4 **Investigation:** Conduct investigations of complex engineering problems using research methods including research-based knowledge, design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions (KA8). Complex engineering problems are referred to as the problems:

- that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline as against problems given at the end of chapters in a typical textbook that can be solved using simple engineering theories and techniques;
- that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions;
- that require consideration of appropriate constraints / requirements not explicitly

given in the problem statement such as cost, power requirement, durability, product life, etc.;
- which need to be defined (modelled) within appropriate mathematical framework; and
- that often require use of modern computational concepts and tools, for example, in the design of an earthquake resistant building.

PO-5 **Modern Tool Usage:** Create, select and apply, and recognize limitations of appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering problems (KA2 and KA6)

PO-6 **The Engineer and the Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practices (KA7).

PO-7 **Ethics:** Apply ethical principles and commit to professional ethics and norms of engineering practice and adhere to relevant national and international laws. Demonstrate an understanding of the need for diversity and inclusion (KA9)

PO-8 **Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse and inclusive teams and in multidisciplinary, face- to-face, remote and distributed settings (KA9)

PO-9 **Communication:** Communicate effectively and inclusively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, making effective presentations, taking into account cultural, language, and learning differences.

PO-10 **Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO-11 **Lifelong learning:** Recognize the need for, and have the preparation and ability for:

- independent and life-long learning,
- adaptability to new and emerging technologies, and
- critical thinking in the broadest context of technological change (KA8)

Knowledge and Attitude Profiles (KAs)

KA-1 **Natural and social science:** A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

KA-2 **Mathematics:** Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

KA-3 **Engineering fundamentals:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

KA-4 **Specialist knowledge:** Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

KA-5 **Engineering design & operations:** Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

KA-6 **Engineering practice:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

KA-7 **Role of Engineering in society:** Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

KA-8 **Research literature:** Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

KA-9 **Ethics and conduct:** Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

5. Programme Specific Outcomes (PSOs):

PSO-1 Ability to identify technical problems and solve faults in the field of telecommunication.

PSO-2 Apply knowledge and skills to integrate computer technology in the field of industrial automation.

PSO-3 Apply the skills in the field of embedded systems, computer networks, Internet of Things (IoT).

6. Total Programme Structure with Teaching and Examination Scheme (Semester Wise):

1.	**Title of UG Engg./ Tech. Programme**	:	B.E. Electronics communication & Automation
2.	**Duration of Programme**	:	Four Years
3.	**Entry Qualification**	:	12 pass with minimum grade C in each subject/ Diploma
4.	**Total Marks**	:	5750
5.	**Total Credits**	:	141
6.	**Total Number of Courses**	:	48
7.	**Qualification Awarded**		B.E in Electronics communication and Automation Engineering
	BE/ B.Tech.	:	BE

8. Summary of Credits and Marks:

Year	Semester	Credits	Total Marks
Year -1	Semester -I	18	725
	Semester – II	19	725
Total		**37**	**1450**
Year -2	Semester -III	18	800
	Semester – IV	18	725
Total		36	1525
Year -3	Semester -V	18	750
	Semester- VI	20	800
Total		38	1550
Year -4	Semester -VII	17	725
	Semester - VIII	13	500
Total		30	1225
Grand Total		**141**	5750

7. Suggested Category wise Courses:

S. No.	Course Category	Abbreviations	Number of Courses	Total Credits
1.	Applied Science Courses	ASC	6	19
2.	Engineering Science Courses	ESC	8	24
3.	Programme Core Courses	PCC	21	63
4.	Programme Elective Courses	PEC	3	9
5.	Open Electives Courses	OEC	0	0
6.	Humanities, Social Science and Management Courses	HSC	6	17

7.	Project, Internship and Industrial Training	PI	4	9
Total			**48**	**141**

First Semester

S.N.	Board of Studies	Course code	Course Cagories	Course Title	Credits ©	Teaching Scheme(Hours)				Examination Scheme (Marks)				Total Marks
										Theory		Practical		
						L	T	P	Total Hours (L+T+P)	ISA	ESA	ISA	ESA	
1		BSH1001	ASC	Calculus and vector	3	3	3	-	**6**	40		60		100
2		BSH1004	ASC	Physics	4	4	2	2	**8**	40	10	60	15	125
3		BSH1002	HSC	English for Technical Communication	3	3	2	2	**7**	40	10	60	15	125
4		BCE1001	ESC	Computer Programming	3	3	1	3	**7**	40	30	60	20	150
5		BEC1001	ESC	Basic Electronics Engineering	3	3	1	1.5	**5.5**	40	25	60		125
6		BME1001	ESC	CAD and Rapid Prototyping	2	1		3	**4**		60		40	100
				Total	**17**	**17**	**9**	**11.5**	**37.5**					**725**

Second Semester

S.N.	Board of Studies	Course code	Course Cagories	Course Title	Credits ©	Teaching Scheme(Hours)				Examination Scheme (Marks)				Total Marks
										Theory		Practical		
						L	T	P	Total Hours (L+T+P)	ISA	ESA	ISA	ESA	
1		BSH2005	ASC	Differential equations	3	3	3	-	6	40		60		100
2		BCE2003	ESC	Object Oriented Programming with C++	3	3	2	3	8	40	30	60	20	150

3		BSH2003	ASC	Computer Architecture	3	3	1	3	7	40	10	60	15	125
4		BEC2002	PCC	Digital Electronics	3	3	1	3	7	40	25	60		125
5		BME2005	ESC	Environment and society	2	3		0	3	20	30			50
6		BEL2003	ESC	Basic Electrical Engineering	3	3	1	2	6	40	25	60		125
				Total	**18**	**16**	**9**	**13**	38					**675**

Third Semester

S.N.	Board of Studies	Course code	Course Cagories	Course Title	Credits ©	Teaching Scheme(Hours)				Examination Scheme (Marks)				Total Marks
										Theory		Practical		
						L	T	P	Total Hours (L+T+P)	ISA	ESA	ISA	ESA	
1		BSH3008	ASC	Linear algebra	3	3	3		6.0	40		60		100
2		BEC3004	PCC	Electromagnetics	3	3	1	1.5	5.5	40	30	60	20	150
3		BEL3005	ESC	Network Analysis	3	3	1	1.5	5.5	40	10	60	15	125
4		BEC3005	PCC	Electronic Circuits	3	3	1	3	7.0	40	30	60	20	150
5		BEC3006	PCC	Microprocessor	3	3	1	3	7.0	40	50	60		150
6		BCE3005	ESC	Database Management System	3	3	1	3	7.0	40	25	60		125
				Total	**18**	**18**	**8**	**12**	38.0					**800**

Fourth Semester

S.N.	Board of Studies	Course code	Course Cagories	Course Title	Credits ©	Teaching Scheme(Hours)	Examination Scheme (Marks)		Total Marks
							Theory	Practical	

						L	T	P	Total Hours (L+T+P)	ISA	ESA	ISA	ESA	
1		BSH4010	ASC	Applied Mathematics	3	3	3		6	40		60		100
2		BEC4008	PCC	Integrated Digital Electronics	3	3	1	1.5	5.5	40	25	60		125
3		BEL4010	PCC	Control System	3	3	1	2	6	40	10	60	15	125
4		BCE4013	HSC	Numerical Methods	3	3	1	3	7	40	25	60		125
5		BEL4011	PCC	Power Electronics & Drive	3	3	1	1.5	5.5	40	10	60	15	125
6		BCE4010	HSC	Entrepreneurship and innovation.	3	3			3	40		60		100
				Total	**18**	**18**	**8**	**8**	33					**700**

Fifth Semester

S.N.	Board of Studies	Course code	Course Cagories	Course Title	Credits ©	Teaching Scheme(Hours)				Examination Scheme (Marks)				Total Marks
										Theory		Practical		
						L	T	P	Total Hours (L+T+P)	ISA	ESA	ISA	ESA	
1		BSH5011	HSC	Probability and Statistics	3	3	1	2	6	40	25	60		125
2		BEC5011	PCC	Embedded System and Robotics	3	3	1	1.5	5.5	40	10	60	15	125
4		BEC5012	PCC	Signals and Systems	3	3	1	1.5	5.5	40	25	60		125
5		BEC5013	PCC	Antennas and Propagation	3	3	1	1.5	5.5	40	25	60		125
6		BEL50009	PCC	Instrumentation	3	3	1	1.5	5.5	40	25	60		125
7		BEC5014	PCC	Communication Systems I	3	3	2	1.5	6.5	40	10	60	15	125

				Total	**18**	**18**	**7**	**9.5**	34.5					**750**

Sixth Semester

S.N.	Board of Studies	Course code	Course Cagories	Course Title	Credits ©	Teaching Scheme(Hours)				Examination Scheme (Marks)				Total Marks
										Theory		Practical		
						L	T	P	Total Hours (L+T+P)	ISA	ESA	ISA	ESA	
1		BEC6016	**PCC**	Communication Systems II	3	3	1	1.5	5.5	40	25	60		125
2		BCE6020	ASC	Computer Networks	3	3	1	3	7	40	25	60		125
3		BEC6017	PCC	Filter Design	3	3	1	1.5	5.5	40	25	60		125
4		BSH6001	HSC	Engineering Economics	3	3	1		4	40		60		100
5		BEC6018	PCC	Industrial Automation and Drives	3	3	1	1.5	5.5	40	25	60		125
6		BSH6003	HSC	Project Management	3	3	1		4	40		60		100
7		BEC6019	PI	Project I	2			3	3		60		40	100
				Total	**20**	**18**	**6**	**10.5**	34.5					**800**

Seventh Semester

S.N.	Board of Studies	Course code	Course Cagories	Course Title	Credits ©	Teaching Scheme(Hours)	Examination Scheme (Marks)		Total Marks
							Theory	Practical	

						L	T	P	Total Hours (L+T+P)	ISA	ESA	ISA	ESA	
1		BEC7025	PCC	Telecommunication Networks	3	3	1	1.5	5.5	40	25	60		125
2		BEC7026	PCC	Digital Signal Processing	3	3	2	1.5	6.5	40	25	60		125
3		BCE7027	PCC	Internet of Things	3	3	1	2	6	40	25	60		125
4		BEC78--	PEC	Elective I	3	3	1	1.5	5.5	40	25	60		125
5		BEC78--	PEC	Elective II	3	3	1	1.5	5.5	40	25	60		125
6		BEC7028	PI	Project II (Part A)	2			3	3		60		40	100
				Total	**17**	**15**	**6**	**11**	32					**725**

Eighth Semester

S.N.	Board of Studies	Course code	Course Cagories	Course Title	Credits ©	Teaching Scheme(Hours)				Examination Scheme (Marks)				Total Marks
										Theory		Practical		
						L	T	P	Total Hours (L+T+P)	ISA	ESA	ISA	ESA	
2		BEG8009*	HSC	Engineering Professional Practice	2	2			2	20		30		50
3		BEC88--	PEC	Elective III	3	3	1	1.5	5.5	40	25	60		125
4		BEC8031	PI	Project II (Part B)	3			6	6		60		40	100
5		BEC8032	PI	Internship	3	3	1	-	4		60	-	40	100
				Total	**13**	**8**	**2**	**9**	19					**500**

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

Elective Subjects:

BE Electronics, Communication and Automation		
7th semester	Elective I	Satellite Communication
		RF and Microwave Communication
		Optical Fiber Communication
	Elective II	Artificial Intelligence
		Data Science
		Data Mining and Warehouse
		Image Processing and Pattern Recognition
		Geographical Information System
8th Semester	Elective III	Solar Photovoltaic Technology
		Next Generation Network
		Avionics
		Biomedical Instrumentation
		Machine Learning

UG Engg. /Tech. Programme in …… **Semester - III**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in ……. **Semester - IV**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in ……. **Semester - V**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in …….. **Semester - VI**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in ……. **Semester - VII**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in ……. **Semester - VIII**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

Task – 2

Title – Design & Development of Programme Structure with Teaching & Examination Scheme for the Identified Programme

Name of the University – Kathmandu University

Programme Title – Electrical & Electronics Engineering (Power & Control)

1. Introduction:

The Bachelor of Engineering in Electrical & Electronics Engineering (Power & Control) is developed in alignment with the vision and mission of the University and the Department of Electrical and Electronics Engineering. The programme aims to produce competent engineers with strong technical knowledge, leadership qualities, and the ability to contribute to digitalization and the global green shift.

The programme provides a solid foundation in electrical and electronics engineering with emphasis on power systems, control engineering, automation, communication systems, renewable energy technologies, and intelligent digital systems. It integrates theoretical learning with practical applications, laboratory work, industrial exposure, projects, and research activities to prepare graduates for professional engineering practice and higher studies.

The curriculum is designed to address modern industrial and societal demands by equipping students with skills in digital technologies, automation, sustainable energy systems, and emerging engineering tools. The programme also promotes innovation, interdisciplinary collaboration, ethical responsibility, and lifelong learning to enable graduates to solve real-world engineering challenges effectively.

Graduates of the programme are expected to contribute to industries, utilities, public institutions, and research organizations through the design, operation, maintenance, and advancement of sustainable, efficient, and reliable engineering systems that support technological development and the service of mankind.

2. Vision & Mission Statements of the University:

The mission statement of the University is "to provide quality education for leadership". The vision is "to become a world-class university devoted to bringing knowledge and technology to the service of mankind".

3. Vision & Mission Statements of the Department

Vision of the department: To develop Electrical and Electronics Engineers for digitalization and the green shift with leadership qualities.

Mission of the department:

- *To provide strong education in electrical and electronics engineering with a focus on digital technologies and modern engineering practices.*
- *To equip students with skills in digitalization, automation, and emerging technologies for industrial and societal needs.*
- *To promote sustainable engineering solutions supporting energy efficiency and the green shift.*
- *To encourage innovation, research, and industry collaboration for solving real-world challenges and continuous learning.*

4. Programme Educational Objectives (PEOs):

- **PEO1:** To have *graduates working in industry, government organizations, or service providers as Electrical, Electronics, or Communication Engineers and applying engineering knowledge and digital technologies.*
- **PEO2:** *To be able to design, develop, operate, and maintain electrical and electronics systems across industrial, public sector, and service-based organizations.*
- **PEO3:** *To implement sustainable and efficient engineering solutions in roles such as Energy Engineer, Power Systems Engineer, or Utility Engineer, supporting the green shift in all sectors.*

5. Programme Outcomes (POs): - As per NEC

PO-1 Engineering Knowledge: Apply knowledge of mathematics, natural science, computing and engineering fundamentals, and an engineering specialization as specified in Knowledge and Attitude Profiles (KA1 to KA4) respectively to develop solutions to complex engineering problems.

PO-2 Problem Analysis: Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences with holistic considerations for sustainable development (KA1 to KA4).

PO-3 Design/development of solutions: Design creative solutions for complex engineering problems and design systems, components or processes to meet identified needs with appropriate consideration for public health and safety, whole- life cost, net zero carbon as well as resources, cultural, societal, and environmental considerations as required (KA5)

PO-4 Investigation: Conduct investigations of complex engineering problems using research methods including research-based knowledge, design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions (KA8). Complex engineering problems are referred to as the problems:

- that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline as against problems given at the end of chapters in a typical textbook that can be solved using simple engineering theories and techniques;
- that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions;
- that require consideration of appropriate constraints / requirements not explicitly given in the problem statement such as cost, power requirement, durability, product life, etc.;
- which need to be defined (modelled) within appropriate mathematical framework; and
- that often require use of modern computational concepts and tools, for example, in the design of an earthquake resistant building.

PO-5 Modern Tool Usage: Create, select and apply, and recognize limitations of appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering problems (KA2 and KA6)

PO-6 The Engineer and the Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practices (KA7).

PO-7 Ethics: Apply ethical principles and commit to professional ethics and norms of engineering practice and adhere to relevant national and international laws. Demonstrate an understanding of the need for diversity and inclusion (KA9)

PO-8 Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse and inclusive teams and in multidisciplinary, face- to-face, remote and distributed settings (KA9)

PO-9 Communication: Communicate effectively and inclusively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, making effective presentations, taking into account cultural, language, and learning differences.

PO-10 Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO-11 Lifelong learning: Recognize the need for, and have the preparation and ability for:

- independent and life-long learning,
- adaptability to new and emerging technologies, and
- critical thinking in the broadest context of technological change (KA8)

Knowledge and Attitude Profiles (KAs)

KA-1 Natural and social science: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

KA-2 Mathematics: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

KA-3 Engineering fundamentals: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

KA-4 Specialist knowledge: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

KA-5 Engineering design & operations: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

KA-6 Engineering practice: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

KA-7 Role of Engineering in society: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

KA-8 Research literature: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

KA-9 Ethics and conduct: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

6. Programme Specific Outcomes (PSOs):

PSO-1: Test and implement practical engineering solutions using laboratories such as High Voltage, Lighting Lab, Grid Modernization, Renewable Energy, Digital Electronics, and Fibre Optics for real-world applications.

PSO-2: Provide students with exposure to research and real-world engineering practices through departmental conferences, academia–industry interactions, industrial engagement, and annual student project exhibition.

PSO-3: Develop students' ability to design and implement analog and digital electronics, computing, and intelligent control systems for modern power grid and automation applications through project-based learning and major engineering projects from the first year of the programme.

7. Total Programme Structure with Teaching and Examination Scheme (Semester-wise):

1.	**Title of UG Engg./ Tech. Programme**	:	Bachelor of Engineering in Electrical and Electronics Engineering with Specialization in Power and Control Engineering
2.	**Duration of Programme**	:	Four Years
3.	**Entry Qualification**	:	Class 12 with PCM or Diploma in Electrical & Electronics Engineering
4.	**Total Marks**	:	5650
5.	**Total Credits**	:	127
6.	**Total Number of Courses**	:	50
7.	**Qualification Awarded**		
	BE/ B.Tech.	:	Credits

8. Summary of Credits and Marks:

Year	Semester	Credits	Total Marks
Year -1	Semester -I	17	800
	Semester - II	16	700
Total		**33**	**1500**
Year -2	Semester -III	16	700
	Semester - IV	16	750
Total		**32**	**1450**
Year -3	Semester -V	16	700
	Semester- VI	18	750
Total		**34**	**1450**
Year -4	Semester -VII	18	750
	Semester - VIII	18	500
Total		**36**	**1250**
Grand Total		**133**	**5650**

8. Suggested Category-wise Courses:

S. No.	Course Category	Abbreviations	Number of Courses	Total Credits
1.	Applied Science Courses	ASC	6	18
2.	Engineering Science Courses	ESC	6	17
3.	Programme Core Courses	PCC	18	54
4.	Programme Elective Courses	PEC	3	9
5.	Open Electives Courses	OEC	2	5

6.	Humanities, Social Science and Management Courses	HSC	6	15
7.	Project, Internship and Industrial Training	PI	8	15
Total			**50**	**133**

UG Engg. /Tech. Programme in …B.E. Electrical and Electronics Engineering……. Semester - I

Board of Studies	Course Code	Course Category	Course Titles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	MATH 101	ASC	Calculus and Linear Algebra	3	3	1	-	4	50	50	-	-	100
	PHYS 101	ASC	Engineering Physics	3	3	1	2	6	50	50	40	10	150
	EEEG 102	ESC	Basic Circuit Analysis	3	3	1	2	6	50	50	40	10	150
	COMP 102	ESC	Computer Programming	3	3	1	2	6	50	50	40	10	150
	EDRG 103	ESC	Engineering Drawing	2	2		4	6	0	0	40	10	100
	EEEG 112	PI	Electrical Skills and Safety Practice	1	1		2	2			40	10	50
	ENGG 101	PI	Engineering Project Preparation & Workshop Practice	2			4	4			80	20	100

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in ……B.E. Electrical and Electronics Engineering……. Semester - II

Board of Studies	Course Code	Course Category	Course Titles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	MATH 104	ASC	Advanced Calculus	3	3	1	-	6	50	50	-	-	100
	EEEG 121	ESC	Electronics Engineering Fundamentals	3	3	1	2	6	50	50	40	10	150
	ENGT 105	HSMC	Technical Communication	3	3	-	2	6	50	50	40	10	150
	EEEG 131	ESC	Digital Logic Circuits	3	3	1	2	6	50	50	40	10	150
	PHYS 112	ESC	Electrical Engineering Materials	3	3	1	-	4	50	50	-	-	100
	EEEG 122	PI	Engineering Project	1	-	-	3	3	-	-	40	10	50

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in ……B.E. Electrical and Electronics Engineering……. **Semester - III**

Board of Studies	Course Code	Course Category	Course Titles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	MATH 201	ASC	Differential Equations and Complex Variables	3	3	1	-	4	50	50	-	-	100
	EEEG 214	PCC	Electronics Engineering Design	3	3	1	2	6	50	50	40	10	150
	EEEG 201	PCC	Electromagnetic Fields and Waves	3	3	1	-	4	50	50	0	0	100
	EEEG 213	PCC	Network Analysis	3	3	1	-	4	50	50	40	10	150
	EEEG 211	PCC	Measurement and Instrumentation	3	3	1	2	6	50	50	40	10	150
	EEEG 205	PI	Engineering Project	1	-	-	3	3			40	10	50

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in …B.E. Electrical and Electronics Engineering……. Semester - IV

Board of Studies	Course Code	Course Category	Course Titles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	MATH 208	ASC	Probability and Statistics for Engineers	3	3	1	-	4	50	50	-	-	100
	MCSC 202	ASC	Numerical Methods	3	3	1	2	6	50	50	40	10	150
	EEEG 221	PCC	Signals and Systems	3	3	1	2	6	50	50	40	10	150
	EEEG 215	PCC	Electrical Machines Fundamentals	3	3	1	2	6	50	50	40	10	150
	EEEG 216	PCC	Microprocessors and Microcontrollers	3	3	1	2	6	50	50	40	10	150
	EEEG 212	PI	Engineering Project	1	-	-	3	3	0	0	40	10	50

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in ……B.E. Electrical and Electronics Engineering……. Semester - V

Board of Studies	Course Code	Course Category	Course Titles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	MGTS 301	HSMC	Engineering Economics	3	3	1	0	4	50	50	0	0	100
	COEG 301	PCC	Control Engineering	3	3	1	2	6	50	50	40	10	150
	EPEG 315	PCC	Power System Fundamentals	3	3	1	2	6	50	50	40	10	150
	EPEG 302	PCC	Advanced Electrical Machinery	3	3	1	2	6	50	50	40	10	150
	EPEG	PCE	Elective-I (program elective)	3	3	1	0	4	50	50	0	0	100
	PCEG 313	PI	Engineering Project	1			3	3	0	0	40	10	50

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in ……B.E. Electrical and Electronics Engineering…….. **Semester - VI**

Board of Studies	Course Code	Course Category	Course Titles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	ETEG 301	PCC	Communication Systems	3	3	1	2	6	50	50	40	10	150
	EPEG 30x	PCC	Power Plant Engineering	3	3	1	2	6	50	50	40	10	150
	EPEG 318	PCC	Power Electronics	3	3	1	2	6	50	50	40	10	150
	EPEG 30x	PCC	Power System Analysis	3	3	1	2	6	50	50	40	10	150
	…	PCE	Elective II (program elective)	3	3	1	0	4	50	50	0	0	100
	PCEG 319	PI	Engineering Project	1			3	3	0	0	40	10	50
	…	HSMC	Professional Engineering Ethics	2	2	0	0	2	40	10	0	0	50

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in ……B.E. Electrical and Electronics Engineering……. Semester - VII

Board of Studies	Course Code	Course Category	Course Titles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	MGTS 4xx	HSMC	Engineering Management and Entrepreneurship	3	3	1	0	4	50	50	0	0	100
	COEG 401	PCC	Control System Design	3	3	1	2	6	50	50	40	10	150
	EPEG 409	PCC	High Voltage Engineering	3	3	1	2	6	50	50	40	10	150
	EPEG 415	PCC	Switchgear and Protection	3	3	1	2	6	50	50	40	10	150
	…	PCE	Elective III (departmental elective)	3	3	1	0	4	50	50	0	0	100
	PCEG 404	PI	Capstone Project-I	1			3	3	0	0	40	10	50
	…	HSMC	Research Methodology	2	2	0	0	2	40	10	0	0	50

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in ……B.E. Electrical and Electronics Engineering…….. Semester - VIII

Board of Studies	Course Code	Course Category	Course Titles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	EPEG 427	PCC	Industrial Electrification and Control	3	3	1	2	6	50	50	40	10	150
	…	MOEC	Elective IV (Open elective)	3	3	1		4	50	50	0	0	100
	PCEG 435	PCC	Capstone Project-II	2	0	0	6	6	0	0	80	20	100
	PCEG 436	PCC	Industrial Internship	6	0	0	6	6	0	0	80	20	100
	…	HSMC	Elective V (holistic, societal impact, National directives)	2	2	0	0	2	40	10	0	0	50

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

Task – 2

Title – Design & Development of Programme Structure with Teaching & Examination Scheme for Bachelor in Electrical Engineering

Name of the University - Manmohan Technical University

Programme Title - Bachelor in Electrical Engineering

1. Introduction:

Manmohan Technical University, located in Budhiganga, Morang (Koshi Province), was established with an aim to shift away from traditional, purely theoretical academic models and focus strictly on producing entrepreneurial, highly skilled, and employment-ready technical human resources.

To drive regional and national development, the School of Engineering launched its rigorous four-year, 8-semester undergraduate programs. The specific design of MTU's Electrical Engineering curriculum majorly focuses on Meeting National Infrastructure and Energy Demands, Bridging the "Theory-Practice" Gap and Shifting towards Industrial Automation.

2. Vision & Mission Statements of the University:

Vision of MTU

To establish Koshi Province as a premier center of excellence in technical education and innovation, nurturing globally competent professionals who contribute to sustainable development across engineering, health sciences, agriculture, pharmacy, forestry, and law.

Mission of MTU

- To cultivate skilled technical professionals across engineering, health sciences, agriculture, pharmacy, forestry, and law, ensuring they are equipped with both theoretical knowledge and practical expertise.
- To advance innovation and research by fostering a culture of inquiry, creativity, and problem-solving that addresses the developmental needs of Koshi Province and Nepal as a whole.
- To promote inclusive and sustainable education by expanding access to technical learning opportunities, strengthening provincial autonomy, and contributing to national progress through excellence in teaching and community engagement.

3. Vision & Mission Statements of the Department

Vision of the Electrical Engineering Department, SOE-MTU

To be a center of excellence in electrical and electronics engineering, producing globally competent professionals and innovators who drive technological advancement and sustainable development in Nepal and beyond.

Mission of the Electrical Engineering Department, SOE-MTU

- To provide high-quality education in electrical and electronics engineering, equipping students with strong theoretical foundations and practical skills to meet global standards.
- To foster innovation and research in power systems, renewable energy, electronics, and emerging technologies that address national and regional development needs.
- To cultivate ethical, socially responsible engineers who contribute to sustainable progress in industry, infrastructure, and society.

4. Programme Educational Objectives (PEOs):

PEO-1: Graduates will have a solid foundation in Electrical Engineering that prepares them for life-long professional careers and professional growth in fields of their choice.

PEO-2: Graduates will be employable in the diversified areas such as industry, government organizations, public sector and multinational corporations and/or pursue higher education in electrical engineering or other fields of their interests.

PEO-3: Graduates will have ability to innovate, create and analyze the solutions to real life problems related to electrical engineering with novel products.

Programme Outcomes (POs): - As per NEC

PO-1 **Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing and engineering fundamentals, and an engineering specialization as specified in Knowledge and Attitude Profiles (KA1 to KA4) respectively to develop solutions to complex engineering problems.

PO-2 **Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences with holistic considerations for sustainable development (KA1 to KA4).

PO-3 **Design/development of solutions:** Design creative solutions for complex engineering problems and design systems, components or processes to meet identified needs with appropriate consideration for public health and safety, whole- life cost, net zero carbon as well as resources, cultural, societal, and environmental considerations as required (KA5)

PO-4 **Investigation:** Conduct investigations of complex engineering problems using research methods including research-based knowledge, design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions (KA8). Complex engineering problems are referred to as the problems:

- that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline as against problems given at the end of chapters in a typical textbook that can be solved using simple engineering theories and techniques;
- that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions;
- that require consideration of appropriate constraints / requirements not explicitly given in the problem statement such as cost, power requirement, durability, product life, etc.;
- which need to be defined (modelled) within appropriate mathematical framework; and
- that often require use of modern computational concepts and tools, for example, in the design of an earthquake resistant building.

PO-5 **Modern Tool Usage:** Create, select and apply, and recognize limitations of appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering problems (KA2 and KA6)

PO-6 **The Engineer and the Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practices (KA7).

PO-7 **Ethics:** Apply ethical principles and commit to professional ethics and norms of engineering practice and adhere to relevant national and international laws. Demonstrate an understanding of the need for diversity and inclusion (KA9)

PO-8 **Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse and inclusive teams and in multidisciplinary, face- to-face, remote and distributed settings (KA9)

PO-9 **Communication:** Communicate effectively and inclusively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, making effective presentations, taking into account cultural, language, and learning differences.

PO-10 **Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO-11 **Lifelong learning:** Recognize the need for, and have the preparation and ability for:

- independent and life-long learning,
- adaptability to new and emerging technologies, and
- critical thinking in the broadest context of technological change (KA8)

Knowledge and Attitude Profiles (KAs)

KA-1 **Natural and social science:** A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

KA-2 **Mathematics:** Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

KA-3 Engineering fundamentals: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

KA-4 Specialist knowledge: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

KA-5 Engineering design & operations: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

KA-6 Engineering practice: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

KA-7 Role of Engineering in society: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

KA-8 Research literature: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

KA-9 Ethics and conduct: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

5. Programme Specific Outcomes (PSOs):

PSO-1 Apply engineering principles and modern tools to design and analyze power generation systems

PSO-2 Design transmission and distribution networks fulfilling the required demands using software tools

PSO-3 Utilize digital automation technologies PLCs, SCADA systems useful for industrial applications

6. Total Programme Structure with Teaching and Examination Scheme (Semester Wise):

1.	**Title of UG Engg./ Tech. Programme**	:	Bachelor in Electrical Engineering
2.	**Duration of Programme**	:	Four Years
3.	**Entry Qualification**	:	10+2 Science or Diploma in Engineering
4.	**Total Marks**	:	5800
5.	**Total Credits**	:	154
6.	**Total Number of Courses**	:	50 courses
7.	**Qualification Awarded BE/ B.Tech.**	:	154 Credits

8. Summary of Credits and Marks:

Year	Semester	Credits	Total Marks
Year -1	Semester -I	19	675
	Semester - II	19	700
Total		**39**	**1375**
Year -2	Semester -III	21	775
	Semester - IV	22	850
Total		**43**	**1625**
Year -3	Semester -V	19	775
	Semester- VI	20	750
Total		**39**	**1525**
Year -4	Semester -VII	20	825
	Semester - VIII	14	450
Total		**34**	**1275**
Grand Total		**154**	**5800**

7. Suggested Category wise Courses:

S. No.	Course Category	Abbreviations	Number of Courses	Total Credits
1.	Applied Science Courses	ASC	5	17
2.	Engineering Science Courses	ESC	11	34
3.	Programme Core Courses	PCC	21	63
4.	Programme Elective Courses	PEC	8	12
5.	Open Electives Courses	OEC	-	-
6.	Humanities, Social Science and Management Courses	HSC	4	10
7.	Project, Internship and Industrial Training	PI	6	18
Total			**48 + 3 electives**	**154**

UG Engg. /Tech. Programme in Bachelors in Electrical Engineering **Semester - I**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	EG401SH	ASC	Differential Calculus	3	3	1	0	4	50	50	-	-	100
	EG402EE+ME	PI	Engineering Workshop	2	1	0	4	5	-	-	30	20	50
	EG403SH	ASC	Engineering Physics	3	3	1	4	5.5	50	50	15	10	125
	EG404ME	ESC	Electrical Drafting and CAD	2	1	-	3	4	-	-	30	20	50
	EG405CO	ESC	Computer Programming	4	3	1	3	6	50	50	30	20	150
	EG406ME	ESC	Engineering Thermodynamics	2	2	1	-	3	25	25	-	-	50
	EG407EE	ESC	Basic Electrical Engineering	3	3	1	1.5	5.5	50	50	30	20	150
			TOTAL	19				33					675

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Bachelors in Electrical Engineering **Semester - II**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	EG451SH	**ASC**	Vector and 3D Geometry	**3**	**3**	**1**	**0**	**4**	**50**	**50**	**-**	**-**	**100**
	EG453ME	**ESC**	Applied Mechanics	**3**	**3**	**1**	**0**	**4**	**50**	**50**	**-**	**-**	**100**
	EG454CE	**ESC**	Survey & Layout (Electrical)	**4**	**3**	**-**	**3**	**6**	**50**	**50**	**30**	**20**	**150**
	EG455CO	**ESC**	Object Oriented Programming	**3**	**3**	**1**	**1.5**	**5.5**	**50**	**50**	**15**	**10**	**125**
	EG456EX	**ESC**	Logic Circuit	**3**	**3**	**1**	**1.5**	**5.5**	**50**	**50**	**25**	**-**	**125**
	EG457EE	**ESC**	Electrical Engineering Materials	**3**	**3**	**1**	**0**	**4**	**50**	**50**	**-**	**-**	**100**
			TOTAL	**19**				**29**					**700**

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Bachelors in Electrical Engineering **Semester - III**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	EG501SH	ASC	Matrices and Transforms	3	3	1	-	4	50	50	-	-	100
	EG502EX	PCC	Microprocessors	3	3	-	1.5	4.5	50	50	25	-	125
	EG503EE	PCC	Electric Circuit Theory	3	3	1	1.5	5.5	50	50	15	10	125
	EG504EX	PCC	Electronics Devices and Circuits	4	4	1	1.5	6.5	50	50	15	10	125
	EG505EE	PCC	Measurement and Instrumentation	3	3	1	1.5	5.5	50	50	25	-	125
	EG506EE	PCC	Transformers and DC machines	3	3	1	1.5	5.5	50	50	25	-	125
	EG507EE	HSC	Technology, Environment & Society	2	2	-	-	2	25	25	-	-	50
			TOTAL	21				33.5					775

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Bachelors in Electrical Engineering **Semester - IV**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	EG551EE	PCC	Synchronous and Induction Machines	3	3	1	1.5	5.5	50	50	25	-	125
	EG552SH	ASC	Complex and Discrete Mathematics	3	3	1	-	4	50	50	-	-	100
	EG553EE	ESC	Numerical Methods	3	3	1	1.5	5.5	50	50	25	-	125
	EG554EE	PCC	Control System Engineering	4	4	1	1.5	5	50	50	15	10	125
	EG555EE	PCC	Power Electronics	3	3	1	1.5	5.5	50	50	25	-	125
	EG556EE	PCC	Power System Fundamentals	3	3	1	1.5	5.5	50	50	25	-	125
	EG557EE	PCC	Industrial Automation	3	3	1	1.5	5.5	50	50	25	-	125
			TOTAL	22				36.5					850

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Bachelors in Electrical Engineering **Semester - V**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	EG601SH	**ASC**	Probability and Statistics	**3**	**3**	**1**	**-**	**4**	**50**	**50**	**-**	**-**	**100**
	EG602EE	**PCC**	Transmission System Design	**3**	**3**	**1**	**1.5**	**5.5**	**50**	**50**	**25**	**-**	**125**
	EG603EX	**PCC**	Digital Control System	**3**	**3**	**1**	**1.5**	**5.5**	**50**	**50**	**25**	**-**	**125**
	EG604EX	**PCC**	Signals and Systems	**3**	**3**	**1**	**1.5**	**5.5**	**50**	**50**	**25**	**-**	**125**
	EG605EE	**PCC**	Electrical Power System Analysis	**3**	**3**	**1**	**1.5**	**5.5**	**50**	**50**	**25**	**-**	**125**
	EG606EE	**PCC**	Electrical Machine Design	**3**	**3**	**1**	**1.5**	**5.5**	**50**	**50**	**25**	**-**	**125**
	EG607EE	**PI**	Electrical Engineering Project	**1**	**-**	**-**	**3**	**3**	**-**	**-**	**30**	**20**	**50**
			TOTAL	**19**				**34.5**					**775**

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Bachelors in Electrical Engineering **Semester - VI**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	EG651EE	PCC	Distribution Line Design	3	3	1	1.5	5.5	50	50	25	-	125
	EG652EE	PCC	Illumination Design and Industrial Electrification	3	3	1	1.5	5.5	50	50	25	-	125
	EG653SH	HSC	Engineering Economics	3	3	1	-	4	50	50	-	-	100
	EG654EE	PCC	Power System Protection	4	4	1	1.5	6.5	50	50	15	10	125
	EG655SH	HSC	Project Management	3	3	1	-	4	50	50	-	-	100
	EG659EE	PI	Engineering Project	1	-	-	3	3	-	-	30	20	50
	EG656EE	PEC	Program Elective Course I	3	3	1	1.5	5.5	50	50	25	-	125
			TOTAL	20				34					750

Program Elective Course I : Flexible AC Transmission System / Microgrids / Intelligent Power System

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Bachelors in Electrical Engineering **Semester - VII**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	EG701EE	PCC	High Voltage Engineering	3	3	1	1.5	5.5	50	50	25	-	125
	EG702EE	PI	Capstone Project - Part I	2	-	-	-	-	-	-	60	40	100
	EG703EE	PCC	Power Plant Engineering	3	3	1	1.5	5.5	50	50	25	-	125
	EG704EE	PCC	Electrical Energy System Management	3	3	1	1.5	5.5	50	50	25	-	125
	EG706EE	PEC	Program Elective Course II	3	3	1	1.5	5.5	50	50	25	-	125
	EG707EE	PEC	Program Elective Course III	3	3	1	1.5	5.5	50	50	25	-	125
			TOTAL	17				16.5	250	250	185		725

Program Elective Course II : Reliability Engineering / Electrical Vehicle (EV) Technology

Program Elective Course III : Applied Photovoltaic Engineering / Micro-Hydro Power / Wind Energy Conversion System

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Bachelors in Electrical Engineering **Semester - VIII**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	EG751CE	**HSC**	Professional Practice and Ethics	**2**	**2**	**-**	**-**	**2**	**25**	**25**	**-**	**-**	**50**
	EG752EE	**PI**	Work Based Education	**6**	**-**	**-**	**-**	**-**	**-**	**-**	**120**	**80**	**200**
	EG753EE	**PI**	Capstone Project - Part I	**6**	**-**	**-**	**-**	**-**	**-**	**-**	**120**	**80**	**200**
			TOTAL	**14**				**2**					**450**

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

Task – 2

Title – Design & Development of Programme Structure with Teaching & Examination Scheme for the Bachelor of Electrical and Electronics Engineering

Name of the University – Pokhara University

Programme Title – Bachelor of Electrical and Electronics Engineering

1. **Introduction:** The Bachelor of Electrical and Electronics Engineering (BEEE) programme offered by Pokhara University is a four-year undergraduate engineering programme designed to produce competent and professionally skilled engineers with strong foundations in electrical and electronics engineering. Structured over eight semesters under the Faculty of Science and Technology, the programme requires the completion of 128 credit hours comprising coursework, project work, and internship.

   The curriculum integrates theoretical knowledge, practical skills, research, innovation, and industry-oriented learning to prepare graduates for professional practice, higher studies, and technological advancement. It is designed in line with contemporary engineering needs and Outcome-Based Education (OBE) principles, enabling students to develop the competencies, technical expertise, problem-solving abilities, and professional attitudes required in modern engineering environments.

   The programme provides students with a broad and holistic understanding of electrical and electronics engineering through the following major curriculum components:

   - Foundation Courses: These courses strengthen students' knowledge in mathematics, physics, chemistry, communication skills, engineering drawing, thermal science, computer applications, and the fundamentals of electrical and electronics engineering.
   - Core Courses: These courses develop comprehensive understanding and practical expertise in key areas of electrical and electronics engineering, including power systems, control systems, electronics, communication, instrumentation, and embedded systems.
   - Elective Courses: Elective courses allow students to pursue specialized areas of interest and develop focused technical competencies in emerging and advanced domains of electrical and electronics engineering.
   - Project Work: Students undertake independent capstone projects involving design, analysis, experimentation, and problem-solving activities, culminating in the preparation and presentation of a formal project report.
   - Internship: The programme includes a three-month industrial internship that provides students with real-world professional exposure and practical experience in engineering

organizations. Internship evaluation is based on the host organization's assessment and the presentation of an internship report.

The BEEE programme serves as a strong foundation for professional career development, entrepreneurship, research, and advanced graduate studies in electrical and electronics engineering and related interdisciplinary fields.

2. Vision & Mission Statements of the University:

2.1 Vision-To be a leader in the promotion of education through quality higher education, health, and community service.

2.2 Mission- Develop the institution into a Center of Excellence for Higher Education by enhancing teaching, learning, and research activities; to accelerate the national development process by producing job market-driven, responsible, productive, welfare-focused and committed human resources. Link the university system with community services. Unfold the potential and creativity of learners, advocating humanism, reason, innovation, and the search for truth.

3. **Vision & Mission Statements of the School:**

3.1 Vision- To become a leading center of excellence in engineering education, research, and innovation by producing competent professionals capable of contributing to sustainable technological and social development in Nepal and beyond.

3.2 Mission- The mission of the School of Engineering is to deliver quality engineering education through modern teaching-learning methods, research, and industry collaboration. It aims to develop technically sound, innovative, and socially responsible engineers who can solve real-world problems and contribute to national and international progress.

4. Programme Educational Objectives (PEOs): Graduates of the Bachelor of Electrical and Electronics Engineering program are expected to:

4.1 Apply fundamental knowledge of mathematics, science, electrical and electronics engineering to solve real-world engineering problems.

4.2 Innovate, design, lead, and optimize advanced electrical and electronics engineering systems by integrating expertise in sustainable energy, intelligent technologies, power electronics, and modern industrial practices to transform Nepal's technological and energy sectors while contributing competitively to the global engineering community.

4.3 Engage in lifelong learning, research, innovation, and professional development to adapt to emerging technologies and industrial needs.

5. Programme Outcomes (POs): - As per NEC

PO-1 **Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing and engineering fundamentals, and an engineering specialization as specified in

Knowledge and Attitude Profiles (KA1 to KA4) respectively to develop solutions to complex engineering problems.

PO-2 **Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences with holistic considerations for sustainable development (KA1 to KA4).

PO-3 **Design/development of solutions:** Design creative solutions for complex engineering problems and design systems, components or processes to meet identified needs with appropriate consideration for public health and safety, whole- life cost, net zero carbon as well as resources, cultural, societal, and environmental considerations as required (KA5)

PO-4 **Investigation:** Conduct investigations of complex engineering problems using research methods including research-based knowledge, design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions (KA8). Complex engineering problems are referred to as the problems:

- that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline as against problems given at the end of chapters in a typical textbook that can be solved using simple engineering theories and techniques;
- that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions;
- that require consideration of appropriate constraints / requirements not explicitly given in the problem statement such as cost, power requirement, durability, product life, etc.;
- which need to be defined (modelled) within appropriate mathematical framework; and
- that often require use of modern computational concepts and tools, for example, in the design of an earthquake resistant building.

PO-5 **Modern Tool Usage:** Create, select and apply, and recognize limitations of appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering problems (KA2 and KA6)

PO-6 **The Engineer and the Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practices (KA7).

PO-7 **Ethics:** Apply ethical principles and commit to professional ethics and norms of engineering practice and adhere to relevant national and international laws. Demonstrate an understanding of the need for diversity and inclusion (KA9)

PO-8 **Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse and inclusive teams and in multidisciplinary, face- to-face, remote and distributed settings (KA9)

PO-9 **Communication:** Communicate effectively and inclusively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, making effective presentations, taking into account cultural, language, and learning differences.

PO-10 **Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own

work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO-11 Lifelong learning: Recognize the need for, and have the preparation and ability for:

- independent and life-long learning,
- adaptability to new and emerging technologies, and
- critical thinking in the broadest context of technological change (KA8)

Knowledge and Attitude Profiles (KAs)

KA-1 Natural and social science: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

KA-2 Mathematics: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

KA-3 Engineering fundamentals: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

KA-4 Specialist knowledge: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

KA-5 Engineering design & operations: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

KA-6 Engineering practice: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

KA-7 Role of Engineering in society: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

KA-8 Research literature: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

KA-9 Ethics and conduct: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

6. Programme Specific Outcomes (PSOs):

PSO-1 Apply electrical and electronics engineering principles to analyze, design, and implement systems related to power, control, communication, embedded systems, and electronic devices.

PSO-2 Use modern engineering tools and emerging technologies for modeling, simulation, testing, automation, and problem-solving in industrial and research environments.

PSO-3 Analyze, design, and develop modern electrical and electronics engineering solutions by integrating principles of power systems, power electronics and drives, and machine learning techniques to address industrial, energy, and societal challenges effectively and sustainably.

7. Total Programme Structure with Teaching and Examination Scheme (Semester Wise):

1.	**Title of UG Engg./ Tech. Programme**	:	Bachelor of Electrical and Electronics Engineering (BEEE)
2.	**Duration of Programme**	:	Four Years
3.	**Entry Qualification**	:	S. L. C. or 10+2 in science or Diploma in any branch of Engineering (with Physics, Chemistry and Math)
4.	**Total Marks**	:	4700
5.	**Total Credits**	:	128
6.	**Total Number of Courses**	:	47
7.	**Qualification Awarded**		
	BE/ B.Tech.	:	Bachelor of Electrical and Electronics Engineering with 126 Credits

8. Summary of Credits and Marks:

Year	Semester	Credits	Total Marks
Year -1	Semester -I	16	700
	Semester - II	17	600
Total		**33**	**1300**
Year -2	Semester -III	18	600
	Semester - IV	16	600
Total		**34**	**1200**
Year -3	Semester -V	17	600
	Semester- VI	16	600
Total		**33**	**1200**
Year -4	Semester -VII	17	600
	Semester - VIII	11	400
Total		**28**	**1000**
Grand Total		**128**	**4700**

9. Suggested Category wise Courses:

S. No.	Course Category	Abbreviations	Number of Courses	Total Credits
1.	Applied Science Courses	ASC	7	19
2.	Engineering Science Courses	ESC	7	18
3.	Programme Core Courses	PCC	25	69
4.	Programme Elective Courses	PEC	2	6
5.	Open Electives Courses	OEC	1	3
6.	Humanities, Social Science and Management Courses	HSMC	3	7

7.	Project, Internship and Industrial Training	PI	2	6
Total			**47**	**128**

UG Engg. /Tech. Programme in Electrical and Electronics Engineering **Semester - I**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	PHY 110	ASC	Applied Physics	3	3	1	2	9	30	50	20	-	100
	ELE 130	ESC	Basic Electrical Circuits	3	3	1	2	9	30	50	20	-	100
	MTH 110	ASC	Calculus	3	3	2	0	7	50	50	-	-	100
	CMP 112	ESC	Computer Programming	3	3	1	2	9	30	50	20	-	100
	ELE 132	ESC	Electrical Practice and Safety	2	2	1	2	6	30	50	20	-	100
	MEC 116	ESC	Basic Engineering Drawing	1	0	0	3	6	-	-	50	50	100
	MEC 136	ESC	Electrical Engineering Workshop	1	0	0	3	6	-	-	50	50	100

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Electrical and Electronics Engineering **Semester - II**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	MTH 150	ASC	Algebra and Geometry	3	3	2	0	7	50	50	-	-	100
	MEC 170	ESC	Basic Mechanical Engineering	3	3	1	0	5	50	50	-	-	100
	ENG 110	ASC	Communication Techniques	2	2	2	0	6	50	50	-	-	100
	ELE 174	ESC	Electrical Engineering Material	3	3	1	0	5	50	50	-	-	100
	ELX 174	PCC	Electronic Devices	3	3	1	2	9	30	50	20	-	100
	ELE 178	PCC	Network Theory	3	3	1	2	9	30	50	20	-	100

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Electrical and Electronics Engineering **Semester - III**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	MTH 210	ASC	Advanced Calculus	3	3	2	0	7	50	50	-	-	100
	ELX 110	PCC	Digital Logic	3	3	1	2	9	30	50	20	-	100
	ELE 230	PCC	Electrical Machine	3	3	2	0	7	50	50	-	-	100
	ELX 234	PCC	Electromagnetic Fields and Waves	3	3	1	0	5	50	50	-	-	100
	ELX 232	PCC	Electronic Circuits	3	3	1	2	9	30	50	20	-	100
	ELE 172	PCC	Instrumentation	3	3	1	2	9	30	50	20	-	100

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Electrical and Electronics Engineering **Semester - IV**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	MTH 250	ASC	Applied Mathematics	3	3	2	0	7	50	50	-	-	100
	ELE 270	PCC	Control System	3	3	1	2	9	30	50	20	-	100
	ELE 272	PCC	Advanced Electrical Machine	2	2	1	2	8	30	50	20	-	100
	ELX 270	PCC	ALP and Microprocessors	3	3	1	2	9	30	50	20	-	100
	MTH 252	ESC	Numerical Methods	2	2	1	2	8	30	50	20	-	100
	ELE 274	PCC	Transmission and Distribution Systems	3	3	1	0	5	50	50	-	-	100

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Electrical and Electronics Engineering **Semester - V**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	ELE 334	PCC	Control System Design	2	2	1	2	8	30	50	20	-	100
	ELE 336	PCC	Electrical Machine Design	3	3	2	0	7	50	50	-	-	100
	MGT 250	HSMC	Engineering Economics	3	3	1	0	5	50	50	-	-	100
	ELE 342	PCC	Power Electronics	3	3	1	2	9	30	50	20	-	100
	ELE 340	PCC	Power System Analysis	3	3	1	2	9	30	50	20	-	100
	ELX 330	PCC	Signals and System	3	3	1	2	9	30	50	20	-	100

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Electrical and Electronics Engineering **Semester - VI**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	MGT 320	HSMC	Engineering Management	2	2	1	0	4	50	50	-	-	100
	ELE 372	PCC	High Voltage Engineering	3	3	1	0	5	50	50	-	-	100
	MTH 216	ASC	Probability and Statistics	2	2	2	0	6	50	50	-	-	100
	ELE 374	PCC	Switch Gear & Protection	3	3	1	2	9	30	50	20	-	100
	ELE 378	PCC	Utilization of Electrical Energy	3	3	2	0	7	50	50	-	-	100
	-	PEC	Program Elective Course I	3	3	1	0	5	50	50	-	-	100

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Electrical and Electronics Engineering **Semester - VII**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	ELX 370	PCC	Modern Communication System	3	3	1	0	5	50	50	-	-	100
	ELE 434	PCC	Power Plant Technology	3	3	1	0	5	50	50	-	-	100
	ELE 436	PCC	Renewable Energy and Grid Integration	3	3	0	2	7	30	50	20	-	100
	ELE 338	ESC	Research Methodology	2	2	1	0	4	50	50	-	-	100
	ELE 440	PCC	Transmission and Distribution Design	3	3	0	2	7	30	50	20	-	100
	-	PEC	Program Elective Course II	3	3	1	0	5	50	50	-	-	100

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

UG Engg. /Tech. Programme in Electrical and Electronics Engineering **Semester - VIII**

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	-	MOEC	Open Elective Course	3	3	1	0	5	50	50	-	-	100
	INT 488	PI	Internship	3	0	0	6	6	-	-	50	50	100
	PRJ 452	PI	Major Project	3	0	0	6	6	-	-	50	50	100
	ELE 460	HSC	Engineering Professional Ethics	2	2	0	0	2	50	50	-	-	100

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

Annexure 4

Sample Electrical and Electronics and Allied Engineering Course Curriculum Detailing of

1. Tribhuvan University
2. Purbanchal University
3. Kathmandu University
4. Manmohan Technical University
5. Pokhara University

Sample Course Curriculum Detailing Format

A)	**Course Title: Digital Electronics**	
B)	**Course Code:** BEC2002	
C)	**Major Pre- requisite Course (s):** Simple mathematics, electrical, electronics & computer knowledge	

D) Rationale:

What is this course?
Why this course is included in this programme? How this course will contribute in the field of work.
What are the topics or contents included in this course? / What learners will attain after completing all the activities of this course?

Digital Electronics is a fundamental course that introduces the principles and applications of digital systems. The course covers theoretical concepts along with practical implementation of digital devices and systems. It provides the foundation required for understanding modern electronic and computer-based technologies.

This course is included in the engineering programme because digital electronics is the basis of modern computing, communication, automation, and embedded systems.

The course contributes to the field of work by preparing students to design, analyze, and troubleshoot digital electronic systems used in industries and modern devices. The knowledge gained is useful in automation, robotics, computer hardware, communication systems, and control applications.

The learner will have skills in developing combinational and sequential circuits number systems, and learners will be able to design and analyze digital circuits.

E) Course Outcomes (COs):

After the completion of the course, teachers are expected to ensure the attainment of following course outcomes by the learners.

S. No	Course outcomes (4-6)
CO1	Select the type of system, for the given application.
CO2	Design combinational logic using Boolean algebra, logic gates and K maps
CO3	Design ROMs, PLDs, comparators, and arithmetic circuits using MSI and LSI based digital system
CO4	Select the relevant flipflops for the required sequential circuit application.
CO5	Design sequential logic circuits for digital electronic systems using latch and flipflops.

F) Course Articulation Matrix (CAM):

Course Outcomes(COs)	Programme Outcomes(POs)	Programme Specific Outcomes (PSOs)

Sample Course Curriculum Detailing Format

	PO-1 Engineering Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Conduct Investigations of Complex Problems	PO-5 Engineering Tool Usage	PO-6 The Engineer and the World	PO-7 Ethics	PO-8 Individual and collaborative Team Work	PO-9 Communication	PO- 10 Project Management and Finance	PO-11 Life-long Learning	PSO-1	PSO-2
CO-1	3	2	1	2	2	-	-	1	2	-	-	1	2
CO-2	3	3	3	3	3	-	-	2	2	-	-	2	3
CO-3	3	2	3	3	2	-	-	2	2	-	-	2	3
CO-4	3	2	3	2	2	-	-	2	2	-	-	2	2
CO-5	3	3	3	3	3	-	-	2	2	-	-	3	3

Legend: High (3), Medium (2), Low (1) and No mapping (-) Optional (*)

G) Teaching and Examination Scheme:

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
4	BEC2002	PCC	Digital Electronics	**3**	3	**1**	**3**	**7**	**40**	**25**	25	60	150

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

H) Course Curriculum Detailing:

For attainment of course outcomes, the students are expected to perform/ undergo various activities through classroom, laboratories, workshops, any other workplace, term work, field sessions, self- learning assignment etc.

Unique features like green skills, SDGs, multidisciplinary aspects, Love for our own country, motivation for startups, societal connect, renewable energy, etc. are integrated appropriately in the course curriculum document.

I) CO(s) Wise Suggested Contents:

Mapped CO(s) Number	Contents
CO1	**Unit- 1.0: Number Systems and Digital Systems** 1.1 Introduction to sensors and digital systems 1.2 Advantages of digital systems over analog systems 1.3 Decimal, binary, octal, and hexadecimal number systems 1.4 Number system conversion 1.4 Complements and subtraction methods 1.6 Binary codes: BCD, Excess-3, Gray code 1.7 Introduction to integrated circuits and 7400 series ICs
CO2, CO3	**Unit- 2.0: Boolean Algebra and Logic** 2.1 Basic definitions of Boolean algebra 2.2 Boolean functions and logical operators 2.3 Boolean theorems and De Morgan's law

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Contents
	2.4 Minterms and maxterms 2.5 Canonical and standard forms 2.6 Basic logic gates and universal gates **2.7** XOR and XNOR gates
CO3	**Unit- 3.0: Karnaugh Maps and Combinational Logic Circuits** 3.1 Simplification using K-maps 3.2 2-variable, 3-variable, and 4-variable K-maps 3.3 Don't care conditions 3.4 Design of Half Adder and Full Adder 3.5 Design of Half Subtractor and Full Subtractor 3.6 Encoders and Decoders 3.7 Multiplexers and Code Converters
CO4	**Unit- 4.0: MSI and LSI Circuits** 4.1 Binary parallel adders 4.2 Adder/Subtractor circuits 4.3 Decimal adders 4.4 Magnitude comparators 4.5 Encoders and Decoders using MSI circuits 4.6 Multiplexers and larger implementation techniques 4.7 ROM, PROM, EPROM, EEPROM 4.8 Programmable Logic Devices (PLA and PAL)
CO5	**Unit- 5.0: Sequential Logic Circuits** 5.1 Latches and flip-flops 5.2 RS, D, JK, and T flip-flops 5.3 Triggering methods 5.4 Flip-flop conversion

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Contents
	5.5 Analysis of clocked sequential circuits 5.6 State equations and design procedures 5.7 Shift registers: SISO, SIPO, PISO, PIPO 5.8 Ripple counters 5.9 Synchronous counters 5.10 Applications of registers and counters

J) CO(s) Wise Suggested List of Practicals:

Mapped CO(s) Number	Laboratory Experiment/ Practicals
CO1	1. Practical for number systems, binary codes, and number conversions
CO2, CO3	1. Practical for logic gates and truth tables 2. Practical for of De Morgan's theorem using logic gates 3. Simplification of Boolean functions using Karnaugh maps
CO3	1. Practical for implementation of Half Adder and Full Adder circuits 2. Practical for implementation of Half Subtractor and Full Subtractor circuits 3. Practical for encoders, decoders, and multiplexer 4. Design and verification of comparator using simulation. 5. Practical for ROM and programmable logic devices using simulation
CO4	1. Implementation and analysis of RS, JK, D, and T flip-flops 2. Design of sequential logic circuits.
CO5	1.Design and implementation of registers and counters using simulations 2. Simulation of digital circuits.

Note: Rubrics need to be prepared for effective performance by each student and their valid and reliable assessment.

K) Suggested In Semester Activities: This may include complex engineering problems, micro projects, seminar, self-learning, industrial/ field visit, assignment etc. It reinforces the development of spectrum of abilities needed for attainment of course outcomes. Complex engineering problems and micro projects need to be provided to learners to develop the problem solving, analytical, critical thinking, creative, investigative, exploring abilities in the learners and to prepare them as future ready work force. MOOCs, spoken tutorials, online educational resources etc. may be used for Self-Learning.

a. Suggested Complex Engineering Problems:

Sample Course Curriculum Detailing Format

S. No.	Suggested Complex Engineering Problems
1.	12 Bit Binary adder/ subtractor
2.	Digital Locks
3.	Stop watch
4.	Vending machine
5.	Traffic lights

b. Suggested Micro Projects:

S. No.	Suggested Micro Projects
1.	Excess 3 to Gray code converter
2.	Room light controller
3.	Water tank level indicator
4.	Elevator floor counter
5.	Electronic score board

c. Suggested Seminar Topics, Self- Learning Topics, Industrial Visits/ Field Demonstration/ Any other relevant activity, as applicable:

S. No.	Seminar Topics	Self- Learning Topics	Industrial Visits/ Field Demonstration	Any other Relevant Activity
1.	Evolution of Digital Electronics	History of digital IC development and modern digital devices		Prepare seminar presentation and report
2.	Number Systems and Their Applications in Computing	Binary arithmetic and coding techniques	Demonstration of digital computation systems	Assignment on number system conversion
3.	Role of Programmable Logic Devices (PLA, PAL, FPGA)	Basics of FPGA programming and programmable devices		Simulation using digital design software
4.	Future Trends in Digital Electronics	AI hardware, VLSI, and nanoelectronics	Demonstration of modern digital devices	Group discussion on emerging technologies

L) Suggested Instructional/ Implementation Strategies: Different instructional/ learning/

implementation strategies may be used appropriately, as per the requirement of the level of learners and outcome to be achieved. Some of them are improved lecture, tutorial, case method, group discussion, industrial visits, industrial training, field trips, role play, live demonstrations in classrooms, lab, field, project work, self-learning, etc. Use of Information and Communications Technology (ICT) based teaching learning, blended or flipped mode, brainstorming, expert session, video clippings, Online Educational Resources (OER), MOOCs, etc. are the some of the suggestive methods/ strategies to be adopted appropriately.

The relevant instructional/ implementation strategies may be mentioned appropriately as per the requirement of CO.

CO Statement	Suggested Relevant Instructional/ Implementation Strategies	Suggested Required Resources
Select the number system, for the given application.		
Design combinational logic using Boolean algebra, logic gates and K maps		
Design ROMs, PLDs, comparators, and arithmetic circuits using MSI and LSI based digital system		
Select the relevant flipflops for the given application.		

M) Suggested Learning Resources:

a) Books

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Digital Design	M. Morris Mano & Michael D. Ciletti	Pearson Education, 6th Edition, ISBN: 978-0134549897
2.	Digital Electronics Principles and Applications	Roger L. Tokheim	McGraw-Hill Education, 8th Edition, ISBN: 978-0073380643

b) Online Open Educational Resources (OER):

1) …….
2) …….
3) …….

c) Suggested List of Equipment: (For Class Size- 30)

S. No.	Name of the Equipment	Suggested Specifications	Remarks
1.	Digital logic trainer kits		

Sample Course Curriculum Detailing Format

S. No.	Name of the Equipment	Suggested Specifications	Remarks
2.	7400 IC		
3.	Logic simulators		

N) (a) Course Curriculum Development Team (Respective Universities)

S. No.	Name and Designation	E-mail Address
1.	Basanta Paudyal, Lecturer	basantapaudyalmail@gmail.com
2.		

(b) Course Curriculum Development Team (Academia & Experts)

S. No.	Name and Designation	E-mail Address
1.		
2.		

****

Sample Course Curriculum Detailing Format

A)	**Course Title: Digital Logic**	
B)	**Course Code: PCC 152**	
C)	**Major Pre- requisite Course (s):** Foundations of Engineering Mathematics (AES 101), Computer Programming (ESC 101), Fundamentals of Electrical and Electronics Engineering (PCC 101)	

D) Rationale:

Digital Logic is a core course in Electronics, Communication and Information Engineering that focuses on the design and analysis of digital electronic systems. The course introduces concepts such as binary number systems, Boolean algebra, logic gates, combinational circuits, and sequential circuits, which are the foundation of modern computers, embedded systems, communication devices, and automation systems.

This course is included in the programme to develop the fundamental knowledge required for advanced subjects like Microprocessors, Embedded Systems, Robotics, IoT, and Digital Signal Processing. It helps students design and implement digital systems used in industries, smart devices, and computer-based applications.

The course covers topics such as number systems, logic simplification, multiplexers, decoders, flip-flops, counters, registers, and memory elements. After completing the course, students will be able to analyze and design digital circuits, use simulation tools, and apply digital logic concepts to real-world engineering problems.

E) Course Outcomes (COs): After the completion of the course, teachers are expected to ensure the attainment of following course outcomes by the learners.

Course Outcomes (COs)	Course Outcome Statements
CO1	Understand number systems, Boolean algebra, and logic gates used in digital systems.
CO2	Analyze and simplify combinational logic circuits using Boolean algebra and Karnaugh maps.
CO3	Design combinational logic circuits such as adders, multiplexers, encoders, and decoders.
CO4	Analyze and design sequential logic circuits including flip-flops, counters, and registers.
CO5	Apply digital logic concepts and simulation tools to solve practical digital system problems.

Sample Course Curriculum Detailing Format

F) Course Articulation Matrix (CAM):

Course Outcomes(COs	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)*		
	PO1 Engineering Knowledge	**PO2** Problem Analysis	**PO3** Design/ Development of Solutions	**PO 4** Investigation	**PO5** Modern Tool Usage	**PO 6** The Engineer and The Society	**PO7** Ethics	**PO8** Individual and Collaborative Teamwork	**PO9** Communication	**PO10** Project Management and Finance	**PO11** Life-long Learning	**PSO1**	**PSO2**	**PSO2**
CO1	2	2	-	-	-	-	-	-	-	-	1	-	-	-
CO2	2	2	1	1	1	-	-	-	-	-	1	1	1	1
CO3	3	3	2	2	3	-	-	1	1	-	1	2	2	2
CO4	3	3	2	2	3	-	-	1	1	-	2	2	2	2
CO5	3	3	3	3	3	2	1	1	2	1	2	2	2	2

Legend: High (3), Medium (2), Low (1) and No mapping (-) Optional (*)

G) Teaching and Examination Scheme:

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	152	**PCC**	**Digital Logic**	**3**	**3**	**1**	**3**	**7**	**40**	**60**	**50**	**-**	**150**

Legend:
L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

H) Course Curriculum Detailing:

For attainment of course outcomes, the students are expected to perform/ undergo various activities through classroom, laboratories, workshops, any other workplace, term work, field sessions, self- learning assignment etc.

Unique features like green skills, SDGs, multidisciplinary aspects, Love for our own country, motivation for startups, societal connect, renewable energy, etc. are integrated appropriately in the course curriculum document.

I) CO(s) Wise Suggested Contents:

Mapped CO(s) Number	Contents
CO1	**Unit 1.0: Introduction to Digital Logic and Logic gates** **1.1** Digital versus analog signals **1.2** Logic level diagram and clock triggering systems

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Contents
	1.3 Digital integrated circuits (ICs) and digital system applications **1.4** Number systems and code conversions: Decimal, Binary, Octal, Hexadecimal, BCD, Excess-3, Gray codes **1.5** Alphanumeric codes: ASCII and EBCDIC **1.6** 1's complement, 2's complement, and signed number representation **1.7** Basic, universal, and exclusive logic gates **1.8** Positive and negative logic **1.9** De Morgan's laws and applications of logic gates
CO2, CO3	**Unit 2.0: Boolean Algebra and K-Maps** **2.1** Boolean algebra and Boolean laws **2.2** Simplification of Boolean expressions **2.3** Midterms, maxterms, SOP and POS forms **2.4** Truth tables and Karnaugh maps **2.5** Four-variable K-map simplification **2.6** Don't care conditions and redundant groups **2.7** Design procedures of combinational circuits **2.8** Half and full adders/subtractors **2.9** Ripple carry and fast adders **2.10** Multiplexers and demultiplexers **2.11** Encoders, priority encoders, and decoders **2.12** Seven-segment decoders and magnitude comparators
CO4	**Unit 3.0: Sequential Logic Circuits** **3.1** Latches and flip-flops: SR, D, JK, and T **3.2** Characteristic equations and excitation tables **3.3** Master-slave flip-flops and timing diagrams **3.4** Flip-flop conversions and applications **3.5** Register fundamentals and types **3.6** Shift registers: SISO, SIPO, PISO, and PIPO **3.7** Asynchronous and synchronous counters **3.8** Up, down, and mod-n counters **3.9** Applications of registers and counters **3.10** Sequential machine design procedures **3.11** State diagrams and transition tables **3.12** Excitation maps and state reduction **3.13** Sequence detector design and realization
CO5	**Unit 4.0: Digital Integrated Circuits and Applications** **4.1** BJT and MOSFET switching circuits **4.2** TTL and CMOS parameters and logic circuits **4.3** Three-state TTL devices **4.4** Applications of digital devices **4.5** Multiplexing displays, frequency counters, and time measurement systems

Sample Course Curriculum Detailing Format

J) CO(s) Wise Suggested List of Practicals:

Mapped CO(s) Number	Laboratory Experiment/ Practicals
CO1	1 Verification of basic, universal, and exclusive logic gates 2 Verification of De Morgan's laws using NAND and NOR gates
CO2, CO3	3 Design of encoders and decoders 4 Design of multiplexers and demultiplexers 5 Realization of adder and subtractor circuits using multiplexers and demultiplexers 6 Design and simulation of magnitude comparators and seven-segment decoder circuits
CO4	7 Design and analysis of RS, D, JK, and T flip-flops 8 Design and analysis of shift registers and timing diagrams 9 Design and implementation of ripple and synchronous counters
CO5	10 Simulation of sequential digital circuits. 11 Design and Simulation of sequence detector circuts.

Note: Rubrics need to be prepared for effective performance by each student and their valid and reliable assessment.

K) Suggested In Semester Activities: This may include complex engineering problems, micro projects, seminar, self-learning, industrial/ field visit, assignment etc. It reinforces the development of spectrum of abilities needed for attainment of course outcomes. Complex engineering problems and micro projects need to be provided to learners to develop the problem solving, analytical, critical thinking, creative, investigative, exploring abilities in the learners and to prepare them as future ready work force. MOOCs, spoken tutorials, online educational resources etc. may be used for Self-Learning.

a. Suggested Complex Engineering Problems:

S. No.	Suggested Complex Engineering Problems
1.	Design a traffic control system for multiple roads that gives priority to pedestrians and emergency vehicles using finite state machines and timing control.
2.	Design a digital elevator control system for a multi-floor building with efficient scheduling and proper sequential logic to avoid conflicts.
3.	Design a digital security system that changes its operation based on a key input and locks itself when unauthorized access is detected.

b. Suggested Micro Projects:

S. No.	Suggested Micro Projects
1.	Build a digital traffic light controller using a finite state machine.
2.	Create a password-based door lock system using flip-flops.
3.	Design a binary to seven-segment display decoder for number display.

Sample Course Curriculum Detailing Format

S. No.	Suggested Micro Projects
4.	Implement a sequence detector that identifies a fixed binary pattern.

c. Suggested Seminar Topics, Self- Learning Topics, Industrial Visits/ Field Demonstration/ Any other relevant activity, as applicable:

S. No.	Seminar Topics	Self- Learning Topics	Industrial Visits/ Field Demonstration	Any other Relevant Activity
1.	Applications of Digital Logic in Modern Electronics Systems	Study of number systems, code conversions, and logic gate operations	Visit to an electronics laboratory or digital system maintenance center	Logic gate implementation using breadboard and ICs
2.	Design and Applications of Combinational Logic Circuits	Self-study on K-map simplification and Boolean algebra techniques	Demonstration of encoder, decoder, and multiplexer circuits in industry/lab	Mini project on binary adder/subtractor circuit
3.	Sequential Logic Circuits and Flip-Flop Applications	Learning different types of flip-flops and timing diagrams	Observation of digital counter and register applications in embedded systems	Design of digital traffic light controller using flip-flops
4.	Digital Integrated Circuits and Their Applications	Study of TTL, CMOS, and switching circuit characteristics	Visit to a communication or automation industry using digital control systems	Development of sequence detector or digital counter project

L) Suggested Instructional/ Implementation Strategies: Different instructional/ learning/ implementation strategies may be used appropriately, as per the requirement of the level of learners and outcome to be achieved. Some of them are improved lecture, tutorial, case method, group discussion, industrial visits, industrial training, field trips, role play, live demonstrations in classrooms, lab, field, project work, self-learning, etc. Use of Information and Communications Technology (ICT) based teaching learning, blended or flipped mode, brainstorming, expert session, video clippings, Online Educational Resources (OER), MOOCs, etc. are the some of the suggestive methods/ strategies to be adopted appropriately.

The relevant instructional/ implementation strategies may be mentioned appropriately as per the requirement of CO.

CO Statement	Suggested Relevant Instructional/ Implementation Strategies	Suggested Required Resources
CO1: Understand number systems, Boolean algebra, and logic gates used in digital systems.	Interactive lectures, tutorial sessions, logic gate demonstrations, ICT-based teaching, self-learning through OER and video lectures	Whiteboard, logic gate trainer kits, digital ICs, multimedia projector, simulation software, reference books

Sample Course Curriculum Detailing Format

CO Statement	Suggested Relevant Instructional/ Implementation Strategies	Suggested Required Resources
CO2: Analyze and simplify combinational logic circuits using Boolean algebra and Karnaugh maps.	Problem-solving tutorials, group discussions, K-map practice sessions, flipped classroom learning	Simulation tools, textbooks, online learning materials
CO3: Design combinational logic circuits such as adders, multiplexers, encoders, and decoders.	Laboratory experiments, mini-project work	Breadboards, IC components, power supply, logic probes, circuit simulation software, lab manuals
CO4: Analyze and design sequential logic circuits including flip-flops, counters, and registers.	Improved lectures, lab-based learning, timing diagram analysis, group assignments, project-based learning	Flip-flop and counter ICs, oscilloscopes, trainer boards, simulation software
CO5: Apply digital logic concepts and simulation tools to solve practical digital system problems.	Project work, industrial visits, expert sessions, ICT-based simulations, brainstorming sessions, self-learning activities	Computer laboratory, simulation software, internet resources, industrial case studies

M) Suggested Learning Resources:

a) Books

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Digital Fundamentals	Thomas L. Floyd	Pearson Education, 11th Edition, ISBN: 9780132737968
2.	Digital Design	M. Morris Mano	Prentice Hall, Latest Edition, ISBN: 9780134549897
3.	Digital Principles and Applications	Donald P. Leach, Albert Paul Malvino, Goutam Saha	Tata McGraw-Hill Education, 8th Edition, ISBN: 9780070141704
4.	An Engineering Approach to Digital Design	William I. Fletcher	Prentice-Hall, Latest Edition, ISBN: 9780132770873

b) Online Open Educational Resources (OER):

1) NPTEL Digital Electronics Courses: https://nptel.ac.in/courses
2) MIT OpenCourseWare – Digital Systems Resources: https://ocw.mit.edu
3) All About Circuits – Digital Electronics Tutorials: https://www.allaboutcircuits.com/textbook/digital/
4) Electronics Tutorials – Digital Logic Tutorials: https://www.electronics-tutorials.ws/logic/logic_1.html
5) Logisim Evolution Digital Logic Simulator: https://github.com/logisim-evolution/logisim-evolution

Sample Course Curriculum Detailing Format

c) Suggested List of Equipment: (For Class Size- 30)

S. No.	Name of the Equipment	Suggested Specifications	Remarks
1.	Digital Logic Trainer Kit	IC-based digital trainer with logic gates, flip-flops, counters, multiplexers, and decoder modules	15 sets (2 students per set)
2.	Breadboard and IC Components Set	Solderless breadboard with TTL/CMOS ICs, LEDs, switches, and connecting wires	Required for circuit implementation
3.	Digital Storage Oscilloscope (DSO)	Dual channel, minimum 50 MHz bandwidth	For waveform and timing analysis
4.	Function Generator	Frequency range up to 5 MHz with square wave output	For clock and pulse generation
5.	Regulated DC Power Supply	Variable DC supply, 0–30V	For powering digital circuits
6.	Digital Multimeter	Auto/manual ranging digital multimeter	For voltage and continuity measurement
7.	Computer Systems	Minimum Core i5 processor, 8 GB RAM	For simulation and digital design software
8.	Digital Logic Simulation Software	Logisim, Multisim, Proteus, or equivalent	For digital circuit simulation
9.	IC Tester	TTL and CMOS IC testing capability	For verification of digital ICs
10.	Projector and Multimedia System	LCD projector with multimedia support	For demonstration and interactive learning

N) (a) Course Curriculum Development Team (Respective Universities)

S. No.	Name and Designation	E-mail Address
1.	Naresh Khatri, Sr. Lecturer	naresh.khatri@khwopa.edu.np
2.		

(b) Course Curriculum Development Team (Academia & Experts)

S. No.	Name and Designation	E-mail Address
1.		
2.		

****

Sample Course Curriculum Detailing Format

A)	**Course Title: Digital Signal Processing (DSP)**	
B)	**Course Code: PCC403**	
C)	**Major Pre- requisite Course (s): Advanced Engineering Mathematics, Signal and Systems, Computer Programming**	

D) Rationale:

Digital Signal Processing (DSP) is a course that teaches how computers and electronic systems analyze, modify, and process signals such as sound, images, videos, and sensor data. It is about converting real-world signals into digital form and improving or analyzing them using mathematical methods and algorithms.

Digital Signal Processing is included in the Electronics Communication and Information Engineering programme because modern electronic and communication systems mainly work skills to process, analyze, transmit and digital signal efficiently.

The main contents of the course cover signals and systems, sampling and reconstruction, discrete-time signal processing, Z-transform, Discrete Fourier transform (DFT), Fast Fourier Transform (FFT), and the design of digital filters such as FIR and IIR filters. It also includes filter design techniques, implementation of DSP systems and applications in communication, audio, image, and video processing.

After completing this course, students will be able to analyze different types of signals and systems, understand the process of converting analog signals into digital form, and apply mathematical tools like Z-transform and Fourier analysis to solve engineering problems. They will also develop the ability to design digital filters, implement basic DSP algorithms using software tools, and simulate signal processing systems

E) Course Outcomes (COs): After the completion of the course, teachers are expected to ensure the attainment of following course outcomes by the learners.

Course Outcomes (COs)	Course Outcome Statements
CO1	Explain the fundamental concepts of signals and systems, including classification of signals and system properties in both continuous and discrete domains.
CO2	Use mathematical tools such as Z-transform to analyze and solve linear time-invariant (LTI) systems in the discrete domain.

Sample Course Curriculum Detailing Format

CO3	Analyze discrete-time signals using time-domain techniques such as convolution and difference equations and evaluate system responses.
CO4	Apply Fast Fourier Transform algorithms such as decimation-in-time (DIT) and decimation-in-frequency (DIF) for efficient computation of DFT.
CO5	Design and implement digital filters, including FIR and IIR filters, using appropriate design techniques using simulation tools.

F) Course Articulation Matrix (CAM):

	Programme Outcomes (POs)											**Programme Specific Outcomes (PSOs)***		
Course Outcomes (COs	**PO1** Engineering Knowledge	**PO2** Problem Analysis	**PO3** Design/ Development of Solutions	**PO4** Investigation	**PO5** Modern Tool Usage	**PO6** The Engineer and The Society	**PO7** Ethics	**PO8** Individual and Collaborative Teamwork	**PO9** Communication	**PO10** Project Management and Finance	**PO11** Life-long Learning	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	-	-	-	-	1	-	-	-	-	-	-
CO2	3	3	2	-	2	-	-	1	-	-	1	2	2	1
CO3	3	3	2	-	2	-	-	1	-	-	2	2	2	1
CO4	3	3	2	-	2	-	-	1	-	-	3	1	2	1
CO5	3	3	3	2	2	-	-	1	-	-	3	2	1	3

Legend: High (3), Medium (2), Low (1) and No mapping (-) Optional (*)

G) Teaching and Examination Scheme:

Board of Studies	**Course Code**	**Course Category**	**CourseTitles**	**Credits (C)**	**Teaching Scheme (Hours)**				**Examination Scheme (Marks)**				**Total Marks**
					L	**T**	**P**	**Total Hours (L+T+P)**	**Theory**		**Practical**		
									ISA	**ESA**	**ISA**	**ESA**	
	403	**PCC**	Digital Signal Processing	**3**	**3**	**1**	**1.5**	**5.5**	**40**	**60**	**25**	**0**	**125**

Legend:
L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

H) Course Curriculum Detailing:

For attainment of course outcomes, the students are expected to perform/ undergo various activities through classroom, laboratories, workshops, any other workplace, term work, field sessions, self- learning assignment etc.

Unique features like green skills, SDGs, multidisciplinary aspects, Love for our own country, motivation for startups, societal connect, renewable energy, etc. are integrated appropriately in the course curriculum document.

I) CO(s) Wise Suggested Contents:

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Contents
CO1	**Unit- 1.0: Discrete time signals and systems** 1.1 Discrete time signal, Basic signal types 1.2 Energy signal, power signal, periodic and aperiodic signal 1.3 Transformation of independent variable 1.4 Discrete time Fourier series and properties 1.5 Discrete time Fourier transform and properties 1.6 Properties of LTI system, Linear time invariant (LTI) system convolution sum and Frequency response of LTI system
CO2	**Unit- 2.0: Z-transform** 2.1 Definition, convergence of Z-transform and region of convergence 2.2 Properties of Z-transform (linearity, time shift, multiplication by exponential sequence, differentiation, time reversal, convolution, multiplication) and Numerical 2.3 Inverse z-transform by long division and partial fraction expansion
CO3	**Unit- 3.0: Analysis of LTI system in frequency domain** 3.1 Frequency response of LTI system, response to complex exponential 3.2 Linear constant co-efficient difference equation and corresponding system function 3.3 Relationship of frequency response to pole-zero of system 3.4 Linear phase of LTI system and its relationship to causality
CO4	**Unit- 4.0: Discrete filter structures and Discrete Fourier Transform** 4.1 FIR filter, Structures for FIR filter (direct form, cascade, frequency sampling, lattice) 4.2 IIR filter, structures for IIR filter (direct form I, direct form II, cascade, lattice, lattice ladder) 4.3 Quantization effect (truncation, rounding), limit cycles and scaling 4.4 Discrete Fourier transform (DFT) representation, properties of DFT (linearity, time shift, frequency shift, conjugation and conjugate symmetry, duality, convolution, multiplication), circular convolution 4.5 Fast Fourier Transform (FFT) algorithm (decimation in time algorithm, decimation in frequency algorithm), Computational complexity of FFT algorithm.
CO5	**Unit- 5.0: Design of FIR and IIR filter** 5.1 Filter design by window method, commonly used windows (rectangular window, Hanning window, Hamming window) 5.2 Filter design by Kaiser window and by frequency sampling method 5.3 Filter design using optimum approximation, Remez exchange algorithm 5.4 Filter design by impulse invariance method and using bilinear transformation 5.5 Design of digital low pass Butterworth filter and Spectral transformation 5.6 Properties of Chebyshev filter, properties of elliptic filter, properties of Bessel filter

J) CO(s) Wise Suggested List of Practicals:

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Laboratory Experiment/ Practicals
CO1	1 Waveform generation of unit impulse, unit step, ramp, exponential, sinusoidal and signum of continuous time signal 2 Waveform generation of unit impulse, unit step, ramp, exponential, sinusoidal and signum discrete time signal
CO2	3 Plot the pole-zero the z-transform of discrete-time signal 4 Plot the region of convergence the z-transform of discrete-time signal
CO3	5 Plot the magnitude response of given differential equation 6 Plot the phase response of given differential equation
CO4	7 Computation of DFT, IDFT using Direct and FFT methods 8 Verification of convolution theorem – comparison circular and linear convolution
CO5	9 Design of LPF using rectangular, Hanning and Hamming, Kaiser windows 10 Design of LPF using impulse invariance method and bilinear transformation

Note: Rubrics need to be prepared for effective performance by each student and their valid and reliable assessment.

K) Suggested In Semester Activities: This may include complex engineering problems, micro projects, seminar, self-learning, industrial/ field visit, assignment etc. It reinforces the development of spectrum of abilities needed for attainment of course outcomes. Complex engineering problems and micro projects need to be provided to learners to develop the problem solving, analytical, critical thinking, creative, investigative, exploring abilities in the learners and to prepare them as future ready work force. MOOCs, spoken tutorials, online educational resources etc. may be used for Self-Learning.

a. Suggested Complex Engineering Problems:

S. No.	Suggested Complex Engineering Problems
1.	Aperiodic discrete-time signals to represent them in the frequency domain
2.	ECG Signal Processing for Biomedical Application
3.	Steganography using DSP Techniques
4.	Design multirate signal processing for Software Radio
5.	Real-Time Audio Noise Reduction System

b. Suggested Micro Projects:

S. No.	Suggested Micro Projects
1.	Real-time DTMF tone detection and decoding system.
2.	Echo cancellation in telecommunication signals
3.	Adaptive noise cancellation
4.	Design and simulate a digital crossover network for audio speakers

Sample Course Curriculum Detailing Format

S. No.	Suggested Micro Projects
5.	Echo cancellation in telecommunication signals

c. Suggested Seminar Topics, Self- Learning Topics, Industrial Visits/ Field Demonstration/ Any other relevant activity, as applicable:

S. No.	Seminar Topics	Self- Learning Topics	Industrial Visits/ Field Demonstration	Any other Relevant Activity
1.	Deep Learning in Speech and Audio Processing	IIR filter design	Nepal Television (NTV) and Radio Nepal Broadcasting	
2.	Biomedical Signal Processing	FFT algorithm	Tribhuvan University Teaching Hospital	
3.	Radar and Sonar Signal Processing	FIR filter design	Tribhuvan International Airport (TIA)	
4.	Array Signal Processing	Lattice structure	Nepal Telecom (NTC)	

L) Suggested Instructional/ Implementation Strategies: Different instructional/ learning/ implementation strategies may be used appropriately, as per the requirement of the level of learners and outcome to be achieved. Some of them are improved lecture, tutorial, case method, group discussion, industrial visits, industrial training, field trips, role play, live demonstrations in classrooms, lab, field, project work, self-learning, etc. Use of Information and Communications Technology (ICT) based teaching learning, blended or flipped mode, brainstorming, expert session, video clippings, Online Educational Resources (OER), MOOCs, etc. are the some of the suggestive methods/ strategies to be adopted appropriately.

The relevant instructional/ implementation strategies may be mentioned appropriately as per the requirement of CO.

CO Statement	Suggested Relevant Instructional/ Implementation Strategies	Suggested Required Resources
CO1: Explain the fundamental concepts of signals and systems, including classification of signals and system properties in both continuous and discrete domains.	Lecturer, Group discussion, Numerical Analysis, Assignment, Unit Test, Lab experiment and field visit	Digital Board, Whiteboard, Marker, MATLAB Software
CO2: Use mathematical tools such as Z-transform to analyze and solve linear time-invariant (LTI) systems in the discrete domain.	Lecturer, Group discussion, Numerical Analysis, Assignment, Unit Test, Lab experiment	Digital Board, Marker, Whiteboard, MATLAB Software
CO3: Analyze discrete-time signals using time-domain	Lecturer, Group discussion, Numerical Analysis, Assignment,	

Sample Course Curriculum Detailing Format

CO Statement	Suggested Relevant Instructional/ Implementation Strategies	Suggested Required Resources
techniques such as convolution and difference equations and evaluate system responses.	Unit Test, Lab experiment and Field visit	Digital Board, Marker, Whiteboard, MATLAB Software
CO4: Apply Fast Fourier Transform algorithms such as decimation-in-time (DIT) and decimation-in-frequency (DIF) for efficient computation of DFT.	Lecturer, Group discussion, Numerical Analysis, Assignment, Unit Test, Lab experiment and Field visit	Digital Board, Marker, Whiteboard, MATLAB Software
CO5: Design and implement digital filters, including FIR and IIR filters, using appropriate design techniques using simulation tools.	Lecturer, Group discussion, Numerical Analysis, Assignment, Unit Test Lab experiment and Field visit	Digital Board, Marker, Whiteboard, MATLAB Software

M) Suggested Learning Resources:

a) Books

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Discrete time signal processing	Alan V. Oppenheim	Pearson Education
2.	Digital Signal Processing	Jhon G. Proakis	Prentice Hall
3.	Digital signal processing	Dr. Sanjay Sharma	S.K. Kataria and sons
4.	Digital Signal processing a computer-based approach	S.K. Mitra	Tata McGraw

b) Online Open Educational Resources (OER):

1) **IIT Madras dsp course**
(https://www.youtube.com/watch?v=zxgobWSMQdg&list=PLUQpHm_JtukLkIO7QB6dp3KITCOM0ChGq)

2) **Nptelhrld electronic dsp course**
(https://www.youtube.com/watch?v=6dFnpz_AEyA&list=PL9567DFCA3A66F299)

3) **Engineering Funda for dsp course**
(https://www.youtube.com/watch?v=qSItUyrRAUM&list=PLgwJf8NK-2e48gQ7yi8K7d4L0gvA4XYKp)

Sample Course Curriculum Detailing Format

c) Suggested List of Equipment: (For Class Size- 30)

S. No.	Name of the Equipment	Suggested Specifications	Remarks
1.	Desktop Computer	64-bit multi-processor	MATLAB software
2.	Memory (RAM)	16 GB	
3.	SSD Card	10 GB	

`

N) (a) Course Curriculum Development Team (Respective Universities)

S. No.	Name and Designation	E-mail Address
1.	Narayan Adhikari Chhetri (Sr. Lecturer)	narayanac@hcoe.edu.np

(b) Course Curriculum Development Team (Academia & Experts)

S. No.	Name and Designation	E-mail Address
1.		
2.		

****

Sample Course Curriculum Detailing Format

A)	**Course Title: Electrical Drives**
B)	**Course Code: PCC 308**
C)	**Major Pre- requisite Course (s): Electrical Machine I, Electric Machine II, Power Electronics**

D) Rationale:

This course is offered to Undergraduate Engineering level designed for Bachelors of Electrical Engineering at Third Year Second Part. The course includes dynamic behavior of DC and AC motor drives, power electronic converters, control strategies, braking methods, and speed control techniques including industrial applications and existing control mechanisms. The course provides students with the knowledge and practical skills required to understand, analyze, select, control, and operate electric motor-driven systems used extensively in industrial, commercial, transportation, and renewable energy applications.

E) Course Outcomes (COs): After the completion of the course, teachers are expected to ensure the attainment of following course outcomes by the learners.

Course Outcomes (COs)	Course Outcome Statements
CO1	Identify the different mechanisms of the given electric drive system.
CO2	Interpret the system dynamics of electric drive system for the given scenario.
CO3	Evaluate the performance and mode of applications of any give DC and AC drive system in the modern industrial systems.
CO4	Understand the Electric Traction System and its applications.
CO5	Select suitable electric motors and drive systems for the given industrial applications.

F) Course Articulation Matrix (CAM):

Course Outcomes (COs	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)*	
	PO1 Engineering Knowledge	**PO2** Problem Analysis	**PO3** Design/ Development of Solutions	**PO4** Investigation	**PO5** Modern Tool Usage	**PO6** The Engineer and The Society	**PO7** Ethics	**PO8** Individual and Collaborative Teamwork	**PO9** Communi cation	**PO10** Project Management and Finance	**PO11** Life-long Learning	**PSO1**	**PSO2**
CO1	3	1	-	-	-	1	-	1	1	-	1	2	2
CO2	3	2	-	1	-	2	-	-	-	-	1	1	1
CO3	3	3	3	2	3	2	-	2	2	-	2	2	2
CO4	3	1	2	2	-	2	-	1	1	-	2	-	-
CO5	3	2	1	2	-	2	-	2	1	-	2	-	-

Sample Course Curriculum Detailing Format

Legend: High (3), Medium (2), Low (1) and No mapping (-) Optional (*)

G) Teaching and Examination Scheme:

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	PCC 308	PCC	Electrical Drives	3	3	1	1.5	5.5	40	60	25		125

Legend:
L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

H) Course Curriculum Detailing: For attainment of course outcomes, the students are expected to perform/ undergo various activities through classroom, laboratories, workshops, any other workplace, term work, field sessions, self- learning assignment etc.

Unique features like green skills, SDGs, multidisciplinary aspects, Love for our own country, motivation for startups, societal connect, renewable energy, etc. are integrated appropriately in the course curriculum document.

I) CO(s) Wise Suggested Contents:

Mapped CO(s) Number	Contents
CO1	**Unit- 1.0: Introduction of Electric Drives and System** 1.1 Concept of electric drives 1.2 Components of electric drive system 1.3 Factors influencing selection of electric drives 1.4 Classification of electric drives 1.5 Advantages of electric drives 1.5 Methods of power transfer 1.6 Control of electric drive
CO2	**Unit- 2.0: Dynamics of Electric Drive** 2.1 Fundamental torque equation of drive system 2.2 Load torque and load characteristics 2.3 Steady state stability of an electric drive 2.4 Transient stability of an electric drive
CO3	**Unit- 3.0: Control of DC Motor Drives**

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Contents
	3.1 Background of DC Drive System 3.1.1 Speed control of DC motors 3.1.2 Braking of DC motors 3.1.3 Four-quadrant operation of DC drives 3.2 Ward Leonard type variable speed drives 3.3 Static Variable DC voltage drives using diodes and/or controlled rectifier 3.4 4- quadrant reversible voltage and power flow drive 3.5 Chopper fed DC drives and closed loop control 3.6 PID speed and torque-controlled drive
	Unit- 4.0: Control of AC Motor Drives 4.1 Background of AC Drive System. 4.1.1 Speed control of induction motors 4.1.1.1 Stator voltage control method 4.1.1.2 Rotor rheostat method 4.1.1.3 Variable frequency drive through inverter and constant Volt-Hertz methods with closed loop control, effect of harmonics produced by Inverter on heating and torque production 4.2 Soft start of AC voltage 4.3 Variable frequency supplies for ac drive 4.4 Slip power recovery schemes 4.5 Introduction to vector control 4.6 Speed control of synchronous motors
CO4	**Unit- 5.0: Electric Traction and Applications** 5.1 Introduction to electric traction 5.1.1 Types of electric traction - self-contained unit system, traction system Fed from a separate distribution line DC and AC supply system 5.1.2 Advantages of electric traction system 5.2 Traction motors and control 5.3 Power supply system for electric traction 5.4 Speed–time curve and performance of trains 5.5 Modern electric traction systems

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Contents
CO5	**Unit – 6.0: Selection and Application of Electric Drives** 6.1 Selection of motor for different applications 6.2 Duty cycles 6.3 Types of enclosures 6.4 Effects of altitude on rated output 6.5 Electric drives used in industrial applications 6.6 Energy conservation in electric drives

J) CO(s) Wise Suggested List of Practicals:

Mapped CO(s) Number	Laboratory Experiment/ Practicals
CO3	1. Analysis of Speed control of DC shunt motor by controlled rectifier 2. Evalution of Speed control of Induction motor by rotor rheostat method 3. Perform Speed control of Induction motor by frequency control method 4. Interpretation of PWM controller for an ac machine 5. Performance analysis of DC motors by using PID controller through simulation
CO5	6. Traction motor characteristics analysis using simulation for DC traction drive 7. Traction motor characteristics analysis using simulation for AC traction drive

Note: Rubrics need to be prepared for effective performance by each student and their valid and reliable assessment.

K) Suggested In Semester Activities: This may include complex engineering problems, micro projects, seminar, self-learning, industrial/ field visit, assignment etc. It reinforces the development of spectrum of abilities needed for attainment of course outcomes. Complex engineering problems and micro projects need to be provided to learners to develop the problem solving, analytical, critical thinking, creative, investigative, exploring abilities in the learners and to prepare them as future ready work force. MOOCs, spoken tutorials, online educational resources etc. may be used for Self-Learning.

a. Suggested Complex Engineering Problems:

S. No.	Suggested Complex Engineering Problems
1.	Analyse and recommend suitable solutions for the frequent failure of Conveyor Belt Drives in a Cement Industry based on ffrequent tripping during startup, excessive heating of motors, belt jerking during loading and voltage dip complaints from nearby feeders.
2.	Design a suitable drive technology for pump drive application in municipal water pumping station considering significant changes in the water demand. Take serious consideration for reduced operational cost and improved supply reliability also.

Sample Course Curriculum Detailing Format

S. No.	Suggested Complex Engineering Problems
3.	Recommend suitable electric drive selection for ropeway transportation in hilly terrain to transport agricultural products.
4.	Analyse the failure of Variable Frequency Drives (VFD) controlled HVAC system in a hospital where electromagnetic interferences with the medical equipment and excessive neutral component in distribution panel is prominent.
5.	Propose regenerative braking strategy for electric public transportation for improving battery efficiency and driving range.

b. Suggested Micro Projects:

S. No.	Suggested Micro Projects
1.	Comparative Study of Motor Starting Methods in Industries
2.	Design and Simulation of a VFD-Based Pump Drive System
3.	Demonstrate Speed Control of DC Motor Using PWM Technique through simulation
4.	Analysis of Electric Drives Used in Electric Vehicles (EVs)
5.	Design PLC-Based Conveyor Belt Motor Control System

c. Suggested Seminar Topics, Self- Learning Topics, Industrial Visits/ Field Demonstration/ Any other relevant activity, as applicable:

S. No.	Seminar Topics	Self- Learning Topics	Industrial Visits/ Field Demonstration	Any other Relevant Activity
1.	Modern Trends in Electric Drive Technology	Industrial Applications of Different Types of Electric Drives	Visit to a Cement Industry for Conveyor and Crusher Drive Systems	Industrial Drive System Case Study Competition
2.	Variable Frequency Drives (VFDs) in Industrial Applications	Basics of Power Electronic Converters Used in Drives	Visit to a Cement Industry for Conveyor and Crusher Drive Systems	Group-Based Simulation of Motor Drive Systems
3.	Electric Drives Used in Electric Vehicles (EVs)	Electric Drives Used in Nepalese Industries	Visit to an Electric Vehicle Charging and Service Center	Electric Drive Fault Diagnosis Workshop
4.	Harmonics and Power Quality Issues in Electric Drives	Regenerative Braking Techniques	Visit to an Industrial Automation Facility	Field Survey and Documentation of Electric Drives in Local Industries

L) Suggested Instructional/ Implementation Strategies: Different instructional/ learning/ implementation strategies may be used appropriately, as per the requirement of the level of learners and outcome to be achieved. Some of them are improved lecture, tutorial, case method, group discussion, industrial visits, industrial training, field trips, role play, live demonstrations in classrooms, lab, field, project work, self-learning, etc. Use of Information and Communications

Sample Course Curriculum Detailing Format

Technology (ICT) based teaching learning, blended or flipped mode, brainstorming, expert session, video clippings, Online Educational Resources (OER), MOOCs, etc. are the some of the suggestive methods/ strategies to be adopted appropriately.

The relevant instructional/ implementation strategies may be mentioned appropriately as per the requirement of CO.

CO Statement	Suggested Relevant Instructional/ Implementation Strategies	Suggested Required Resources
CO1	Interactive lectures using block diagrams and system decomposition, think-pair activities, flipped classroom, Audio and Video Lectures	Interactive board, Experimental setup, worksheets, Simulation software.
CO2	Simulation-based learning, Case-based discussion, lab demonstrations, Graphical interpretation, Problem-based learning	Interactive board, Simulation software, industrial case studies, Printed system response graphs
CO3	Comparative analysis workshops, case study evaluation sessions, group presentations, Field-based learning	Industry case study documents, Manufacturer catalogs, technical specification sheets of motors and drives
CO4	Video-based learning, Block diagram explanation, Case studies, Seminar-based learning, Group discussions	Electric traction system diagrams, Audio, Videos, Simulation models,
CO5	Design-oriented problem-based learning, comparative evaluation exercises, Industrial scenario simulations, real industry-based system design, Field-based assignments	application-specific case studies, Load characteristic charts, Simulation tools, Motor selection catalogues and datasheets

M) Suggested Learning Resources:

a) Books

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Utilization of electric power and electric traction	Gupta, J.B.	S.K. Kataria & Sons Publishing House, ISBN-10: 9350142589
2.	Power electronics (Latest Edition)	Bimbhra, P.S.	Khanna Publishers. ISBN-10: 8195123120
3.	Basics of electrical drives	Pillai, S.K.	New Age International Pvt. Ltd., ISBN-10: 1781830118
4.	Fundamentals of electrical drives (Latest Edition)	Dubey, G.K.	Narosa Publishing House, ISBN-10: 8173194289
5.	Electric Motor Drives: Modeling, Analysis, and Control	Krishnan, R	Prentice Hall., ISBN-10: 0130910147

Sample Course Curriculum Detailing Format

b) Online Open Educational Resources (OER):

1) NPTEL (National Programme on Technology Enhanced Learning – India
2) MIT Open Courseware (OCW)

c) Suggested List of Equipment: (For Class Size- 30)

S. No.	Name of the Equipment	Suggested Specifications	Remarks
1.	DC Shunt Motor	Rating: 0.5–2 HP (or 0.37–1.5 kW) Voltage: 220 V DC Type: Separately excited / shunt wound Speed: 1000–1500 rpm Field supply: Independent DC excitation	
2.	Controlled Rectifier Unit	Type: Fully controlled 1-phase or 3-phase bridge Devices: SCR-based (thyristor) Input: 230 V AC / 415 V AC Output: 0–220 V DC adjustable Firing control: Phase angle control module	
3.	Measurement Instruments	DC voltmeter: 0–300 V DC ammeter: 0–10 A Tachometer: 0–3000 rpm (digital preferred) CRO / DSO: ≥ 20 MHz bandwidth	
4.	Variable Frequency Drive (VFD)	Input: 3-phase 415 V AC Output: 0–415 V AC, variable frequency (0–50/60/100 Hz) Control modes: V/f control, scalar control Power rating: matching motor (1–3 HP)	
5.	PWM Inverter Trainer Kit	Type: IGBT/Mosfet-based inverter Input: 230 V AC single-phase / DC link supply Output: 3-phase PWM AC Switching frequency: 2–20 kHz adjustable Modulation: SPWM / SVPWM selectable	
6.	Three-Phase Induction Motor	Rating: 1–3 HP Voltage: 415 V, 3-phase Type: Squirrel cage/Slip Ring Frequency: 50 Hz base	

N) (a) Course Curriculum Development Team (Respective Universities)

S. No.	Name and Designation	E-mail Address
1.	Rakesh Gwachha	gwachha.rakesh@khwopa.edu.np
2.	Rabin Shrestha	rabin@acem.edu.np

Sample Course Curriculum Detailing Format

(b) Course Curriculum Development Team (Academia & Experts)

S. No.	Name and Designation	E-mail Address
1.	Akhileshwor Mishra	akhileshwar@ioe.edu.np
2.	Lalit Bikram Rana	

****

Sample Course Curriculum Detailing Format

A)	**Course Title: Electronics Devices and Circuits**	
B)	**Course Code: PCC151**	
C)	**Major Pre- requisite Course (s): Fundamentals of Electrical and Electronics**	

D) Rationale:

Electronics Devices and Circuits is a foundational course that introduces semiconductor devices, transistor circuits, amplifiers, oscillators, operational amplifiers, power amplifiers, and voltage regulator circuits.

This course provides fundamental knowledge required for analysis, design, and implementation of analog electronic systems used in communication, instrumentation, embedded systems, automation, and VLSI applications.

The course develops analytical and practical skills required in electronics design, troubleshooting, maintenance, circuit simulation, and hardware development industries.

In these major topics included are BJT, MOSFET, FET amplifiers, oscillators, operational amplifiers, power amplifiers, voltage regulators, IC timers, differential amplifiers, and power supplies.

After completion, learners will be able to analyze electronic circuits, design basic analog systems, perform laboratory experiments, and apply semiconductor device concepts in engineering applications.

E) Course Outcomes (COs): After the completion of the course, teachers are expected to ensure the attainment of following course outcomes by the learners.

Course Outcomes (COs)	Course Outcome Statements
CO1	Analyze the operation and characteristics of semiconductor devices including BJT and FET circuits.
CO2	Analyze transistors amplifier circuits using suitable biasing techniques.
CO3	Design operational amplifiers and oscillators in analog electronic circuit applications.
CO4	Analyze power amplifiers and output stages for practical electronic systems.
CO5	Design voltage regulator circuits for given applications and execute laboratory experiments, analyze measured data, and prepare technical reports related to electronic devices and circuits.

F) Course Articulation Matrix (CAM):

Sample Course Curriculum Detailing Format

Course Outcomes (COs	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)*	
	PO1 Engineering Knowledge	**PO2** Problem Analysis	**PO3** Design/ Development of Solutions	**PO4** Investigation	**PO5** Modern Tool Usage	**PO6** The Engineer and The Society	**PO7** Ethics	**PO8** Individual and Collaborative Teamwork	**PO9** Communi cation	**PO10** Project Management and Finance	**PO11** Life-long Learning	**PSO1**	**PSO2**
CO1	3	2	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	2	2	2	-	-	1	1	-	1	3	2
CO3	2	2	3	2	2	-	-	1	1	-	1	3	2
CO4	3	2	2	2	2	1	1	1	1	1	1	2	3
CO5	2	2	2	3	3	1	1	2	2	1	2	2	2

Legend: High (3), Medium (2), Low (1) and No mapping (-) Optional (*)

G) Teaching and Examination Scheme:

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	PCC151		Electronics Devices and Circuits	3	3	1	3	7	40	60	50	-	150

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

H) Course Curriculum Detailing: For attainment of course outcomes, the students are expected to perform/ undergo various activities through classroom, laboratories, workshops, any other workplace, term work, field sessions, self- learning assignment etc.

Unique features like green skills, SDGs, multidisciplinary aspects, Love for our own country, motivation for startups, societal connect, renewable energy, etc. are integrated appropriately in the course curriculum document.

I) CO(s) Wise Suggested Contents:

Mapped CO(s) Number	Contents
CO1	Unit 1: Bipolar Junction Transistor 1.1 BJT operation 1.2 Transistor characteristics 1.3 DC analysis 1.4 Load line analysis 1.5 BJT amplifier parameters

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Contents
	1.6 Biasing techniques 1.7 Small signal models 1.8 Amplifier configurations 1.9 Switching applications
CO2	Unit 2: Field Effect Transistor 2.1 JFET structure and operation 2.2 MOSFET operation 2.3 MOSFET characteristics 2.4 Depletion MOSFET 2.5 MOS biasing 2.6 MOSFET amplifier 2.7 CMOS logic circuits
CO3	Unit 3: Operational Amplifier and Oscillators 3.1 Sinusoidal oscillators 3.2 Op-amp oscillator circuits 3.3 LC and crystal oscillators 3.4 555 timer circuits 3.5 Precision rectifiers 3.6 Differential amplifiers 3.7 The Widlar Current Sources 3.8 Active loads
CO4	Unit 4: Power Amplifiers and Regulators 4.1 Output stage classification 4.2 Class A amplifier 4.3 Class B amplifier 4.4 Class AB amplifier 4.5 Power BJTs 4.6 Push-pull amplifier 4.7 Tuned amplifiers
CO4,CO5	Unit 5: Power Supplies and Voltage Regulators 5.1 Unregulated supply 5.2 Zener regulator 5.3 Voltage references 5.4 Series/shunt regulator 5.5 Feedback regulators 5.6 IC regulators

J) CO(s) Wise Suggested List of Practicals:

Mapped CO(s) Number	Laboratory Experiment/ Practicals
CO1	1 Performance of Diode Characteristics and Rectifier Circuits 2 Analysis of Zener Diode Characteristics and Voltage Regulation
CO2, CO3	3 performance of Bipolar Junction Transistor (BJT) Characteristics 4 Design and Analysis of Single Stage BJT Amplifier 5 Performance of Field Effect Transistor (FET) Characteristics

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Laboratory Experiment/ Practicals
	6 Design and Analysis of FET Amplifier Circuits
CO3	7 Implementation of Relaxation Oscillator Circuit 8 Design and Analysis of Wien Bridge Oscillator 9 Design and Analysis of Phase Shift Oscillator 10 Implementation of Multivibrator using 555 Timer IC
CO4	11 Study and Performance Analysis of Power Amplifiers 12 Design and Analysis of Series and Shunt Voltage Regulators 13 Performance of IC Voltage Regulator Circuits
CO5	14 Project presentation and report preparation

Note: Rubrics need to be prepared for effective performance by each student and their valid and reliable assessment.

K) Suggested In Semester Activities: This may include complex engineering problems, micro projects, seminar, self-learning, industrial/ field visit, assignment etc. It reinforces the development of spectrum of abilities needed for attainment of course outcomes. Complex engineering problems and micro projects need to be provided to learners to develop the problem solving, analytical, critical thinking, creative, investigative, exploring abilities in the learners and to prepare them as future ready work force. MOOCs, spoken tutorials, online educational resources etc. may be used for Self-Learning.

a. Suggested Complex Engineering Problems:

S. No.	Suggested Complex Engineering Problems
1.	Design a transistor amplifier for low-noise audio applications
2.	Analyze thermal stability of BJT biasing circuits
3.	Design a regulated DC power supply using Zener and IC regulator
4.	Compare efficiency of Class A, B, and AB amplifiers
5.	Design an oscillator circuit for signal generation applications

b. Suggested Micro Projects:

S. No.	Suggested Micro Projects
1.	Mini audio amplifier
2.	Automatic night lamp using transistor switch
3.	Regulated power supply design

Sample Course Curriculum Detailing Format

S. No.	Suggested Micro Projects
4.	LED flasher using 555 timer
5.	Low-frequency oscillator circuit

c. Suggested Seminar Topics, Self- Learning Topics, Industrial Visits/ Field Demonstration/ Any other relevant activity, as applicable:

S. No.	Seminar Topics	Self- Learning Topics	Industrial Visits/ Field Demonstration	Any other Relevant Activity
1.	CMOS Technology	Modern semiconductor fabrication	Electronics industry visit	
2.	Operational Amplifier Applications	IC fabrication basics	PCB manufacturing	
3.	Power Electronics Devices	Advanced MOSFET applications	Power supply maintenance	
4.	Analog IC Design	Simulation using Multisim/LTSpice	Instrumentation lab visit	

L) Suggested Instructional/ Implementation Strategies: Different instructional/ learning/ implementation strategies may be used appropriately, as per the requirement of the level of learners and outcome to be achieved. Some of them are improved lecture, tutorial, case method, group discussion, industrial visits, industrial training, field trips, role play, live demonstrations in classrooms, lab, field, project work, self-learning, etc. Use of Information and Communications Technology (ICT) based teaching learning, blended or flipped mode, brainstorming, expert session, video clippings, Online Educational Resources (OER), MOOCs, etc. are the some of the suggestive methods/ strategies to be adopted appropriately.
The relevant instructional/ implementation strategies may be mentioned appropriately as per the requirement of CO.

CO Statement	Suggested Relevant Instructional/ Implementation Strategies	Suggested Required Resources
Analyze the operation and charcterstics of semiconductor devices including BJT and diodes circuits.	Interactive lectures, tutorial problem solving, graphical analysis, live circuit demonstrations	Whiteboard, semiconductor trainer kits, CRO/DSO
Analyze and design BJT and MOSFET amplifier circuits using	Lecture discussion method, numerical tutorials, laboratory implementation	Breadboard, BJT/MOSFET kits, DC power supply,

Sample Course Curriculum Detailing Format

CO Statement	Suggested Relevant Instructional/ Implementation Strategies	Suggested Required Resources
suitable biasing techniques.		function generator
Apply operational amplifiers and oscillators in analog electronic circuit applications.	Lecture discussion method, tutorials, laboratory implementation	Opamp ICs ,555 timer ICs, oscillators kits, CRO, waveform generator,
Analyze power amplifier ,output stages and voltage regulator circuits for practical electronic systems.	Group assignment ,laboratory experimentation	Power amplifiers trainers kits, voltage regulators ICs, heat sink , transformers, regulated power supplies, testing instruments
Perform laboratory experiments, analyze measured data, and prepare technical reports related to electronic devices and circuits.	Hands on laboratory work, project presentation, peer learning	Laboratory manuals, computers system, internet, presentation tools

M) Suggested Learning Resources:

a) Books

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Microelectronic Circuits	Sedra & Smith	Oxford University Press
2.	Electronic Devices and Circuit Theory	Boylested & Nashelsky	Pearson
3.	Electronic Devices	Thomas Floyd	Pearson
4.	Integrated Electronics	Milimam & Halkias	Tata McGraw Hill

b) Online Open Educational Resources (OER):

Sample Course Curriculum Detailing Format

1) NEPTEL -Basic Electronics:- https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_ee74
2) Electronics Tutorials :-https://www.electronics-tutorials.ws/amplifier/amp_1.html
3) Electronics Tutorials:- https://www.electronics-tutorials.ws/transistor/tran_1.html

c) Suggested List of Equipment: (For Class Size- 30)

S. No.	Name of the Equipment	Suggested Specifications	Remarks
1.	CRO/DSO	30 MHz or above	Electronics Lab
2.	Function Generator	1 MHz or above	Signal Generation
3.	Regulated DC power Supply	0-30 V	Lab experiments
4.	Active and Passive Components	Resistors, Capacitors, Leds, BJT, Mosfet, IC's	Practical Use
5.	Breadboard Kit	Standard	Circuit Prototyping
6.	Digital Multimeter	Auto-ranging	Measurements

N) (a) Course Curriculum Development Team (Respective Universities)

S. No.	Name and Designation	E-mail Address
1.	Amit Kumar Rauniyar/Senior Assistant Professor	amitkumar.rauniyar@acem.edu.np
2.		

(b) Course Curriculum Development Team (Academia & Experts)

S. No.	Name and Designation	E-mail Address
1.		
2.		

****

Sample Course Curriculum Detailing Format

A)	**Course Title: Wireless Communication**	**University Logo**
B)	**Course Code:**	
C)	**Major Pre- requisite Course (s):**	

D) Rationale:

This course introduces the principles, analysis, design, and performance evaluation of modern wireless communication systems and networks.

This course is included to provide communication engineering students with theoretical and practical knowledge of wireless technologies that are essential for modern communication systems and industry applications.

This course helps graduates develop the ability to analyze, design, simulate, and optimize wireless communication systems used in cellular networks and emerging wireless technologies.

The course covers wireless propagation, fading, cellular systems, link analysis, network design, performance evaluation, and simulation of wireless systems, enabling learners to analyze and apply modern wireless communication techniques for real-world engineering problems

E) Course Outcomes (COs): After the completion of the course, teachers are expected to ensure the attainment of following course outcomes by the learners.

Course Outcomes (COs)	Course Outcome Statements
CO1	Use relevant mathematical principles to analyze the given parameters of wireless networks.
CO2	Evaluate wireless communication links and cellular network parameters to meet the given performance requirements.
CO3	Apply simulation techniques for modeling, analysis, and optimization of wireless communication systems.
CO4	Compare the design requirements and performance characteristics of different wireless networks.
CO5	Analyze modern wireless communication technologies, standards, and emerging trends for contemporary communication engineering applications.

Sample Course Curriculum Detailing Format

Course Outcomes(COs)	Programme Outcomes(POs)											Programme Specific Outcomes (PSOs)		
	PO-1 Engineering Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Conduct Investigations of Complex Problems	PO-5 Engineering Tool Usage	PO-6 The Engineer and the World	PO-7 Ethics	PO-8 Individual and collaborative Team Work	PO-9 Communication	PO- 10 Project Management and Finance	PO-11 Life-long Learning	PSO-1	PSO-2	PSO-3
CO-1	3	3	1	2	1	-	-	-	1	-	1	2	2	1
CO-2	3	3	2	2	1	-	-	-	1	1	1	3	3	1
CO-3	3	2	3	3	3	1	-	1	1	1	2	2	3	3
CO-4	3	3	2	1	1	-	-	-	1	-	1	2	2	1
CO-5	3	3	3	1	1	3	2	1	1	2	2	1	2	2

PSO-1: Test and implement practical engineering solutions using laboratories and modern simulation tools for real-world applications.

PSO-2: Provide students with exposure to research and real-world engineering practices through departmental conferences, academia–industry interactions, industrial engagement, and annual student project exhibition.

PSO-3: Develop students' ability to design and implement analog and digital electronics, computing, communication, and intelligent control systems for modern communication system through project-based learning and major engineering projects from the first year of the programme.

F) Course Articulation Matrix (CAM):

Legend: High (3), Medium (2), Low (1) and No mapping (-) Optional (*)

G) Teaching and Examination Scheme:

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	ETEG 432	PCC	Wireless Communication	3	3	1	2	3	50	50	80	20	200

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

H) Course Curriculum Detailing:

For attainment of course outcomes, the students are expected to perform/ undergo various activities through classroom, laboratories, workshops, any other workplace, term work, field sessions, self- learning assignment etc.

Unique features like green skills, SDGs, multidisciplinary aspects, Love for our own country, motivation for startups, societal connect, renewable energy, etc. are integrated appropriately in the course curriculum

Sample Course Curriculum Detailing Format

document.

I) CO(s) Wise Suggested Contents:

Mapped CO(s) Number	Contents
CO1	**Unit- 1.0:** 1.1 Probability and random processes for wireless system 1.2 Wireless channel modelling 1.3 Signal and power in wireless channel 1.4 Statistical characterization of channels 1.5 Shannon capacity
CO2	**Unit- 2.0:** 2.1 Wireless link budget analysis. 2.2 Cellular network planning 2.3 Coverage and capacity analysis 2.4 Cellular network planning 2.5 QoS and performance matrix
CO3	**Unit- 3.0:** 3.1 Introduction to simulation tools 3.2 Optimization of wireless system…….. 3.3 ……. 3.4 …….
CO4	**Unit- 4.0:** 4.1 Evolution of wireless technologies 4.2 Multiple access techniques 4.3 Architecture and protocols of different wireless networks (1G to 5G)
CO5	**Unit- 5.0:** 5.1 Beyond 5G and 6G vision 5.2 IoT 5.3 AI and ML in wireless communication 5.4 SDN and network virtulization

J) CO(s) Wise Suggested List of Practicals:

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Laboratory Experiment/ Practicals
CO1	1 Path loss models using matlab 2 Fading models using matlab
CO2	3 Link budget calculation (uplink/download) 4 Cellular coverage analysis 5 Capacity analysis based on Earlang calculation
CO3	6 Monte carlo simulation lab 7 NS3 simulation lab
CO4	8 FDMA and OFDMA comparision 9 Simulation effect of cell sectoring and splitting
CO5	10 Atoll simulation of 5G networks

Note: Rubrics need to be prepared for effective performance by each student and their valid and reliable assessment.

K) Suggested In Semester Activities: This may include complex engineering problems, micro projects, seminar, self-learning, industrial/ field visit, assignment etc. It reinforces the development of spectrum of abilities needed for attainment of course outcomes. Complex engineering problems and micro projects need to be provided to learners to develop the problem solving, analytical, critical thinking, creative, investigative, exploring abilities in the learners and to prepare them as future ready work force. MOOCs, spoken tutorials, online educational resources etc. may be used for Self-Learning.

a. Suggested Complex Engineering Problems:

S. No.	Suggested Complex Engineering Problems
1.	Performance analysis and study of 4G networks in Banepa Area considering urban population increment trend based on the latest census and the service demand trend
2.	
3.	
4.	
5.	

b. Suggested Micro Projects:

S. No.	Suggested Micro Projects
1.	Using mobile app, analyse the received power from different cells for every hour and present the analysis report for Friday and Saturday busy hours, also note handoff between cells and between networks

Sample Course Curriculum Detailing Format

S. No.	Suggested Micro Projects
2.	
3.	
4.	
5.	

c. Suggested Seminar Topics, Self- Learning Topics, Industrial Visits/ Field Demonstration/ Any other relevant activity, as applicable:

S. No.	Seminar Topics	Self- Learning Topics	Industrial Visits/ Field Demonstration	Any other Relevant Activity
1.			Field visit to ISP & MSC for observation and interaction	
2.				
3.				
4.				

L) Suggested Instructional/ Implementation Strategies: Different instructional/ learning/ implementation strategies may be used appropriately, as per the requirement of the level of learners and outcome to be achieved. Some of them are improved lecture, tutorial, case method, group discussion, industrial visits, industrial training, field trips, role play, live demonstrations in classrooms, lab, field, project work, self-learning, etc. Use of Information and Communications Technology (ICT) based teaching learning, blended or flipped mode, brainstorming, expert session, video clippings, Online Educational Resources (OER), MOOCs, etc. are the some of the suggestive methods/ strategies to be adopted appropriately.
The relevant instructional/ implementation strategies may be mentioned appropriately as per the requirement of CO.

CO Statement	Suggested Relevant Instructional/ Implementation Strategies	Suggested Required Resources

M) Suggested Learning Resources:

a) Books

Sample Course Curriculum Detailing Format

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Wireless Communications: Principles and Practice	Theodore S. Rappaport	Pearson, 2nd Edition, ISBN: 978-0130422323
2.	Fundamentals of Wireless Communication	David Tse, Pramod Viswanath	Cambridge University Press
3.	Modern Wireless Communications	Simon Haykin, Michael Moher	Pearson
4.			

b) Online Open Educational Resources (OER):

1) …….
2) …….
3) …….

c) Suggested List of Equipment: (For Class Size- 30)

S. No.	Name of the Equipment	Suggested Specifications	Remarks
1.	Computers with simulation software	Matlab, Atoll, NS3	
2.			
3.			
4.			

N) (a) Course Curriculum Development Team (Respective Universities)

S. No.	Name and Designation	E-mail Address
1.	Anup Thapa	xanupx@gmail.com
2.		

(b) Course Curriculum Development Team (Academia & Experts)

S. No.	Name and Designation	E-mail Address
1.		
2.		

****

Curriculum Detailing Format

A)	**Course Title: Digital Signal Processing**
B)	**Course Code: BEC7026**
C)	**Major Pre- requisite Course (s): Signal & System, Filter Design**

D) Rationale:

Digital Signal Processing is a branch of engineering and computer science that deals with the analysis, modification, and synthesis of signals using digital techniques and algorithms. Digital Signal Processing plays a vital role in modern technology including mobile communication, audio and video systems, medical instruments, robotics, radar systems, artificial intelligence, and embedded systems. The Digital Signal Processing course is important because it provides the fundamental concepts and practical techniques required to process real-world signals efficiently and accurately. The course helps students understand how digital systems manipulate signals for filtering, compression, transmission, enhancement, and analysis. After successful completion of this course, learners will be able to develop problem solving and analytical skills related to digital signal and system.

E) Course Outcomes (COs): After the completion of the course, students will be able to:

Course Outcomes (COs)	Course Outcome Statements
CO1	Evaluate digital signal using given mathematical and computational techniques.
CO2	Select the relevant frequency transformation technique for the given practical application.
CO3	Develop digital signal processing solution for the given real-world applications.
CO4	Design relevant digital filters with the given specification for varying operational conditions.
CO5	Use MATLAB software to simulation, test, and implement digital signal processing systems.

F) Course Articulation Matrix (CAM):

Course	Programme Outcomes(POs)	Programme Specific Outcomes (PSOs)

Curriculum Detailing Format

Outcomes (COs)	PO-1 Engineering Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Conduct Investigations of Complex Problems	PO-5 Engineering Tool Usage	PO-6 The Engineer and the World	PO-7 Ethics	PO-8 Individual and collaborative Team Work	PO-9 Communication	PO- 10 Project Management and Finance	PO-11 Life-long Learning	PSO-1	PSO-2	PSO-2
CO-1	3	3	1	2	2	1	-	1	-	-	2	2	2	2
CO-2	3	3	3	3	2	2	1	1	2	1	3	2	3	2
CO-3	3	3	3	3	3	2	2	1	-	1	3	3	3	3
CO-4	3	3	3	3	3	1	1	2	1	1	3	3	3	3
CO-5	1	3	3	3	3	2	1	1	2	2	3	1	1	2

Legend: High (3), Medium (2), Low (1) and No mapping (-) Optional (*)

G) Teaching and Examination Scheme:

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	BEC7026	PCC	Digital Signal Processing	3	3	2	1.5	6.5	40	25	60		125

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

H) Course Curriculum Detailing:

For attainment of course outcomes, the students are expected to perform/ undergo various activities through classroom, laboratories, workshops, any other workplace, term work, field sessions, self- learning assignment etc.

Unique features like green skills, SDGs, multidisciplinary aspects, Love for our own country, motivation for startups, societal connect, renewable energy, etc. are integrated appropriately in the course curriculum document.

I) CO(s) Wise Suggested Contents:

Mapped CO(s) Number	Contents
CO1, CO5	**Unit- 1.0: Discrete Signals and systems:** 1.1 Basic Elements of DSP system, application of DSP 1.2 Basic Elementary signals - unit impulse signal, unit step signal, ramp signal exponential signal, sinusoidal signal 1.3 Classification of discrete signals – analog and digital signals, deterministic and random signals, periodic and aperiodic signals, even and odd signals and energy and power signals

Curriculum Detailing Format

Mapped CO(s) Number	Contents
	1.4 Transformation of independent variable – Time shifting, Amplitude scaling, Time scaling, Time inversion and Combined Operations 1.5 Discrete time system, Classification- static and dynamic systems, time variant and time invariant systems, linear and nonlinear systems, causal and noncausal systems, stable and unstable systems 1.6 Analysis of Discrete time LTI systems - Convolution summation of discrete systems, response to discrete inputs 1.7 Properties of Convolution – Commutative property, Associative property, Distributive property 1.8 Causality and Stability of LTI system
CO2, CO3, C05	**Unit- 2.0: Frequency transformations properties and application** 2.1 Definition of the Z-transform and its applications, Region of convergence, relationship to causality 2.2 Inverse Z-transform – by Power series expansion, by partial fraction expansion 2.3 Z-transform properties – Linearity, Time shift, Scaling, Conjugation, Convolution, Differentiation, Parseval's theorem 2.4 Analysis of LTI systems in z domain - transient and steady state sinusoidal response, pole-zero relationships, stability 2.5 Solution of difference equations using the z-transform 2.6 The discrete Fourier transform (DFT) definition and application, frequency domain sampling theorem 2.7 DFT as a Linear Transformation, Properties of the DFT- Linearity, Periodicity, symmetry, Multiplication of two DFTs and Circular convolution, Circular time shift, time reversal, Circular time shift, Complex conjugate and Parseval's Theorem **2.8** Efficient Computation of the DFT : Radix-2 Algorithm, DIF, DIT, Applications of FFT Algorithms **2.9** Application of FFT in Frequency Domain signal Analysis
CO3, CO4, C05	**Unit- 3.0: Realization and design of Digital Filter** 3.1 FIR filter Structures - Direct Form structure, Cascaded form structure and Linear Phase structure 3.2 IIR filter structures - Direct Form structures, Cascaded form structure and Parallel structure 3.3 Lattice structure- Lattice structures for FIR system, Lattice and Lattice Ladder structures for IIR systems, Conversion from Direct form to lattice and vice versa 3.4 Digital filters, finite precision implementations of discrete filters

Curriculum Detailing Format

Mapped CO(s) Number	Contents
	3.5 Introduction, Classical filter design using polynomial approximations - Butterworth, Chebyshev 3.6 IIR filter design by transformation -Impulse-Invariant Transform, Matched Z-Transform and Bilinear Transformation 3.7 Application of the bilinear transformation to IIR lowpass discrete filter design 3.8 Spectral transformations in Digital Domain – low pass to (low pass, high pass, band pass and band stop) transformation 3.9 FIR filter design by Fourier approximation, the complex Fourier series method, Gibbs phenomena in FIR filter design approximations 3.10 Applications of window functions - Rectangular window, Triangular window, Hanning Window, Hamming Window and Kaiser windows 3.11 FIR filter design by the frequency sampling method – Type I Design and Type II Design 3.12 Design of Optimum method for FIR filters-Park-McClellan Algorithm
CO3, C05	**Unit- 4.0: Analysis of finite word length effects and digital processers** 4.1 Representation of Numbers, fixed and binary floating-point numbers, effect of rounding and truncation, limit cycle oscillations effect 4.2 Scaling and noise in digital filters, finite quantized signals, quantization error, linear models 4.3 DSP processor and Applications

J) CO(s) Wise Suggested List of Practical:

Mapped CO(s) Number	Laboratory Experiment/ Practicals
CO1, C05	1. Basic signals – Unit impulse signal, Unit step signal, Ramp signal, Sinusoidal Signal, Exponential signal and square signal 2. Compute even and odd parts of signal
CO2, CO3	1. Implement Convolution Sum for different sequences 2. Apply convolution in real-world problems
CO2, CO3	1. Computations of z-transform and Inver z-transform functions 2. verifications the properties of z-transform 3. Frequency response and pole zero plot of differential equation

Curriculum Detailing Format

Mapped CO(s) Number	Laboratory Experiment/ Practicals
CO2, CO3	1. Compute 4-point and 8-point DFT and investigate their magnitude response 2. Apply Different Properties of DFT 3. Investigate Application of FFT
CO4	1. Determination of Lattice ladder parameters from Direct form transfer function of IIR 2. Design an IIR lowpass filter using Impulse Invariant Method 3. Design an IIR lowpass filter using Bilinear Transformation
C04	1. Design FIR filter using Rectangular, Hamming, Hamming windowing method and compare them.
C05	1. Real-Time Audio Signal Loopback and Visualization

Note: Rubrics need to be prepared for effective performance by each student and their valid and reliable assessment.

K) Suggested In Semester Activities: This may include complex engineering problems, micro projects, seminar, self-learning, industrial/ field visit, assignment etc. It reinforces the development of spectrum of abilities needed for attainment of course outcomes. Complex engineering problems and micro projects need to be provided to learners to develop the problem solving, analytical, critical thinking, creative, investigative, exploring abilities in the learners and to prepare them as future ready work force. MOOCs, spoken tutorials, online educational resources etc. may be used for Self-Learning.

a. Suggested Complex Engineering Problems:

S. No.	Suggested Complex Engineering Problems
1.	Design an FIR-based system to adjust specific frequency bands (bass, mid, treble) for a live audio stream.
2.	Implement a digital filter to remove 50/60 Hz power line interference and muscle artifacts from a medical ECG signal.
3.	Create a system using the Goertzel algorithm or DFT to identify touch-tone frequencies in telecommunication signals.
4.	
5.	

b. Suggested Micro Projects:

S. No.	Suggested Micro Projects
1.	Use 2D convolution principles to enhance edges in a digital image.
2.	Generate a melody by synthesizing sinusoidal signals of different frequencies and durations.

Curriculum Detailing Format

S. No.	Suggested Micro Projects
3.	Simulate an adaptive filter that removes acoustic echoes from a microphone input.
4.	Build a MATLAB GUI that displays the real-time frequency spectrum of a voice recording using FFT.
5.	

c. Suggested Seminar Topics, Self- Learning Topics, Industrial Visits/ Field Demonstration/ Any other relevant activity, as applicable:

S. No.	Seminar Topics	Self- Learning Topics	Industrial Visits/ Field Demonstration	Any other Relevant Activity
1.	Applications of DSP in 5G.	Wavelet Transform Basics.	Telecommunication Hub (BTS/MSC)	
2.		FPGA Implementation of DSP.	Medical Imaging Center (MRI/CT)	
3.		Machine Learning for DSP.		

L) Suggested Instructional/ Implementation Strategies: Different instructional/ learning/ implementation strategies may be used appropriately, as per the requirement of the level of learners and outcome to be achieved. Some of them are improved lecture, tutorial, case method, group discussion, industrial visits, industrial training, field trips, role play, live demonstrations in classrooms, lab, field, project work, self-learning, etc. Use of Information and Communications Technology (ICT) based teaching learning, blended or flipped mode, brainstorming, expert session, video clippings, Online Educational Resources (OER), MOOCs, etc. are the some of the suggestive methods/ strategies to be adopted appropriately.

The relevant instructional/ implementation strategies may be mentioned appropriately as per the requirement of CO.

CO Statement	Suggested Relevant Instructional/ Implementation Strategies	Suggested Required Resources
Evaluate digital signal using given mathematical and computational techniques.	Improved Lecture & Problem-Based Learning: Focus on mathematical derivations for signal classification and LTI system analysis. Use brainstorming for transformation properties.	MATLAB, Scientific Calculators, Notes, and MATLAB for signal visualization.
Students will be able to select the relevant	Case Method & Group Discussion: Compare Z-	Real-time datasets, DSP Starter Kits (DSK) for

Curriculum Detailing Format

CO Statement	Suggested Relevant Instructional/ Implementation Strategies	Suggested Required Resources
frequency transformation technique for the given practical application.	Transform and DFT for different stability and causality scenarios. Use video clippings to demonstrate frequency sampling.	hardware prototyping , and Online Educational Resources (OER) and reference books
Develop digital signal processing solution for the given real-world applications.	Project-Based Learning & Lab Demonstrations	Digital Storage Oscilloscope (DSO) for filter response visualization, MATLAB Toolbox, Online Educational Resources (OER) and reference books
Design relevant digital filters with the given specification for varying operational conditions.	Project-Based Learning & Lab Demonstrations: Step-by-step design of FIR/IIR filters using windowing and bilinear transformation.	Digit Oscilloscope for filter response visualization, MATLAB Filter Design Toolbox , and OER for FIR design. Online Educational Resources (OER) and reference books
Use MATLAB software to simulation, test, and implement digital signal processing systems.	lended Learning & Live Demonstrations: Direct hands-on sessions in the lab. Use MOOCs and spoken tutorials for self-paced software mastery.	MATLAB software, computer laboratory, and sample code from learning resources.

M) Suggested Learning Resources:

a) Books

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Digital signal Processing	J.G. Proakis and D.G. Manolakis	Prentice Hall of India
2.	Digital Signal Processing Fundamentals and Applications	Li Tan and Jean Jiang	Elsevier Inc., Second Edition 2013
3.	Digital signal Processing, A Computer-based Approach	S. K. Mitra	McGraw Hill
4.	Fundamentals of Digital Signal Processing using MATLAB	Robert J. Schilling, Sandra L. Harris, Thomson	

Curriculum Detailing Format

b) Online Open Educational Resources (OER):

1) https://www.elprocus.com/fir-filter-for-digital-signal-processing/
2) https://www.tutorialspoint.com/digital_signal_processing/dsp_discrete_fourier_transform_introduction.htm
3) https://drive.google.com/file/d/1bqqwaB6DMSwHI6Yz_vzJf0eDKQQAHfL/view?usp=sharing

c) Suggested List of Equipment: (For Class Size- 30)

S. No.	Name of the Equipment	Suggested Specifications	Remarks
1.	MATLAB Software	Latest Version with DSP System Toolbox	
2.	Digital Storage Oscilloscope	100 MHz, Dual Channel	For signal visualization
3.	DSP Starter Kits (DSK)	TMS320C6748 or equivalent	For hardware interfacing

N) (a) Course Curriculum Development Team (Respective Universities)

S. No.	Name and Designation	E-mail Address
1.	Ganesh Ram Dhonju	gr.dhonju@khec.edu.np
2.	Basanta Paudel	basanta.paudel@pu.edu.np
3.	Naresh Khatri	Naresh.khatri@khwopa.edu.np

(b) Course Curriculum Development Team (Academia & Experts)

S. No.	Name and Designation	E-mail Address
1.	Dr. Sarbagya Buddhacharya	s.buddhacharya@khec.edu.np
2.	Abhas Maskey	abhash.maskey@gmail.com

****
****

Sample Course Curriculum Detailing Format

A)	**Course Title: Power System Fundamentals**	
B)	**Course Code:**	
C)	**Major Pre- requisite Course (s): Circuit Theory/Network Analysis, Electrical Machine, Calculus, Linear Algebra, Basic programming**	

D) Rationale:

Power System fundamental is a core Electrical Engineering course that deals with the generation, transmission, distribution, and analysis of electric power systems. The course teaches learners about transmission lines, power flow, line parameters, system modeling, voltage regulation, efficiency, and performance analysis of power networks. It provides the basic knowledge and analytical techniques required for designing, operating, and maintaining modern electrical power systems.

The course contributes in the field of work by preparing engineers to work in power plants, substations, transmission networks, and electrical utilities for reliable and efficient power system operation.

Upon completion of this course, learners will be able to analyze and model power system components, calculate transmission line parameters, and evaluate the performance of transmission systems using fundamental power system analysis techniques.

E) Course Outcomes (COs): After the completion of the course, teachers are expected to ensure the attainment of following course outcomes by the learners.

Course Outcomes (COs)	Course Outcome Statements
	Learners will be able to
CO1	Apply the concept of generation, transmission, distribution and renewable energy integration for structuring modern power system.
CO2	Model power system using per-unit representation, single line diagrams, reactance and impedance diagrams.
CO3	Formulate electrical parameters of transmission line and underground cables for mathematical modelling.
CO4	Evaluate the performance of transmission lines by determining voltage regulation, transmission efficiency and reactive power requirement.
CO5	Develop mathematical model of short, medium and long transmission line using appropriate transmission line parameters
CO6	Design a transmission system for a given voltage level by using MATLAB Simulink

Sample Course Curriculum Detailing Format

F) Course Articulation Matrix (CAM):

Course Outcomes (COs	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)*	
	PO1 Engineering Knowledge	**PO2** Problem Analysis	**PO3** Design/ Development of Solutions	**PO4** Investigation	**PO5** Modern Tool Usage	**PO6** The Engineer and The Society	**PO7** Ethics	**PO8** Individual and Collaborative Teamwork	**PO9** Communi cation	**PO10** Project Management and Finance	**PO11** Life-long Learning	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	1	3	2
CO2	3	2	2	-	2	-	-	-	-	-	-	1	2
CO3	3	1	2	-	-	-	-	-	-	-	-	2	2
CO4	3	2	-	2	-	-	-	-	-	-	-	1	1
CO5	3	3	3	2	-	-	-	-	-	-	-	-	-
C06	3	3	3	3	2	1	2	2	1	2	1	3	3

Legend: High (3), Medium (2), Low (1) and No mapping (-) Optional (*)

G) Teaching and Examination Scheme:

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
Academic Council	**BEL4008**	**PCC**	**POWER SYSTEM FUNDAMENTALS**	**3**	**3**	**1**	**2**	**6**	**40**	**60**	**10**	**15**	**125**

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

H) Course Curriculum Detailing:

For attainment of course outcomes, the students are expected to perform/ undergo various activities through classroom, laboratories, workshops, any other workplace, term work, field sessions, self- learning assignment etc.

Unique features like green skills, SDGs, multidisciplinary aspects, Love for our own country, motivation for startups, societal connect, renewable energy, etc. are integrated appropriately in the course curriculum document.

I) CO(s) Wise Suggested Contents:

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Contents
CO1	**Unit- 1.0: General Background** 1.1 Growth of electric power system and energy production 1.2 Generation, transmission and distribution components 1.3 Conventional and renewable energy sources 1.4 Major electrical components and bus concepts 1.5 Voltage levels, AC/DC transmission and power delivery
CO2	**Unit- 2.0: Computational Techniques** 2.1 Single-phase representation and single-line diagram 2.2 Impedance and reactance diagrams 2.3 Complex power and power flow concepts 2.4 Per-unit system and applications
CO3	**Unit- 3.0: Overhead and Underground Transmission** 3.1 Transmission line conductors and insulators 3.2 Underground cables and insulation systems 3.3 Cable faults, fault location and string efficiency
CO3	**Unit- 4.0: Line Parameters Calculations** 4.1 Resistance, inductance and capacitance of transmission lines 4.2 GMR, GMD and conductor configurations 4.3 Inductance and capacitance calculations of transmission lines 4.4 Earth effect, transposition and double-circuit lines
CO4, CO5, CO6	**Unit- 5.0: Transmission Line Modelling and Performance Analysis** 5.1 Short, medium and long transmission line models 5.2 ABCD parameters and equivalent circuits 5.3 Voltage regulation and transmission efficiency 5.4 Reactive power, surge impedance loading and line compensation

J) CO(s) Wise Suggested List of Practicals:

Mapped CO(s) Number	Laboratory Experiment/ Practicals
CO1	1 To obtain the single-line diagram of a typical electric power system. 2 To analyze the structure and components of generation, transmission, and distribution systems.
CO2	3 To design impedance and reactance diagrams for a given power network. 4 To obtain per-unit quantities of power system components for system representation. 5 To analyze the power system using single-line, impedance, and reactance diagrams.

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Laboratory Experiment/ Practicals
CO3	6 To measure transmission line inductance using GMR and GMD concepts. 7 To measure transmission line capacitance for different conductor configurations. 8 To test the effects of conductor spacing, transposition, and bundled conductors on line parameters.
CO4	9 To measure voltage regulation and transmission efficiency of transmission lines. 10 To analyze real and reactive power flow through transmission lines under different loading conditions.
CO5, CO6	11 To design Nominal T and Nominal π models of medium transmission lines and determine ABCD parameters. 12 To analyze the performance of long transmission lines using distributed parameter models. 13 To test the performance of transmission systems for specified voltage levels using MATLAB/Simulink. 14 To analyze and compare the performance of short, medium, and long transmission lines through simulation studies.

Note: Rubrics need to be prepared for effective performance by each student and their valid and reliable assessment.

K) Suggested In Semester Activities: This may include complex engineering problems, micro projects, seminar, self-learning, industrial/ field visit, assignment etc. It reinforces the development of spectrum of abilities needed for attainment of course outcomes. Complex engineering problems and micro projects need to be provided to learners to develop the problem solving, analytical, critical thinking, creative, investigative, exploring abilities in the learners and to prepare them as future ready work force. MOOCs, spoken tutorials, online educational resources etc. may be used for Self-Learning.

a. Suggested Complex Engineering Problems:

S. No.	Suggested Complex Engineering Problems
1.	Analyze and determine the optimum conductor configuration for a 132 kV transmission line considering inductance, capacitance, and transmission efficiency.
2.	Evaluate voltage regulation, efficiency, and reactive power requirements of a transmission system supplying a remote load center.
3.	Investigate the impact of conductor spacing, transposition, and bundled conductors on transmission line parameters and system performance.
4.	Design and analyze a transmission network for integrating a renewable energy source into an existing power system while maintaining acceptable voltage profiles.
5.	Develop and compare the performance of short, medium, and long transmission lines for a specified load condition using ABCD parameters.

b. Suggested Micro Projects:

S. No.	Suggested Micro Projects
1.	Investigation of Ferranti effect and methods for its mitigation in long transmission line using simulation tools.

Sample Course Curriculum Detailing Format

S. No.	Suggested Micro Projects
2.	Design and simulation of a transmission network supplying a remote load center while maintaining permission voltage regulation.
3.	Comparative study of AC and HVDC transmission systems for long-distance power transfer considering technical and economic factors.
4.	Analysis of reactive power compensation techniques for improving voltage profile and transmission efficiency of power system.
5.	Develop a transmission line parameter calculator using MATLAB OR Python for GMD, GMR, inductance and capacitance and ABCD parameters.

c. Suggested Seminar Topics, Self- Learning Topics, Industrial Visits/ Field Demonstration/ Any other relevant activity, as applicable:

S. No.	Seminar Topics	Self- Learning Topics	Industrial Visits/ Field Demonstration	Any other Relevant Activity
1.	Recent Trends in Transmission Line Design	HVDC Transmission Systems	Visit to a Transmission Substation (66/132/220 kV)	Technical report on substation components and operation
2.	Reactive Power Compensation and FACTS Devices	Flexible AC Transmission Systems (FACTS)	Field visit to a Load Dispatch Centre or Grid Control Centre	Case study on voltage stability and grid operation
3.	Renewable Energy Integration in Power Systems	Smart Grid Technologies and PMUs	Visit to a Solar PV Plant or Hydropower Station	Presentation on challenges of renewable integration
4.	Power Quality Issues in Transmission Networks	MATLAB/Simulink Applications in Power System Analysis	Demonstration of transmission line protection and monitoring systems	Mini-project on transmission line performance improvement

L) Suggested Instructional/ Implementation Strategies: Different instructional/ learning/ implementation strategies may be used appropriately, as per the requirement of the level of learners and outcome to be achieved. Some of them are improved lecture, tutorial, case method, group discussion, industrial visits, industrial training, field trips, role play, live demonstrations in classrooms, lab, field, project work, self-learning, etc. Use of Information and Communications Technology (ICT) based teaching learning, blended or flipped mode, brainstorming, expert session, video clippings, Online Educational Resources (OER), MOOCs, etc. are the some of the suggestive methods/ strategies to be adopted appropriately.

The relevant instructional/ implementation strategies may be mentioned appropriately as per the requirement of CO.

Sample Course Curriculum Detailing Format

CO Statement	Suggested Relevant Instructional / Implementation Strategies	Suggested Required Resources
CO1: Apply the concepts of generation, transmission, distribution and renewable energy integration for structuring modern power systems.	Interactive lectures, case studies, group discussions, field visits to substations and power plants	Multimedia classroom, power system models, videos, utility reports
CO2: Model power systems using per-unit representation, single-line diagrams, reactance and impedance diagrams.	Tutorial sessions, problem-solving exercises, simulation demonstrations	Drawing tools, MATLAB/ETAP/PowerWorld, worksheets
CO3: Formulate electrical parameters of transmission lines and underground cables.	Numerical exercises, laboratory experiments, collaborative learning	Transmission line models, laboratory equipment, simulation software
CO4: Evaluate transmission line performance using voltage regulation, efficiency and reactive power analysis.	Case studies, simulation-based learning, analytical assignments	MATLAB/Simulink, ETAP, technical manuals
CO5: Develop mathematical models of short, medium and long transmission lines.	Project-based learning, tutorials, simulation exercises	MATLAB/Simulink, computer laboratory, reference books
CO6: Design a transmission system for a given voltage level using MATLAB/Simulink.	Design projects, self-learning, expert sessions, software-based laboratory work	MATLAB/Simulink, high-performance computers, internet resources

M) Suggested Learning Resources:

a) Books

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Power System Analysis	Hadi Saadat	McGraw-Hill Education, 978-0-07-284869-4
2.	Modern Power System Analysis	I. J. Nagrath & D. P. Kothari	McGraw-Hill Education, 978-1-259-00317-2
3.	Power System Analysis and Design	J. Duncan Glover, Thomas Overbye & M.S. Sarma	Cengage Learning, 978-1-305-63213-4
4.	Power System Analysis	John J. Grainger & William D. Stevenson Jr.	McGraw-Hill Education, 978-1-259-00835-1

b) Online Open Educational Resources (OER):

1) NPTEL – Power System Analysis Courses (https://nptel.ac.in)
2) MIT OpenCourseWare – Electrical Energy Systems (https://ocw.mit.edu)
3) MATLAB Academy and Simulink Onramp (https://matlabacademy.mathworks.com)

Sample Course Curriculum Detailing Format

c) Suggested List of Equipment: (For Class Size- 30)

S. No.	Name of the Equipment	Suggested Specifications	Remarks
1.	Computer Laboratory	Minimum 30 PCs, Core i5/Ryzen 5 or higher, 8 GB RAM	For simulation and design
2.	MATLAB/Simulink Software	Academic license with Simscape Electrical toolbox	Power system modelling and analysis
3.	Transmission Line Trainer Kit	Configurable short, medium and long line models	Laboratory demonstrations
4.	Digital Projector and Smart Classroom Facility	Multimedia-enabled teaching system	Interactive teaching and presentations

N) (a) Course Curriculum Development Team (Respective Universities)

S. No.	Name and Designation	E-mail Address
1.	Md Zaid	zaideeuet@gmail.com
2.		

(b) Course Curriculum Development Team (Academia & Experts)

S. No.	Name and Designation	E-mail Address
1.		
2.		

****

Sample Course Curriculum Detailing Format

A)	**Course Title: Control Engineering**
B)	**Course Code: COEG 301**
C)	**Major Pre- requisite Course (s): MATH 201, EEEG 213**

D) Rationale:

This course introduces the fundamental principles and analytical methods used to model, analyze, and design dynamic systems in engineering. It enables learners to understand system behavior, stability, and performance in both time and frequency domains. It also builds a foundation for advanced study in automation and process control. The course covers mathematical modeling of electromechanical systems, performance analysis in time and frequency domains, stability assessment, and controller design to satisfy specified performance requirements.

E) Course Outcomes (COs):

After the completion of the course, teachers are expected to ensure the attainment of following course outcomes by the learners.

Course Outcomes (COs)	Course Outcome Statements
The student should be able to:	
CO1	Formulate mathematical models for the given electromechanical systems
CO2	Examine the performance characteristics for the given electro-mechanical systems in time domain
CO3	Test the stability of the given modeled system in time domain
CO4	Test the stability of the given modeled system in frequency domain
CO5	Design controllers to meet the performance specifications in time and frequency domain for the given electromechanical system

F) Course Articulation Matrix (CAM):

Course Outcomes (COs	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)*		
	PO1 Engineering Knowledge	**PO2** Problem Analysis	**PO3** Design/ Development of Solutions	**PO4** Investigation	**PO5** Modern Tool Usage	**PO6** The Engineer and The Society	**PO7** Ethics	**PO8** Individual and Collaborative Teamwork	**PO9** Communi cation	**PO10** Project Management and Finance	**PO11** Life-long Learning	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	-	1	-	2	-	-	1	-	2	-
CO2	3	3	3	3	3	1	-	2	-	-	1	1	2	-
CO3	3	3	3	3	3	1	-	2	1	-	1	1	2	-
CO4	3	3	3	3	3	1	-	2	1	-	1	1	2	-
CO5	3	3	3	3	3	1		2	1	-	1	3	2	3

Legend: High (3), Medium (2), Low (1) and No mapping (-) Optional (*)

Sample Course Curriculum Detailing Format

G) Teaching and Examination Scheme:

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	COEG 301	PCC	Control Engineering	3	3	1	2	6	50	50	40	10	150

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

H) Course Curriculum Detailing: For attainment of course outcomes, the students are expected to perform/ undergo various activities through classroom, laboratories, workshops, any other workplace, term work, field sessions, self- learning assignment etc.

Unique features like green skills, SDGs, multidisciplinary aspects, Love for our own country, motivation for startups, societal connect, renewable energy, etc. are integrated appropriately in the course curriculum document.

I) CO(s) Wise Suggested Contents:

Mapped CO(s) Number	Contents
CO1	**Unit- 1.0: Mathematical Modeling of electromechanical systems** 1.1 Introduction: Definition of control systems, Open loop and closed loop systems, Classification and examples of control system, History of control system 1.2 Mathematical Modeling: Modeling mechanical systems, electrical circuits, transfer function, liquid level systems, thermal systems, force-voltage and force-current analogous system, Gear and transformers, sensors and encoders, generators, electromechanical system, mixed electromechanical system 1.3 State Space Analysis: State space equation, Matrix representation of differential equations, Relation between state space and transfer function, State space equations of electrical and mechanical system 1.4 System Reduction Techniques: Block diagram representation, Rules for block diagram reduction, Block diagram reduction examples, Definitions of Signal Flow Graph, Rules for construction of Signal Flow Graph, Block diagram to Signal Flow Graph, Signal Flow Graph to block diagram reduction conversion, Block diagram and Signal Flow Graph for Mixed system
CO2	**Unit- 2.0: Time Response Analysis** 2.1 Introduction of time response, Standard test signals, 2.2 Response of first order systems to test signals, 2.3 Response of second order systems to test signals, 2.4 Time response specifications, Steady state error

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Contents
CO3	**Unit- 6.0: Stability Analysis** 6.1 Definitions of stability and stable systems, 6.2 Routh Hurwitz criterion, 6.3 Root locus plot-Introduction, Rules for constructing root locus
CO4	**Unit- 7.0: Frequency Response Analysis** 7.1 Frequency response methods, 7.2 Bode plot for different factors of transfer function, Stability criterion for Bode plot, 7.3 Polar plots, Nyquist's stability criterion, 7.4 Nichols' chart, Stability margins, Frequency response specifications
CO5	**Unit- 8.0: Design of Linear Control Systems** 8.1 Specification for control system design, 8.2 Phase lead and lag compensation, 8.3 Design of Control System by root locus method, 8.4 Design of control system by Bode plot

J) CO(s) Wise Suggested List of Practicals:

Mapped CO(s) Number	Laboratory Experiment/ Practicals
CO1, CO2	1 Modeling of the given first order electromechanical system and examination of its performance characteristics using MATLAB code and Simulink blocks 2 Modeling of the given second order electromechanical system and examination of its performance characteristics using MATLAB code and Simulink blocks 3 Modeling of the given first order electromechanical system and examination of its performance characteristics using Simscape 4 Modeling of the given second order electromechanical system and examination of its performance characteristics using Simscape
CO2, CO3	5 Examine the stability of the given first and second order system in time domain using MATLAB code 6 Examine the performance characteristics of P, PD, PI and PID controller for the stability of the given first and second order system in time domain
CO4	7 Examine the stability of the given first and second order system in frequency domain using MATLAB code 8 Examine the stability of the given first and second order system in frequency domain using LTI viewer in MATLAB
CO3, CO4, CO5	9 Design a lead compensator for the given electromechanical system and test the stability of the system in time and frequency domain

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Laboratory Experiment/ Practicals
	10 Design a lead compensator for the given electromechanical system and test the stability of the system in time and frequency domain 11 Design a PID controller for the given electromechanical system and test the stability of the system in time domain 12 Design a model for an Armature controlled DC motor with PID controller and test the stability of the system in time domain

Note: Rubrics need to be prepared for effective performance by each student and their valid and reliable assessment.

K) Suggested In Semester Activities: This may include complex engineering problems, micro projects, seminar, self-learning, industrial/ field visit, assignment etc. It reinforces the development of spectrum of abilities needed for attainment of course outcomes. Complex engineering problems and micro projects need to be provided to learners to develop the problem solving, analytical, critical thinking, creative, investigative, exploring abilities in the learners and to prepare them as future ready work force. MOOCs, spoken tutorials, online educational resources etc. may be used for Self-Learning.

a. Suggested Complex Engineering Problems:

S. No.	Suggested Complex Engineering Problems
1.	Model, simulate and analyse a Hydropower Plant
2.	Model, simulate and analyse a Plant Electric tram
3.	Model, simulate and analyse a wind energy conversion system
4.	
5.	

b. Suggested Micro Projects:

S. No.	Suggested Micro Projects
1.	To design and analyze the behavior of the given closed loop control system. Task to be accomplished: • Define the system and its components. Draw the schematic diagram of the system and list the governing equations for all the components of the closed loop system. • Obtain the transfer function of the system relating the input and output assumed. • Analyze the time domain response of the system and from the specification predict the nature and behavior of the system. • Plot the time domain response and root locus to predict the system's behavior. • Comment on the nature and stability of the system (Use Simulink as well as MATLAB codes). • Analyze the frequency response of the system and from the specifications predict the nature and behavior of the system. • Construct the Bode plot and Nyquist plot to study the system.

Sample Course Curriculum Detailing Format

S. No.	Suggested Micro Projects
	• Comment on the nature and stability of the system (use MATLAB codes). • Suggest the type of controller that can be implemented to improve the performance of the system. The suggested closed system are: 1. Voltage control of a 3-phase induction generator 2. Frequency control of a synchronous generator connected to varying load 3. Excitation control of a synchronous generator 4. Speed control of a single phase induction motor by varying voltage applied 5. Automatic voltage control of a system by capacitor bank switching 6. Yaw control of a small wind turbine 7. Flood level control of a dam and operation of sluice gate 8. Speed control of a single phase induction motor 9. Speed control of a water turbine by operation of the valve at water inlet in the penstock 10. Elevator motor control 11. Conveyor belt operation for an industry 12. Air-conditioning unit for a room 13. Vehicle fuel injection control (2 students)

c. Suggested Seminar Topics, Self- Learning Topics, Industrial Visits/ Field Demonstration/ Any other relevant activity, as applicable:

S. No.	Seminar Topics	Self- Learning Topics	Industrial Visits/ Field Demonstration	Any other Relevant Activity
1.	Modeling of the given electromechanical system			
2.	Comparison of time domain and frequency domain analysis			
3.				
4.				

L) Suggested Instructional/ Implementation Strategies: Different instructional/ learning/ implementation strategies may be used appropriately, as per the requirement of the level of learners and outcome to be achieved. Some of them are improved lecture, tutorial, case method, group discussion, industrial visits, industrial training, field trips, role play, live demonstrations in classrooms, lab, field, project work, self-learning, etc. Use of Information and Communications Technology (ICT) based teaching learning, blended or flipped mode, brainstorming, expert session, video clippings, Online Educational Resources (OER), MOOCs, etc. are the some of the suggestive methods/ strategies to be adopted appropriately.

The relevant instructional/ implementation strategies may be mentioned appropriately as per the

Sample Course Curriculum Detailing Format

requirement of CO.

CO Statement	Suggested Relevant Instructional/ Implementation Strategies	Suggested Required Resources
CO1	Lecture, Tutorial, Practical, Micro-project	Books, MATLAB Software
CO2	Lecture, Tutorial, Practical, Micro-project	Books, MATLAB Software
CO3	Lecture, Tutorial, Practical, Micro-project	Books, MATLAB Software
CO4	Lecture, Tutorial, Practical, Micro-project	Books, MATLAB Software
CO5	Lecture, Tutorial, Practical, Micro-project	Books, MATLAB Software

M) Suggested Learning Resources:

a) Books

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Control System and Engineering	Nise S. N.,	John Wiley and Sons , ISBN: 978-1-119-47422-7
2.	Automatic Control Systems	Golnaraghi F., Kuo B. C	Mc Graw Hill, ISBN: 9781259643835
3.	Modern Control Engineering	Ogata K	Pearson, ISBN-13: 9780137551064
4.	Modern Control System	Dorf C. R., Bishop H. R.,	Pearson, ISBN-13: 9780137307098

b) Online Open Educational Resources (OER):

1) …….
2) …….
3) …….

c) Suggested List of Equipment: (For Class Size- 30)

Sample Course Curriculum Detailing Format

S. No.	Name of the Equipment	Suggested Specifications	Remarks
1.	Desktop Computer and MATLAB software	Dual core processor with 16GB	
2.			
3.			
4.			

N) (a) Course Curriculum Development Team (Respective Universities)

S. No.	Name and Designation	E-mail Address
1.	Shailendra Kumar Jha	shailendra@ku.edu.np
2.		

(b) Course Curriculum Development Team (Academia & Experts)

S. No.	Name and Designation	E-mail Address
1.		
2.		

****

Sample Course Curriculum Detailing Format

A)	**Course Title: Digital Circuit and System Design**	**University Logo**
B)	**Course Code: EEEG 320**	
C)	**Major Pre- requisite Course (s): Digital Logic**	

D) Rationale:

This course is designed to provide undergraduate Electrical and Electronics Engineering students with fundamental and applied knowledge of digital circuit analysis and system-level design methodologies. Emphasis is placed on systematic design approaches that enable students to transform engineering problems into reliable digital hardware solutions. Through theoretical study and design-oriented problem solving, students gain the ability to analyze digital circuits, design optimized logic systems, and understand the operational principles of modern digital architectures.

E) Course Outcomes (COs): After the completion of the course, teachers are expected to ensure the attainment of following course outcomes by the learners.

Course Outcomes (COs)	Course Outcome Statements
CO1	Design combinational digital systems such as adders, multiplexers, encoders, decoders, comparators, and arithmetic logic units based on given engineering specifications.
CO2	Design and evaluate sequential circuits including flip-flops, counters, registers, and finite state machines while considering timing and synchronization requirements.
CO3	Implement digital systems using modern design tools and programmable logic devices such as HDL-based simulation environments, CPLDs, or FPGAs for practical hardware realization.
CO4	Apply systematic digital design methodologies to develop reliable and optimized digital systems for real-world engineering and embedded applications.

Sample Course Curriculum Detailing Format

F) Course Articulation Matrix (CAM):

Course Outcomes(COs	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)*		
	PO1 Engineering Knowledge	**PO2** Problem Analysis	**PO3** Design/ Development of Solutions	**PO4** Investigation	**PO5** Modern Tool Usage	**PO6** The Engineer and The Society	**PO7** Ethics	**PO8** Individual and Collaborative Teamwork	**PO9** Communi cation	**PO10** Project Management and Finance	**PO11** Life-long Learning	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	1	1	-	2	2	-	2	3	1	1
CO2	3	3	3	3	1	1	-	2	2	-	2	3	1	1
CO3	3	3	3	3	3	1	-	2	2	-	2	1	2	3
CO4	3	3	3	3	3	1	-	2	2	-	2	1	2	3

Legend: High (3), Medium (2), Low (1) and No mapping (-) Optional (*)

G) Teaching and Examination Scheme:

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
		PCC	**Digital Circuit and System Design**	**3**	**3**	**1**	**2**	**6**	**50**	**50**	**40**	**10**	**150**

Legend:
L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

H) Course Curriculum Detailing:

For attainment of course outcomes, the students are expected to perform/ undergo various activities through classroom, laboratories, workshops, any other workplace, term work, field sessions, self- learning assignment etc.

Unique features like green skills, SDGs, multidisciplinary aspects, Love for our own country, motivation for startups, societal connect, renewable energy, etc. are integrated appropriately in the course curriculum document.

I) CO(s) Wise Suggested Contents:

Mapped CO(s) Number	Contents
CO1, CO2	**Unit- 1.0: Review of Digital Logic and Electronics Engineering** 1.1 Boolean algebra 1.2 Simplification of switching functions

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Contents
	1.3 Combinational logic 1.4 Sequential logic 1.5 DTL, RTL, TTL, BJT, FET, CMOS
CO1, CO2	**Unit- 2.0: Digital Circuits** 2.1 Scale of integration 2.2 Logic families 2.3 Logic levels, noise margins 2.4 Fan-out and fan-in 2.5 Delay, power, area 2.6 CMOS logic 2.7 Latches and flip-flops 2.8 Clock cycle and timing paths 2.9 Tristate
CO3	**Unit- 3.0: Very High Speed Integrated Circuit Hardware Description Language** 3.1 Overview of Hardware Description Language, Basic Very High Speed Integrated Circuit Hardware Description Language (VHDL) Concept 3.2 Structural Description and Behavioral Description, Testbench 3.3 Skeleton of a Basic VHDL Program, Entity Declaration and Architecture Body, Design Unit and Library, 3.4 Sequential Statements of VHDL, VHDL Process, and IF, CASE, FOR loop Statement
CO1	**Unit- 4.0: Memory Devices** 4.1 Terminologies, general memory operation 4.2 ROMs and RAMs, power-down storage 4.3 Cache memory, FIFO

Sample Course Curriculum Detailing Format

CO2	**Unit- 5.0: Asynchronous Sequential Circuits** 5.1 Types, analysis and synthesis of pulse-mode circuits 5.2 Analysis and synthesis of fundamental mode circuits 5.3 Races, cycles hazards
CO1, CO3	**Unit- 6.0: Design Implementation** 6.1 Custom ICs, ASICs, programmable devices. 6.2 ROMs and RAMs, power-down storage 6.3 Cache memory, FIFO
CO1	**Unit- 7.0: Combinational Circuit Design with Programmable Logic Devices** 7.1 Logic array circuits, field-programmable, realizing logic functions with PROMs 7.2 LUT, programmable array logic
C02	**Unit- 8.0: Sequential Circuit Design with Programmable Logic Devices** 8.1 Registered programmable logic devices 8.2 Programmable gate arrays
CO1, CO3	**Unit- 9.0: Optimization of Logic** 9.1 Improving timing, area and power, partitioning
CO2, CO3	**Unit- 10.0: Logic Circuit Testing and Testable Design** 10.1 Fault models, combinational logic circuit testing 10.2 Sequential logic circuit testing 10.3 Design for testability, BIST
CO4	**Unit- 11.0: Field Programmable Gate Arrays Prototyping** 11.1 Introduction to Field Programmable Gate Arrays (FPGA), Overview of the Xilinx Spartan-3 devices 11.2 Development Flow, Overview of the Xilinx ISE Project Navigator , Synthesis and Physical Design, Verification and Testing

J) CO(s) Wise Suggested List of Practicals:

Mapped CO(s) Number	Laboratory Experiment/ Practicals
CO1	1. To **verify** the truth tables of basic logic gates 2. Universal Gate Implementation 2. To design minimized combinational circuits and implement SOP and POS forms physically or in simulation. 3. To implement Half Adder and Full Adder Design and verify outputs experimentally.
CO2, CO3	4. To design a 2:1 and 4:1 Multiplexer and Demultiplexer Circuits 5. Comparator and Arithmetic Circuits 6. To implement SR flip-flop, JK flip-flop and D flip-flop
CO3	7. To design an asynchronous and synchronous Counter Design 8. To realization FSM using flip-flops.
CO4	9. To demonstrate LED blinking using VHDL on FPGA board. 10. To demonstrate 7-segment display interfacing in FPGA board.

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Laboratory Experiment/ Practicals
	11. To realize VHDL of MUX, Decoder, Counter, FSM on FPGA board.

Note: Rubrics need to be prepared for effective performance by each student and their valid and reliable assessment.

K) Suggested In Semester Activities: This may include complex engineering problems, micro projects, seminar, self-learning, industrial/ field visit, assignment etc. It reinforces the development of spectrum of abilities needed for attainment of course outcomes. Complex engineering problems and micro projects need to be provided to learners to develop the problem solving, analytical, critical thinking, creative, investigative, exploring abilities in the learners and to prepare them as future ready work force. MOOCs, spoken tutorials, online educational resources etc. may be used for Self-Learning.

a. Suggested Complex Engineering Problems:

S. No.	Suggested Complex Engineering Problems
1.	Traffic light controller on FPGA
2.	Sequence detector using FSM
3.	UART transmitter/receiver basics
4.	
5.	

b. Suggested Micro Projects:

S. No.	Suggested Micro Projects
1.	Smart Traffic Light Controller
2.	Digital Voting Machine
3.	Password-Based Digital Lock
4.	Automatic Water Tank Controller
5.	FPGA-Based Calculator

c. Suggested Seminar Topics, Self- Learning Topics, Industrial Visits/ Field Demonstration/ Any other relevant activity, as applicable:

S. No.	Seminar Topics	Self- Learning Topics	Industrial Visits/ Field Demonstration	Any other Relevant Activity
1.				
2.				

Sample Course Curriculum Detailing Format

S. No.	Seminar Topics	Self- Learning Topics	Industrial Visits/ Field Demonstration	Any other Relevant Activity
3.				
4.				

L) Suggested Instructional/ Implementation Strategies: Different instructional/ learning/ implementation strategies may be used appropriately, as per the requirement of the level of learners and outcome to be achieved. Some of them are improved lecture, tutorial, case method, group discussion, industrial visits, industrial training, field trips, role play, live demonstrations in classrooms, lab, field, project work, self-learning, etc. Use of Information and Communications Technology (ICT) based teaching learning, blended or flipped mode, brainstorming, expert session, video clippings, Online Educational Resources (OER), MOOCs, etc. are the some of the suggestive methods/ strategies to be adopted appropriately.

The relevant instructional/ implementation strategies may be mentioned appropriately as per the requirement of CO.

CO Statement	Suggested Relevant Instructional/ Implementation Strategies	Suggested Required Resources

M) Suggested Learning Resources:

a) Books

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Digital Integrated Circuits,	J. M. Rabaey, A. Chandrakasan, and B. Nikolic	Pearson Education
2.	Digital Systems,	R. J. Tocci,	Prentice-Hall
3.	Digital Logic Circuit Analysis & Design, Prentice-Hall	V. P. Nelson, H. T. Nagle, J. D. Irwin, and B. D. Carrol	Wiley, Latest Edition

Sample Course Curriculum Detailing Format

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
4.	RTL Hardware Design Using VHDL: Coding for Efficiency, Portability, and Scalability	Pong P. Chu	

b) Online Open Educational Resources (OER):

1) …….
2) …….
3) …….

c) Suggested List of Equipment: (For Class Size- 30)

S. No.	Name of the Equipment	Suggested Specifications	Remarks
1.	Xinlinx Vivado	Version 2025.1	
2.	PC	Quad Core or 8+ Processor, 32 GB RAM, 100+ GB hard disk,	
3.	FPGA board	PYNQ or Basic Altera Board	
4.			

N) (a) Course Curriculum Development Team (Respective Universities)

S. No.	Name and Designation	E-mail Address
1.	Ram Kaji Budhathoki, Professor	ram.budhathoki@ku.edu.np
2.		

(b) Course Curriculum Development Team (Academia & Experts)

S. No.	Name and Designation	E-mail Address
1.		
2.		

****

Sample Course Curriculum Detailing Format

A)	**Course Title: Electronic Devices and Circuits**
B)	**Course Code:** EG503EE
C)	**Major Pre- requisite Course (s): Engineering materials,Basic electrical circuits and mathmatics**

D) Rationale:

Electronic Devices and Circuits(EG504EX) is a core course in electronics and electrical engineering that introduces learners to semiconductor devices and their practical applications. It builds a strong foundation by covering diodes, transistors, FETs, operational amplifiers, oscillators, and power supplies, enabling students to understand how modern electronic systems are designed and operate. The course balances theory and practice, ensuring learners gain skills essential for advanced studies in communication systems, VLSI design, embedded systems, and power electronics.

Professionally, the knowledge acquired supports the design and analysis of amplifiers, regulators, oscillators, and digital logic circuits, which are vital in industries such as telecommunications, computing, robotics, automation, and renewable energy. Key topics include semiconductor physics, PN junctions, diode applications, transistor biasing and amplifiers, MOSFET operation, op-amp circuits, power amplifiers, and voltage regulators.

By completing the course activities, learners will be able to understand semiconductor principles, analyze and design analog and digital circuits, apply concepts in laboratory experiments, evaluate circuit performance, and develop problem-solving skills for real-world electronics challenges. This makes the course a cornerstone of engineering education, bridging theoretical physics with practical engineering applications and preparing students for both academic progression and industry demands.

Course Outcomes (COs): After the completion of the course, teachers are expected to ensure the attainment of following course outcomes by the learners.

Course Outcomes (COs)	Course Outcome Statements
	Students will be able to
CO1	Select the relevant rectifier circuit for the given application.
CO2	design current control biasing circuits for the given amplifier and switching application.
CO3	design voltage control devices for the given amplifier and switching application
CO4	apply op-amp circuit to implement mathematical functions for the given electrical circuit application.
CO5	design the oscillator circuits to suit the frequency response on the given electrical circuits.

E) Course Articulation Matrix (CAM):

Sample Course Curriculum Detailing Format

Course Outcomes (COs	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)*	
	PO1 Engineering Knowledge	**PO2** Problem Analysis	**PO3** Design/ Development of Solutions	**PO4** Investigation	**PO5** Modern Tool Usage	**PO6** The Engineer and The Society	**PO7** Ethics	**PO8** Individual and Collaborative Teamwork	**PO9** Communi cation	**PO10** Project Management and Finance	**PO11** Life-long Learning	**PSO1**	**PSO2**
CO1	2	2	-	-	2	1	-	1		1	3	1	
CO2	2	3	-	1	2	1		1			3	1	1
CO3	2	2	2	1	2	3	1	1	1	1	3		
CO4	2	2	3	2	2	3	1	2	1	1	1		2
CO5	3	2	3	2	2	3	1	2	2	1	1		3

Legend: High (3), Medium (2), Low (1) and No mapping (-) Optional (*)

F) Teaching and Examination Scheme:

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	EG504 EX	PC C	**Electronic Devices and Circuits**	4	4	1	1.5	6.5	50	50	15	10	125

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

G) Course Curriculum Detailing:

For attainment of course outcomes, the students are expected to perform/ undergo various activities through classroom, laboratories, workshops, any other workplace, term work, field sessions, self- learning assignment etc.

Unique features like green skills, SDGs, multidisciplinary aspects, Love for our own country, motivation for startups, societal connect, renewable energy, etc. are integrated appropriately in the course curriculum document.

H) CO(s) Wise Suggested Contents:

Mapped CO(s) Number	Contents
Students will be able to select the relevant rectifier circuit for the given application.	**Unit- 1:** **1.1 Semiconductor Diodes and circuits** • Review Basic working principle of general diode • Diode equivalent circuits, transition and diffusion capacitance • Reverse recovery time, diode specification sheet

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Contents
	• Tunnel Diode, Varactor Diode and their applications • Schottky barrier diode, PIN Diode, Photo Diode, Photo Transistor, LED, LCD and their applications • Load –line Analysis of diode • Series and Parallel Diode configurations • Break down mechanism in diodes, Zener diode characteristics and as voltage regulators applications • Voltage multiplier circuits 1.2 Rectifiers and circuits • Introduction to Rectifiers, Half wave rectifier circuits, operation • Full wave rectifier, Bridge rectifier circuits, operation • Performance Parameters (Regulation, Ripple factor, efficiency etc.) Derivations of Half Wave Rectifier • Performance Parameters (Regulation, Ripple factor, efficiency etc.) Derivations of Full Wave Rectifier and bridge rectifier 1.3 Clippers, Clampers, Introduction to filters, Capacitor filters 1.4 Shunt Voltage Regulators, Series Voltage Regulator
• Students will be able to design current control biasing circuits for the given amplifier and switching application. • Students will be able to design voltage control devices for the given amplifier and switching application	**Unit- 2.0:** **2.1 Transistor Biasing and Design** • Bipolar Junction Transistor (BJT), construction and operation of BJT (pnp and npn) • Transistor Current Components • Common-base configuration characteristics, early effect, punch through • Common-Emitter configuration characteristic, Active, cut-off and saturation regions • Common-collector configuration characteristic, Limits of operation, study of Transistor data sheet Transistor as a switch and amplifier • Transistor Biasing, Need for Biasing, DC/AC load line, Quiescent operating Point • Fixed Bias Circuit and Collector Feedback Bias circuit analysis, derivation of expression for S • Emitter Feedback Bias Circuit analysis • Analysis of Collector-Emitter Feedback Bias and Voltage Divider Bias • Bias Stability, stability factor analysis, Thermal Runway **2.2 Large Signal Amplifiers** • Introduction, series-fed Class A amplifier, Transformer-Coupled Class A amplifier • Class B amplifier operation, Class B amplifier circuits, Amplifier distortion • Class C and Class D amplifier, Heat sink and its operation
Students will be able to design voltage control devices for the given amplifier and switching application	**Unit- 3.0:** **FET,MOSFET Biasing and Amplification** • FET introduction, construction, principle of operation, Drain and Transfer characteristics of n channel and p-channel FETs • Pinch off voltage, definitions of Rd, gm and μ of JFET. Calculation from characteristic curves. • FET as Voltage variable Resistor • Biasing FET, Analysis and design of self bias and voltage divider bias, zero temp drift biasing

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Contents
	• The JFET Small Signal Model • Analysis of FET common source Amplifier and Common Drain Amplifier • MOSFET (Construction, Principle of operation) • MOSFET Characteristics in Enhancement and Depletion modes • Comparison of BJT and FET amplifiers
Students will be able to apply op-amp circuit to implement mathematical functions for the given electrical circuit application.	**Unit- 4.0:** **Operational Amplifiers and Feedback Amplifiers** • Operational Amplifier, Ideal Characteristics,Inverting and Non-inverting mode,Virtual ground • Logarithmic and exponential amplifier • Logarithmic multiplier • Applications of operational amplifier: Adder, Subtractor, Multiplier, Voltage Follower, Divider, Integrator
Students will be able to design the oscillator circuits to suit the frequency response on the given electrical circuits.	**Unit- 5.0:** **5.1 Oscillators and Multivibrators** • Principle of oscillation, RC oscillator, Oscillator with LC feedback • Colpitts oscillator, Hartley oscillator, Crystal controlled oscillator • Design of different oscillator circuits • Multivibrators, Square and Triangular wave generation using a stable multivibrators **5.2 Nonlinear Analog Circuits** • Phase locked loop; Precision rectification and precision clam • Voltage to frequency and frequency to voltage conversion

I) CO(s) Wise Suggested List of Practicals:

Mapped CO(s) Number	Laboratory Experiment/ Practicals
CO1	Diode Characteristics 1.To measure ripple factor at the output of (a) Half wave rectifier (b) Bridge rectifier with and without filter capacitor. 2. Obtain I-V characteristic of general Diode and Zener Diode. 3.Implement Zener Diode as voltage regulator.
CO2	Bipolar Junction Transistor Characteristics and Single Stage Amplifier 1.To obtain characteristic of transistor as a switch circuit. 2. To obtain input and output characteristics and calculate gain of CE and CB amplifier circuits. 3.To obtain frequency response of single stage transistor amplifier.
CO3	MOSFET Characteristics 1. To obtain characteristic of MOSFET as a switch circuit. 2.To obtain the transfer characteristics of MOSFET.
CO4	Power Amplifiers 1. Determine the efficiency of push pull power amplifier 2.To design and test the class A power amplifier 3. To implement single tuned voltage Amplifier and to calculate 1. Resonant Frequency. 2. Q factor. 3. Bandwidth and 4. Impedance Operational Amplifier 4 To measure the performance of negative feedback amplifier and compare gain, BW with amplifier without feedback

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Laboratory Experiment/ Practicals
CO5	0scillator Characteristics 1.To obtain the Voltage gain for two stage RC coupled Amplifier and also to observe the frequencyResponse.

Note: Rubrics need to be prepared for effective performance by each student and their valid and reliable assessment.

J) Suggested In Semester Activities: This may include complex engineering problems, micro projects, seminar, self-learning, industrial/ field visit, assignment etc. It reinforces the development of spectrum of abilities needed for attainment of course outcomes. Complex engineering problems and micro projects need to be provided to learners to develop the problem solving, analytical, critical thinking, creative, investigative, exploring abilities in the learners and to prepare them as future ready work force. MOOCs, spoken tutorials, online educational resources etc. may be used for Self-Learning.

a. Suggested Complex Engineering Problems:

S. No.	Suggested Complex Engineering Problems
1.	A company requires a DC power supply for three different applications: 1. Mobile Charger – requires 5 V DC, low ripple, high efficiency. 2. Industrial Motor Control – requires 24 V DC, high current, moderate ripple acceptable.Precision Measurement Equipment – requires 12 V DC, extremely low ripple, stable regulation.Your task include:Identify which rectifier circuit (Half-Wave, Full-Wave, Bridge) is most suitable for each case.Justify your choice based on efficiency, ripple factor, transformer utilization factor (TUF), and cost.Suggest additional components (filters, regulators) needed to meet the requirements.
2.	Design biasing circuits for two different applications:Amplifier Application – A Class A amplifier using a BJT transistor requires a stable operating point at IC=2 mA and VCE=6 V with a 12 V supply.Design a voltage divider bias circuit to achieve this.Calculate resistor values for biasing and verify stability against variations in β.
3.	Design voltage control circuits for two different scenarios: • **Amplifier Application** – A Class A amplifier requires a stable bias voltage of 2 V at the base of a BJT transistor, with a supply voltage of 12 V. • Design a **voltage divider bias circuit** to achieve this. • Calculate resistor values and verify stability against variations in transistor β. • Suggest how a Zener diode could be used to improve voltage stability.
4.	Design op-amp based circuits to perform mathematical operations for two different applications: • Signal Processing Application – A sensor outputs a voltage signal in the range of 0–100 mV. • Design an op-amp amplifier circuit to scale this signal to 0–5 V for ADC input. • Show calculations for gain and resistor selection.

Sample Course Curriculum Detailing Format

S. No.	Suggested Complex Engineering Problems
	• Verify linearity and bandwidth requirements.
5.	Design oscillator circuits for two different applications: **Audio Signal Generator** – A sine wave oscillator is required to produce a stable 1 kHz signal for testing **audio amplifiers.** • Design a Wien Bridge Oscillator using an op-amp. • Derive the frequency of oscillation formula. • Select resistor and capacitor values to achieve 1 kHz. • Discuss how amplitude stabilization can be achieved.

b. Suggested Micro Projects:

S. No.	Suggested Micro Projects
1.	Design, Simulation, and Analysis of Rectifier Circuits for Real-World Applications
2.	Design and Implementation of Biasing Circuits for Amplifier and Switching Applications
3.	Design and Implementation of Voltage Control Circuits for Amplifier and Switching Applications
4.	Choose resistor and capacitor values to set gain and frequency response.Use resistors in kΩ range for stability,Capacitors in nF–μF range depending on cutoff frequency,Ensure op-amp bandwidth > application frequency
5.	Design and Implementation of Voltage Control Circuits for Amplifier and Switching Applications

c. Suggested Seminar Topics, Self- Learning Topics, Industrial Visits/ Field Demonstration/ Any other relevant activity, as applicable:

S. No.	Seminar Topics	Self- Learning Topics	Industrial Visits/ Field Demonstration	Any other Relevant Activity
1	Rectifier circuits and applications	Ripple factor, efficiency comparison	Visit to a power supply manufacturing unit	Case study on mobile charger rectifier
2	Biasing techniques for amplifiers and switches	Stability analysis with transistor β variations	Demonstration in electronics lab on biasing circuits	Simulation practice in Multisim/Proteus
3	Voltage control devices (Zener, regulators)	Voltage regulation principles, load regulation	Visit to an electronics service center (SMPS/UPS)	Mini project: regulated DC supply design
4	Op-amp applications in	Summing, integrator,	Demonstration of op-amp trainer kit in lab	Hands-on experiment with

Sample Course Curriculum Detailing Format

S. No.	Seminar Topics	Self- Learning Topics	Industrial Visits/ Field Demonstration	Any other Relevant Activity
	mathematical functions	differentiator circuits		waveform processing

K) Suggested Instructional/ Implementation Strategies: Different instructional/ learning/ implementation strategies may be used appropriately, as per the requirement of the level of learners and outcome to be achieved. Some of them are improved lecture, tutorial, case method, group discussion, industrial visits, industrial training, field trips, role play, live demonstrations in classrooms, lab, field, project work, self-learning, etc. Use of Information and Communications Technology (ICT) based teaching learning, blended or flipped mode, brainstorming, expert session, video clippings, Online Educational Resources (OER), MOOCs, etc. are the some of the suggestive methods/ strategies to be adopted appropriately.

The relevant instructional/ implementation strategies may be mentioned appropriately as per the requirement of CO.

CO Statement	Instructional / Implementation Strategies	Required Resources
Select the relevant rectifier circuit for the given application	Rectifier types (half-wave, full-wave, bridge) with diagrams; compare ripple factor & efficiency; case studies (chargers, motor drives, instrumentation)	Breadboard, diodes (IN4007, IN4148), transformer, resistive loads, Oscilloscope, power supply
Design current control biasing circuits for amplifier & switching application	Teach biasing methods (fixed bias, voltage divider bias); design problems with given IC, VCE; simulate in Multisim/Proteus; verify stability vs transistor β	BJT transistors (BC547, 2N2222), resistors, DC supply, CRO, simulation software
Design voltage control devices for amplifier & switching application	Demonstrate voltage divider bias & Zener stabilization; design regulator circuits; lab measurement of regulated output	Zener diodes, voltage regulator ICs, resistors, capacitors, breadboard, DC supply
Apply op-amp circuits to implement mathematical functions	Introduce op-amp configs (summing, integrator, differentiator); assign design tasks for scaling, addition, differentiation; simulate & verify transfer functions	Op-amp ICs (741, LM324), resistors, capacitors, function generator, CRO, simulation software
Design oscillator circuits to suit frequency response	Teach oscillator types (RC phase shift, Wien bridge, Colpitts, Hartley); design problems for audio (1 kHz) & RF (10 MHz); lab verification of frequency response & stability	Op-amp ICs, BJT transistors, capacitors, inductors, function generator, CRO, simulation software

Sample Course Curriculum Detailing Format

L) Suggested Learning Resources:

S. No.	Name of the Equipment	Suggested Specifications	Remarks
1	Breadboard, Digital Multimeter	Breadboard: 830 tie-points, reusable; Multimeter: Digital, auto-ranging, measures V/I/R, continuity	Essential for prototyping and basic measurements
2	Regulated DC Power Supply	Dual output, 0–30 V, 0–2 A, fine/coarse adjustment	Provides stable DC supply for experiments
3	Cathode Ray Oscilloscope (CRO) / Digital Storage Oscilloscope (DSO)	Bandwidth: ≥ 20 MHz, Dual channel	For waveform observation and frequency response analysis
4	Diodes (IN4007, IN4148)	IN4007: 1 A, 1000 V; IN4148: fast switching, 100 mA, 100 V	For rectifier and switching experiments
5	Function Generator	Frequency range: 1 Hz – 1 MHz, sine/square/triangle outputs	For signal input in amplifier and filter circuits
6	BJT Transistors	BC547 (NPN, low power), 2N2222 (NPN, general purpose)	For biasing, amplifier, and switching applications
7	Operational Amplifier ICs	LM741, LM324	For mathematical function circuits (summing, integrator, differentiator)
8	Passive Components	Resistors (¼ W, 5%), Capacitors (electrolytic & ceramic), Inductors	Standard stock for circuit design
9	Soldering Station	Adjustable temperature, 25–60 W	For permanent circuit assembly
10	Safety Tools	Wire stripper, ESD mat, wrist strap	For safe handling and assembly

a) Books

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Electronic Circuit Analysis and Design	Neamen, D.A (2006),	Tata McGraw Hill, 3rd Edition.
2.	Microelectronic Circuits Theory and Applications	Sedra, A. S. Smith, K. C. & Chandorkar, A. N. (2013),	International Version, Oxford International, 6th Edition
3.	Electronic Devices and Circuits	Dudhe, R. S. & Farhan M. (2013),	Synergy Knowledge ware, 1st Edition.
4.	Electronic Devices and Circuits Theory	Boylestad, R.L. & Nashelsky, L. (2015)	Pearson Education,11th Edition.

b) Online Open Educational Resources (OER):

1) www.electrical4u.com
www.geeksforgeeks.org

c) Suggested List of Equipment: (For Class Size- 30)

Sample Course Curriculum Detailing Format

M) (a) Course Curriculum Development Team (Respective Universities)

S. No.	Name and Designation	E-mail Address
1.	Khem Nath Khatiwada	khem.khatiwada@mtu.edu.np
2.	Sagun Paudyal	sagun.paudyal@mtu.edu.np

(b) Course Curriculum Development Team (Academia & Experts)

S. No.	Name and Designation	E-mail Address
1.	Basanta Paudyel	basantapaudyalmail@gmail.com
2.	Md.Zaid	zaideeuet@gmail.com

****

Sample Course Curriculum Detailing Format

A)	**Course Title: Transmission System Design**	
B)	**Course Code: EG 602 EE**	
C)	**Major Pre- requisite Course (s):** **Electric Circuit Theory, Electrical Engineering Materials, Power System Fundamentals**	

D) Rationale:

This core third-year course, **Transmission System Design (EG602EE)**, provides vital technical knowledge to plan, construct, operate, and maintain power transmission schemes. It is included to equip learners with the practical and theoretical expertise needed to solve real-world grid engineering challenges. The curriculum spans general planning, transmission line parameters, voltage and circuit selection, insulation coordination, conductor choice, and HVDC systems.

Through practical design projects, students apply these concepts directly to mapping out infrastructure and evaluating electrical performance. Ultimately, learners master the skills required to perform complex electrical calculations, select economical materials, determine routing, and design safe mechanical support structures based on terrain, weather, and safety regulations.

E) Course Outcomes (COs): After the completion of the course, teachers are expected to ensure the attainment of following course outcomes by the learners.

Course Outcomes (COs)	Course Outcome Statements
	The Learners will be able to…..
CO1	Evaluate transmission line parameters and components based on the load characteristics and safety regulations.
CO2	Select voltage level, air clearance parameters and conductor for the given application.
CO3	Design support structures for the given transmission line based on technical and economic requirements.
CO4	Evaluate the requirement of insulators and protection for the given voltage levels to handle the transmission of electrical power.
CO5	Suggest relevant emerging technology for the development of power sector of Nepal.

Sample Course Curriculum Detailing Format

F) Course Articulation Matrix (CAM):

Course Outcomes (COs	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)*		
	PO1 Engineering Knowledge	**PO2** Problem Analysis	**PO3** Design/ Development of Solutions	**PO4** Investigation	**PO5** Modern Tool Usage	**PO6** The Engineer and The Society	**PO7** Ethics	**PO8** Individual and Collaborative Teamwork	**PO9** Communication	**PO10** Project Management and Finance	**PO11** Life-long Learning	**PSO1**	**PSO2**	
CO1	3	1	1	-	1	2	-	2	1	2	3	1	3	1
CO2	1	3	3	3	2	2	-	2	-	-	1	-	3	-
CO3	2	2	3	3	2	3	1	1	-	2	2	-	3	-
CO4	2	2	3	3	2	2	-	1	1	2	2	-	3	-
CO5	3	2	2	2	2	2	-	2	2	3	3	1	3	1

Legend: High (3), Medium (2), Low (1) and No mapping (-) Optional (*)

G) Teaching and Examination Scheme:

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	EG602EE	PCC	Transmission System Design	3	3	1	1.5	5.5	50	50	25	-	125

Legend:
L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

H) Course Curriculum Detailing: For attainment of course outcomes, the students are expected to perform/ undergo various activities through classroom, laboratories, workshops, any other workplace, term work, field sessions, self- learning assignment etc.

Unique features like green skills, SDGs, multidisciplinary aspects, Love for our own country, motivation for startups, societal connect, renewable energy, etc. are integrated appropriately in the course curriculum document.

Sample Course Curriculum Detailing Format

I) CO(s) Wise Suggested Contents:

Mapped CO(s) Number	Contents
CO1	**Unit 1: Background of Transmission line** 1.1 Development of Power transmission system 1.2 Review of Transmission systems of Nepal 1.3 Overview of power grid systems and components 1.4 Transmission line design and planning 1.5 Physical structures of transmission lines; ampacities, towers, Wire choices, insulation and protection against lightning, shielding, grounding, sagging and clearance,right-of-way and other design and construction problems, terrain and weather implications 1.6 Different classification of transmission line 1.7 Computation of line parameters: resistance, inductance, capacitance, and conductance 1.8 Representation of T and Pi model of medium lines, calculation of ABCD parameters 1.9 Distributed parameter model of ling lines, calculation of ABCD parameters 1.10 Voltage regulation & efficiency calculation 1.11 Surge impedance loading
CO2	**Unit 2: Selection of Voltage Level, Air Clearance and Conductor** 2.1 Effect of voltage level in power and energy loss, conductor and insulator economy 2.2 Technical aspects of alternating current overhead lines, power and VAR transmission capability as functions of line length, line impedance and voltage level 2.3 Choice of voltage level for transmission for single and multiple circuit 2.4 Electrical, mechanical and economical requirements 2.5 Conductor material and preliminary size selection 2.6 Meeting electrical requirements, voltage regulation, efficiency, corona etc. 2.7 Conductor choices, wire types and size, bundled conductors

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Contents
	2.8 Economical size determination
CO3	**Unit 3: Support Structures for Transmission Lines** 3.1Route selection for transmission lines 3.2 Environmental impact assessment: routing and mitigation measures 3.3 Surveying requirements for transmission line design and construction 3.4 Mechanical aspects; tensioning and sagging, stringing chart, supports at unequal level 3.5 Tower design: span selection, ground clearance, moments acting on tower and tower strength computation
CO4	**Unit 4: Overhead Line Insulator and Protection Design** 4.1 Factors affecting insulator design 4.2 Air clearance computations, shield wires and tower grounding 4.3 Overhead line insulator material, types of overhead line insulators 4.4 Advantages of string insulators, string efficiency, string insulator configurations 4.5 Insulation coordination: flashover and breakdown voltage 4.6 Lightning and surge protection 4.7 Grounding system for transmission line 4.8 Fault detection and protection schemes 4.9 Selections of overhead line insulators considering continuous operating voltage and over voltages
CO5	**Unit 5: Emerging Technologies in Power Transmission** 5.1 Advanced Grid Management Software 5.2 Advanced Conductors 5.3 Digital Substation and Monitoring System 5.4 High Voltage Direct Current (HVDC) 5.4.1 Technical and economic comparison of ac and dc transmission 5.4.2 Components of HVDC System 5.4.3 HVDC system configuration 5.4.4 HVDC converters operation 5.4.5 Design consideration for HVDC line: Voltage level selection and rating, line losses and efficiency, selection of insulation and conductor material

Sample Course Curriculum Detailing Format

J) CO(s) Wise Suggested List of Practicals:

Mapped CO(s) Number	Laboratory Experiment/ Practicals
CO1	1. Computation of Line Parameters and ABCD Modeling of Medium Transmission Lines using MATLAB/Python 2. Simulation and Analysis of Long Transmission Lines and Surge Impedance Loading (SIL) using MATLAB/Powerworld Simulator
CO2	3. Economic Optimization of Conductor Size 4. Voltage Regulation, Efficiency, and Corona Loss Analysis for Bundled Conductors using MATLAB/Powerworld 5. Power and Capability Modeling as a Function of Line Length
CO3	6. Transmission Line Route Selection and Right-of-Way (RoW) Mapping using Google Earth/GIS tools 7. Mathematical Calculation of Sag and Tension for Supports at Equal and Unequal Levels
CO4	8. Determination of String Efficiency in Suspension Insulators using software tools 9. Insulation Coordination and Flashover Analysis Under Surge Voltage
CO5	10. Modeling and Converter Operation of a Point-to-Point HVDC Transmission Link

Note: Rubrics need to be prepared for effective performance by each student and their valid and reliable assessment.

K) Suggested In Semester Activities: This may include complex engineering problems, micro projects, seminar, self-learning, industrial/ field visit, assignment etc. It reinforces the development of spectrum of abilities needed for attainment of course outcomes. Complex engineering problems and micro projects need to be provided to learners to develop the problem solving, analytical, critical thinking, creative, investigative, exploring abilities in the learners and to prepare them as future ready work force. MOOCs, spoken tutorials, online educational resources etc. may be used for Self-Learning.

a. Suggested Complex Engineering Problems:

S. No.	Suggested Complex Engineering Problems
1.	An engineering team is designing a 150 km, 132 kV transmission link through a rugged, asymmetrical valley in Nepal where standard horizontal or equilateral conductor configurations cannot be mechanically accommodated on the hillsides. The three phases must be arranged in an unsymmetrical vertical configuration with unequal spacing between conductors.
2.	A new 120 km, 132 kV transmission circuit is being planned to traverse a narrow mountain pass where flat horizontal spacing is physically impossible due to terrain restrictions. The line must use an asymmetrical vertical configuration with unequal spacing between phases. Initial calculations indicate that this physical imbalance

Sample Course Curriculum Detailing Format

S. No.	Suggested Complex Engineering Problems
	introduces severe inductive and capacitive asymmetry among the phases, risking negative sequence currents and voltage unbalance at a downstream industrial substation.
3.	A power generation company in Nepal is planning a transmission link to evacuate 150 MW of power from a newly built hydropower plant to a major grid substation located 100 km away. The engineering team must choose between transmitting at a standard 132 kV level or upgrading to a 220 kV level.
4.	A 400 kV overhead AC transmission line traversing a high-altitude, heavily polluted mountain region in Nepal experiences localized dielectric failures. Measurements reveal that the line-end insulator disc in a 24-disc suspension string carries over 22% of the total operating phase voltage, causing recurring corona discharges, radio interference, and premature insulation aging. The utility company wants to raise the overall string efficiency from a baseline of 62% to at least 88% without replacing the existing insulator discs.
5.	A 220 kV transmission line is being designed to transmit 250 MW over a 150 km corridor traversing a high-altitude plateau in Nepal (average altitude of 2,500 meters above sea level). At this altitude, the reduced atmospheric pressure significantly lowers the air breakdown strength, causing severe corona discharge and associated active power losses during foul weather if standard single ACSR conductors are utilized. The design team must transition to a bundled conductor configuration to mitigate corona without violating strict thermal ampacity limits or making the capital cost of the conductor economically unviable over a 30-year lifecycle.

b. Suggested Micro Projects:

S. No.	Suggested Micro Projects
1.	Students will conduct a comprehensive research and data-mapping project focused on the evolution and current state of the Integrated Nepal Power System (INPS).
2.	Students will design and build a functional, interactive software or excel template that automates the calculation of electrical line constants and network matrices based on user-defined configurations.
3.	Students will design a computer-based calculation tool that analyzes and identifies the most cost-effective transmission voltage level (e.g., 66 kV, 132 kV, or 220 kV) for a user-defined power transfer requirement over a specific distance.
4.	Students will conduct a technical design study to coordinate the insulation levels of a localized transmission tower against transient overvoltages caused by lightning strikes.
5.	Students will develop a software simulation model (using MATLAB/Simulink or PowerWorld) or a small-scale laboratory hardware prototype to detect and isolate electrical faults on an overhead transmission line.

Sample Course Curriculum Detailing Format

c. Suggested Seminar Topics, Self- Learning Topics, Industrial Visits/ Field Demonstration/ Any other relevant activity, as applicable:

S. No.	Seminar Topics	Self- Learning Topics	Industrial Visits/ Field Demonstration	Any other Relevant Activity
1.	Grid Interconnection and Power Evacuation Challenges in Mountainous Terrains: A Case Study of the Nepal Integrated Power System (INPS	Geospatial and LIDAR Technologies in Modern Transmission Line Surveying and Route Selection	A Grid Substation and Transmission Line Corridor Project (e.g., Nepal Electricity Authority 400kV/220kV/132kV grid hubs or active construction spans).	Case-Study Analysis: "The Cross-Border Interconnection between Nepal and India"
2.	Mitigation of the Ferranti Effect and Voltage Instability in Ultra-Long EHV/UHV AC Transmission Lines	The Physics of Corona Discharge: Critical Factors, Visual Onset, and Mitigation via Bundle Configuration	An active Transmission Construction Site or Conductor Stringing Phase	
3.	Advanced Insulation Coordination and Strategic Guard Ring Design for High-Voltage Insulator Strings	Dynamic Insulation Breakdown Mechanisms: High-Voltage Flashover vs. Puncture in Composite and Porcelain Insulators	A High-Voltage Grid Substation Switchyard (132 kV or above).	
4.	Technical and Economic Trade-offs of High-Voltage Direct Current (HVDC) vs. High-Voltage AC (HVAC) for Bulk Power Transmission	Grid Synchronization and Inversion Mechanics in Voltage Source Converter (VSC) based HVDC Systems	A Modern Load Despatch Centre (LDC) or a Digital/Automated Substation Hub.	

Sample Course Curriculum Detailing Format

L) Suggested Instructional/ Implementation Strategies: Different instructional/ learning/ implementation strategies may be used appropriately, as per the requirement of the level of learners and outcome to be achieved. Some of them are improved lecture, tutorial, case method, group discussion, industrial visits, industrial training, field trips, role play, live demonstrations in classrooms, lab, field, project work, self-learning, etc. Use of Information and Communications Technology (ICT) based teaching learning, blended or flipped mode, brainstorming, expert session, video clippings, Online Educational Resources (OER), MOOCs, etc. are the some of the suggestive methods/ strategies to be adopted appropriately.
The relevant instructional/ implementation strategies may be mentioned appropriately as per the requirement of CO.

CO Statement	Suggested Relevant Instructional/ Implementation Strategies	Suggested Required Resources
Evaluate transmission line parameters and components based on the load characteristics and safety regulations.	Interactive Lecture Method	Books, MATLAB/Python, PowerWorld Simulator, IEEE Standard
Select voltage level, air clearance parameters and conductor for the given application.	Case-based Learning	Books, MATLAB/Python, PowerWorld Simulator, IEEE Standard
Design support structures for the given transmission line based on technical and economic requirements.	Interactive Simultion	Books, MATLAB/Python, PowerWorld Simulator, IEEE Standard
Evaluate the requirement of insulators and protection for the given voltage levels to handle the transmission of electrical power.	Transient Simulation Lab	Books, MATLAB/Python, PowerWorld Simulator, IEEE Standard
Suggest relevant emerging technology for the development of power sector of Nepal.	Guided Research Seminars and Guest Lectures	Books, MATLAB/Python, PowerWorld Simulator, IEEE Standard

Sample Course Curriculum Detailing Format

M) Suggested Learning Resources:

a) Books

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Elements of Power System Analysis (4th Edition)	William D. Stevenson Jr.	McGraw-Hill.
2.	Electrical Power System Design	M.V. Deshpande	FIT Print
3.	Design of Electrical Transmission Lines: Structures and Foundations	Prasad Yapa	Elsevier
4.	Power System Protection and Switchgear	Badri Ram and D. N. Vishwakarma	McGraw-Hill

b) Online Open Educational Resources (OER):

1) AC Power Systems" & "Transmission Lines" Chapters (LibreTexts Engineering)
2) PandaPower (Open-Source Workflow Toolkit)
3) Conductor Engineering & Technical Bulletins" (OpenStax)
4) IEEE Open Journal of Power and Energy / MDPI Energies

c) Suggested List of Equipment: (For Class Size- 30)

S. No.	Name of the Equipment	Suggested Specifications	Remarks
1.	Transmission Line Simulator/Trainer Kit	Single-phase 230 V AC, 50 Hz or 3 phase 415 V AC line-to-line 50 Hz	
2.	Total Station Surveyors	30x optical zoom, 2.5 to 3.0 power	
3.	Earth Testers, Meggers, Digital Calipers, Conductor Sample Boards	Low voltage applications	
4.	Smart Grid Simulation Softwares	MATLAB Power, PowerWorld Simulator or DigsilentPowerfactory	

N) (a) Course Curriculum Development Team (Respective Universities)

S. No.	Name and Designation	E-mail Address
1.	Sagun Paudyal, Lecturer	Sagun.paudyal@mtu.edu.np
2.	Khem Nath Khatiwada, Lecturer	Khem.aspire.ku@gmail.com

(b) Course Curriculum Development Team (Academia & Experts)

S. No.	Name and Designation	E-mail Address
1.	Basanta Paudyal, Associate Professor	Basantapaudyalmail@gmail.com
	Md. Zaid, Assistant Professor	Zaideeuet@gmail.com

Sample Course Curriculum Detailing Format

A)	**Course Title: Basic Electrical Circuits**
B)	**Course Code: ELE 130**
C)	**Major Pre- requisite Course (s): Math and Physics of grade XII**

D) Rationale:

Basic Electrical Circuits is a foundational course designed to provide undergraduate engineering students with fundamental knowledge of electrical circuit theory and analysis. The course introduces the principles of DC and AC circuits, magnetic circuits, network theorems, resonance, and three-phase systems. The course develops analytical, problem-solving, and practical laboratory skills essential for electrical and electronics engineering applications. Students gain competency in analyzing electrical quantities such as current, voltage, impedance, power, and power factor under steady-state and transient conditions. The course also familiarizes learners with electrical energy generation, transmission, and distribution systems.

E) Course Outcomes (COs): After the completion of the course, teachers are expected to ensure the attainment of following course outcomes by the learners.

Course Outcomes (COs)	Course Outcome Statements
CO1	Apply fundamental electrical laws and principles to analyze DC electric circuits.
CO2	Analyze AC circuits using phasor representation, impedance concepts, and network theorems.
CO3	Evaluate magnetic, inductive, and capacitive circuits under steady-state and transient conditions.
CO4	Analyze resonance, power factor, and power relationships in AC circuits.
CO5	Analyze balanced and unbalanced three-phase electrical circuits.

F) Course Articulation Matrix (CAM):

Course Outcomes (COs	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)*		
	PO1 Engineering Knowledge	**PO2** Problem Analysis	**PO3** Design/ Development of Solutions	**PO4** Investigation	**PO5** Modern Tool Usage	**PO6** The Engineer and The Society	**PO7** Ethics	**PO8** Individual and Collaborative Teamwork	**PO9** Communication	**PO10** Project Management and Finance	**PO11** Life-long Learning	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	1	2	-	1	2	1	-	1	3	-	1
CO2	3	3	2	1	2	-	1	2	1	-	1	1	-	1
CO3	3	3	2	2	2	-	1	2	1	-	1	3	-	2

Sample Course Curriculum Detailing Format

CO4	3	3	2	2	2	-	1	2	1	-	1	3	-	2
CO5	3	3	2	1	2	-	1	2	1	-	1	3	-	2

Legend: High (3), Medium (2), Low (1) and No mapping (-) Optional (*)

G) Teaching and Examination Scheme:

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	ELE 130	**PCC**	**Basic Electrical Engineering**	**3**	**3**	**1**	**2**	**9**	**30**	**50**	**20**	**-**	**100**

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

H) Course Curriculum Detailing: For attainment of course outcomes, the students are expected to perform/ undergo various activities through classroom, laboratories, workshops, any other workplace, term work, field sessions, self- learning assignment etc.

Unique features like green skills, SDGs, multidisciplinary aspects, Love for our own country, motivation for startups, societal connect, renewable energy, etc. are integrated appropriately in the course curriculum document.

I) CO(s) Wise Suggested Contents:

Mapped CO(s) Number	Contents
CO1	**Unit- 1.0: Basics of Electric Circuits** 1.1 Electric charge, current, emf and potential difference 1.2 Ohm's law, resistance, resistivity and temperature coefficient 1.3 Overview of energy sources 1.4 Linear and nonlinear circuit parameters 1.5 Kirchhoff's laws 1.6 Voltage and current divider rule 1.7 Series and parallel circuits 1.8 Source transformation 1.9 Nodal and mesh analysis
CO2	**Unit 2.0: Network Theorems**
	2.1 Superposition theorem 2.2 Reciprocity theorem 2.3 Thevenin's theorem

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Contents
	2.4 Norton's theorem 2.5 Maximum power transfer theorem 2.6 AC systems and waveform 2.7 AC systems and waveform 2.8 Average and RMS values 2.9 Phasor representation
CO3	**Unit 3.0: Magnetic Circuit, Inductance and Capacitance** 3.1 Ampere's circuital law 3.2 B-H curve 3.3 Reluctance, flux and mmf 3.4 Self and mutual inductance 3.5 RL circuit analysis 3.6 Electric field and electric flux 3.7 Capacitance and capacitor charging 3.8 RC circuit analysis
CO4	**Unit 3.0: AC Circuit Analysis** 3.1 Series and parallel AC circuits 3.2 Power factor 3.3 Resonance in RLC circuits 3.4 Q-factor and bandwidth
CO5	**Unit 8.0: Poly-phase AC Circuits** 5.1 Three-phase generation 5.2 Star and delta connection 5.3 Balanced and unbalanced loads 5.4 Three-phase power calculation

J) CO(s) Wise Suggested List of Practicals:

Mapped CO(s) Number	Laboratory Experiment/ Practicals
CO1	1. Verification of Ohm's law. 2. Verification of Kirchhoff's laws
CO2	3. Verification of Superposition theorem 4. Verification of Thevenin's theorem 5. Measurement of AC quantities using CRO
CO3	6. Determination of B-H curve

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Laboratory Experiment/ Practicals
	7. RL and RC circuit analysis
CO4	8. Power factor measurement 9. Resonance in RLC circuit.
CO5	10. Measurement in three-phase systems 11. Two wattmeter method

Note: Rubrics need to be prepared for effective performance by each student and their valid and reliable assessment.

K) Suggested In Semester Activities: This may include complex engineering problems, micro projects, seminar, self-learning, industrial/ field visit, assignment etc. It reinforces the development of spectrum of abilities needed for attainment of course outcomes. Complex engineering problems and micro projects need to be provided to learners to develop the problem solving, analytical, critical thinking, creative, investigative, exploring abilities in the learners and to prepare them as future ready work force. MOOCs, spoken tutorials, online educational resources etc. may be used for Self-Learning.

a. Suggested Complex Engineering Problems:

S. No.	Suggested Complex Engineering Problems
1.	Design and analysis of an Energy-Efficient Residential Electrical Distribution System E.g. Analyse and design a single phase residential electrical circuit considering load estimation, voltage drop, and power factor improvement.

b. Suggested Micro Projects:

S. No.	Suggested Micro Projects
1.	Design and analyze a household electrical wiring circuit.
2.	Analyze power factor improvement in industrial loads.
3.	Investigate resonance behavior in RLC circuits.
4.	Simulation of AC and DC circuits using software tools.
5.	Three-phase load balancing demonstration.

c. Suggested Seminar Topics, Self- Learning Topics, Industrial Visits/ Field Demonstration/ Any other relevant activity, as applicable:

S. No.	Seminar Topics	Self- Learning Topics	Industrial Visits/ Field Demonstration	Any other Relevant Activity
1.	Applications of Basic Electrical Circuits in Daily Life	Electrical Safety Rules and Precautions	Visit to Electrical Workshop / Wiring Laboratory	Preparation of Circuit Diagrams using Standard Symbols

Sample Course Curriculum Detailing Format

S. No.	Seminar Topics	Self- Learning Topics	Industrial Visits/ Field Demonstration	Any other Relevant Activity
2.	DC Circuit Analysis and Network Theorems	Series, Parallel, and Combination Circuits	Demonstration of Measurement using Multimeter and CRO	Group Discussion on Household Electrical Systems
3.	Electrical Measuring Instruments and Their Applications	Operation of Basic Electrical Components (Resistor, Capacitor, Inductor)	Field Visit to Distribution Substation / Electrical Maintenance Unit	Mini Experiment on Verification of Ohm's Law and Kirchhoff's Laws
4.	Introduction to AC Circuits and Power Factor	Basics of Electrical Wiring and Earthing Systems	Demonstration of Transformer and Electrical Protection Devices	Technical Presentation / Quiz on Electrical Circuit Fundamentals

L) Suggested Instructional/ Implementation Strategies: Different instructional/ learning/ implementation strategies may be used appropriately, as per the requirement of the level of learners and outcome to be achieved. Some of them are improved lecture, tutorial, case method, group discussion, industrial visits, industrial training, field trips, role play, live demonstrations in classrooms, lab, field, project work, self-learning, etc. Use of Information and Communications Technology (ICT) based teaching learning, blended or flipped mode, brainstorming, expert session, video clippings, Online Educational Resources (OER), MOOCs, etc. are the some of the suggestive methods/ strategies to be adopted appropriately.

The relevant instructional/ implementation strategies may be mentioned appropriately as per the requirement of CO.

CO Statement	Suggested Relevant Instructional/ Implementation Strategies	Suggested Required Resources
CO1	Lecture, tutorial, numerical problem solving	Whiteboard, simulation tools
CO2	Group discussion and laboratory work	AC circuit trainer
CO3	Experimental learning and demonstrations	Magnetic circuit kit
CO4	Simulation and practical verification	RLC trainer
CO5	Industrial examples and laboratory practice	Three-phase trainer

M) Suggested Learning Resources:

a) Books

Sample Course Curriculum Detailing Format

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Introductory Circuit Analysis	Robert L. Boylestad	Pearson Education, 13th Edition, ISBN: 978-0133923605
2.	Engineering Circuit Analysis	William H. Hayt Jr., Jack E. Kemmerly & Steven M. Durbin	McGraw-Hill Education, 9th Edition, ISBN: 978-0073380575
3.	Electrical and Electronic Technology	Edward Hughes	Pearson Education, 12th Edition, ISBN: 978-1292082981
4.	Textbook of First Course in Electrical Engineering	A.K. Mishra & B.A. Puri	Laxmi Publications, Revised Edition, ISBN: 978-8131805923

b) Online Open Educational Resources (OER):

1) NPTEL Electrical Engineering Courses
2) MIT Open Course Ware – Circuits and Electronics
3) IEEE Educational Resources
4) All About Circuits Learning Platform

c) Suggested List of Equipment: (For Class Size- 30)

S. No.	Name of the Equipment	Suggested Specifications	Remarks
1.	DC Power Supply	Variable 0–30V	
2.	Oscilloscope	Dual Channel	
3.	RLC Trainer Kit	Educational Laboratory Type	
4.	Three-phase Supply Trainer	Laboratory Model	

N) (a) Course Curriculum Development Team (Respective Universities)

S. No.	Name and Designation	E-mail Address
1.	Dr. Rammani Adhikari	rammaniadhikari@pu.edu.np
2.	Dr. Ananta Adhikari	ananta.adhikari@pu.edu.np

(b) Course Curriculum Development Team (Academia & Experts)

S. No.	Name and Designation	E-mail Address
1.	Er. Sanjeev Thapa	sanjeevthapa@pu.edu.np
2.	Er. Purna Bahadur Pun	purnabahadur.pun@pu.edu.np

****

Sample Course Curriculum Detailing Format

A)	Course Title: Power Electronics
B)	Course Code: ELE 342
C)	Major Pre- requisite Course (s): Basic Electrical Circuit, Electrical Engineering Material and Network Theory

D) Rationale:

The purpose of the course is to provide the fundamental concept of switching devices (controlled and uncontrolled types) and their role for power conversion. Furthermore, this course provides the idea of operating principle and characteristics of different power converters which are used to convert one form of power into other form like dc to ac conversion which is performed by the inverter that is predominantly used in the Photo-Voltaic technology electrical power generation.

This course includes the detail analysis of the ac to dc, dc-dc, dc to ac and ac to ac conversion along with the different topology and the characteristics of the switches which is favorable to on this type of converter.

E) Course Outcomes (COs):

After the completion of the course, teachers are expected to ensure the attainment of following course outcomes by the learners.

Course Outcomes (COs)	Course Outcome Statements
CO1	Select the relevant switching device for the given power converter topology.
CO2	Select relevant type and configuration of power converter for the given application.
CO3	Evaluate the performance indices associated with power converter.
CO4	Interpret the characteristics of the given power converter.
CO5	Select the relevant power converters with specification for the given renewable energy technology.

F) Course Articulation Matrix (CAM):

Course Outcomes (Cos)	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)*		
	PO1 Engineering Knowledge	**PO2** Problem Analysis	**PO3** Design/ Development of Solutions	**PO4** Investigation	**PO5** Modern Tool Usage	**PO6** The Engineer and The Society	**PO7** Ethics	**PO8** Individual and Collaborative Teamwork	**PO9** Communication	**PO10** Project Management and Finance	**PO11** Life-long Learning	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	3	2	-	2	2	1	2	2	3	3
CO2	3	3	3	3	2	2	-	2	2	2	2	2	3	3
CO3	3	3	2	3	2	2	-	1	1	1	2	2	3	3
CO4	3	3	3	3	3	2		1	1	1	2	2	3	3
CO5	3	3	3	3	3	3	2	3	2	3	3	3	3	3

Sample Course Curriculum Detailing Format

Legend: High (3), Medium (2), Low (1) and No mapping (-) Optional (*)

G) Teaching and Examination Scheme:

Board of Studies	Course Code	Course Category	CourseTitles	Credits (C)	Teaching Scheme (Hours)				Examination Scheme (Marks)				Total Marks
					L	T	P	Total Hours (L+T+P)	Theory		Practical		
									ISA	ESA	ISA	ESA	
	ELE 342	PCC	Power Electronics	3	3	1	2	6	30	50	20	-	100

Legend:

L: Lecture, T: Tutorial, P: Practical/ Laboratory, ISA: In Semester Assessment for theory and practical, ESA: End Semester Assessment for theory and practical

Sample Course Category: Applied Science Courses (ASC), Engineering Science Courses (ESC), Professional Core Courses (PCC), Professional Core Elective (PCE), Multidisciplinary Open Electives Courses (MOEC), Humanities, Social Science and Management Courses (HSMC), Project & Internship (PI), etc.

H) Course Curriculum Detailing: For attainment of course outcomes, the students are expected to perform/ undergo various activities through classroom, laboratories, workshops, any other workplace, term work, field sessions, self- learning assignment etc.

Unique features like green skills, SDGs, multidisciplinary aspects, Love for our own country, motivation for startups, societal connect, renewable energy, etc. are integrated appropriately in the course curriculum document.

I) CO(s) Wise Suggested Contents:

Mapped CO(s) Number	Contents
CO1	**Unit- 1.0: Switching Devices (11 hrs.)** 1.1 Power Semi-Conductor Devices: Basic operation and characteristics of power diodes, power BJTs, power MOSFETs, IGBTs, Safe Operation Area (SOA) for each device, Comparison of devices, selection of devices for various applications, Conduction and switching losses. 1.2 Thyristors: Basic operation of silicon-controlled rectifier (SCR), Static characteristics, two transistor analogy, Dynamic characteristics, firing circuits (R, RC, Ramp triggering using UJT), Commutation circuits, Protection circuit of SCR and Parallel operation of SCR. 1.3 SCR families: TRIAC and DIAC operation mechanism and switching characteristics.
CO2, CO3, CO4, CO5	**Unit- 2.0: Controlled AC to DC Converters** (10 **hrs.)** 2.1 Single phase half wave uncontrolled rectifiers, full wave rectifiers for R and R-L load 2.2 Three Phase half and full wave uncontrolled rectifiers for R and R-L load 2.3 Performance parameter of converter: output voltage, ratings of diode, input power factor and harmonic factor. 2.4 Single phase semi and full converter for R and RL and RLE load, Performance evaluation and single-phase dual converter 2.5 Three phase semi and full converter with R, and R-L and RLE load, performance evaluation 2.6 Effect of source inductance, Voltage at point of common coupling **2.7** Causes of low power factor and improvement of power factor: Extinction angle control, Symmetrical angle control and PWM control Rectification and inversion mode of single phase fully controlled rectifier
CO2, CO3, CO4, CO5	**Unit- 3.0: DC to DC converters (6 hrs.)** 3.1 Introduction, Classification, Principle and Operation, Control strategies, step up and step-down operation 3.2 Switched mode power supply: step down (buck), Step up (boost) and step down/step up (buck/boost) converters

Sample Course Curriculum Detailing Format

Mapped CO(s) Number	Contents
	3.3 Four Quadrant operation 3.4 Online and offline SMPS
CO2, CO3, CO4, CO5	**Unit- 4.0: DC to AC converters(8hrs.)** 4.1Classification based on source and power level, 4.2 Single phase bridge Inverters (VSI), Performance parameters, 4.3 Three phase VSI (120° and 180° conduction mode) 4.4 Control of single-phase and three phase inverters- PWM Techniques: Single pulse, Multi pulse and Sinusoidal PWM inverter 4.5Basics of Space vector modulation 4.6 Single phase current source inverters (CSI), comparison of VSI and CSI
CO2, CO3, CO4, CO5	**Unit- 5.0: AC Voltage Controllers (5hrs.)** 5.1Introduction, Principal of On-Off control and Phase Control, 5.2 Single phase Bidirectional Controllers with R and R-L load. 5.3Three phase full wave controllers. 5.4 Cycloconverters: Single Phase and Three phase Cyclo-converter; Center point tap and Bridge type and Matrix Converter

J) CO(s) Wise Suggested List of Practicals:

Mapped CO(s) Number	Laboratory Experiment/ Practicals
CO1	1. Determination of Power Diode characteristics. 2. Determination of MOSFET and IGBT characteristics and Control of power using MOSFET and IGBT. 3. Determination of SCR characteristics and Control of power using MOSFET and IGBT.
CO2, CO3, CO4, CO5	4. Simulation of single-phase uncontrolled and controlled Rectifier for R and RL load and evaluation of performance indices. 5. Simulation of three-phase uncontrolled and controlled Rectifier for R and RL load and evaluation of performance indices. 6. Modelling and simulation of buck converter and evaluation of performance indices. 7. Modelling and simulation of boost converter and evaluation of performance indices. 8. Modelling and simulation of buck-boost converter and evaluation of performance indices. 9. Modelling and Simulation of single-phase single pulse, multi-pulse and SPWM Voltage Source inverters for the given load and performance evaluation 10. Modelling and Simulation of three-phase single pulse, multi-pulse and SPWM Voltage Source inverters for the given load and performance evaluation

Note: Rubrics need to be prepared for effective performance by each student and their valid and reliable assessment.

K) Suggested In Semester Activities: This may include complex engineering problems, micro projects, seminar, self-learning, industrial/ field visit, assignment etc. It reinforces the development of spectrum of abilities needed for attainment of course outcomes. Complex engineering problems and micro projects need to be provided to learners to develop the problem solving, analytical, critical thinking, creative, investigative, exploring abilities in the learners and to prepare them as future ready work force. MOOCs, spoken tutorials, online educational resources etc. may be used for Self-Learning.

a. Suggested Complex Engineering Problems:

Sample Course Curriculum Detailing Format

S. No.	Suggested Complex Engineering Problems
1.	Based on the specified voltage and current rating along with the switching power loss, on-state power loss, switching frequency and operating temperature select the relevant switching device for the given power converter
2.	Develop a buck-boost converter for a solar PV charging system capable of maintaining regulated charging voltage under varying solar irradiation and load conditions. For this task consider the following factors: Converter topology selection, Inductor and capacitor selection, MOSFET/IGBT selection considering switching losses, CCM and DCM analysis, PWM control implementation, Efficiency and ripple analysis, Thermal consideration of switching devices, Simulation and prototype testing.
3.	Design a single-phase SPWM inverter for UPS application and investigate harmonic reduction techniques to improve output waveform quality. For this task consider the following factors: Generate SPWM gating pulses, compare square-wave and SPWM operation, analyze output voltage THD, LC filter for harmonic mitigation, compare inverter performance for R and RL loads, Evaluate switching frequency effects

b. Suggested Micro Projects:

S. No.	Suggested Micro Projects
1.	Compare SCR, MOSFET, BJT, and IGBT based on switching characteristics and applications.
2.	Design and implement an SCR based AC power controller for lamp dimming or fan speed control.
3.	Develop a PWM-based DC motor speed control system using MOSFET.
4.	Design a step-down converter to obtain regulated low DC voltage from higher DC source.
5.	Develop a low-power inverter using SPWM technique.

c. Suggested Seminar Topics, Self- Learning Topics, Industrial Visits/ Field Demonstration/ Any other relevant activity, as applicable:

S. No.	Seminar Topics	Self- Learning Topics	Industrial Visits/ Field Demonstration	Any other Relevant Activity
1.	Role of power electronics in renewable	Safe Operating Area (SOA) of Power Devices	Kali Gandaki Hydropower Station Static excitation systems	review 3–5 recent IEEE papers on power electronics application
2.	Power Electronics in Smart Grid applications	Turn On and Turn Off Techniques of controlled switching devices	Variable Frequency Drives (VFDs) Hongshi Cement	Motor overheating due to harmonics in industries
3.	Power Quality Issues in Power Electronics	Thermal Management of Power Electronic Devices	Industrial automation	Group Discussion
4.	Multilevel Inverters for High Power Applications	Comparison of Power Semiconductor Devices	Nuwakot Solar Plant	Component Selection and Datasheet Analysis

L) Suggested Instructional/ Implementation Strategies: Different instructional/ learning/

Sample Course Curriculum Detailing Format

implementation strategies may be used appropriately, as per the requirement of the level of learners and outcome to be achieved. Some of them are improved lecture, tutorial, case method, group discussion, industrial visits, industrial training, field trips, role play, live demonstrations in classrooms, lab, field, project work, self-learning, etc. Use of Information and Communications Technology (ICT) based teaching learning, blended or flipped mode, brainstorming, expert session, video clippings, Online Educational Resources (OER), MOOCs, etc. are the some of the suggestive methods/ strategies to be adopted appropriately.

The relevant instructional/ implementation strategies may be mentioned appropriately as per the requirement of CO.

CO Statement	Suggested Relevant Instructional/ Implementation Strategies	Suggested Required Resources
CO1	Lecture, Datasheet analysis activity	Relevant datasheet from the manufacturer
CO2	Application-oriented numerical problems, Interactive lectures, case study	simulation software, Demonstration kits for power electronics devices
CO3	Numerical tutorials, Simulation-based THD and PF analysis	Harmonic analyzer, simulation software
CO4	Experimental observation of converter operation, Simulation result interpretation, Group discussion	Converter hardware kits, Laboratory manuals
CO5	Seminar on renewable energy converters, Project-based learning	Journal or conference articles

M) Suggested Learning Resources:

a) Books

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Power Electronics - circuits, devices and applications	Muhammad H. Rashid	Prentice Hall of India
2.	Power Electronics	P. S. Bimbhra	Khanna Publishers
3.	Power electronics: converters, applications, and design	Ned Mohan, Tore M. Undeland	John Wiley &Sons
4.	Modern Power Electronics & AC Drives	B. K. Bose	Prentice Hall India

b) Online Open Educational Resources (OER):

Sample Course Curriculum Detailing Format

1) NPTEL Power Electronics Course
2) MIT OpenCourseWare
3) MATLAB and Simulink Learning Resources
4) Open Library

c) Suggested List of Equipment: (For Class Size- 30)

S. No.	Name of the Equipment	Suggested Specifications	Remarks
1.	Digital Storage Oscilloscope	Bandwidth: 50–100 MHz Channels: Minimum 2 Sampling Rate: ≥ 1 GS/s	
2.	Regulated DC Power Supply	Output Voltage: 0–30 V Current Rating: 3–5 A Dual output preferred Current limiting protection	
3.	Power Electronics Trainer Kit	SCR firing circuit TRIAC controller MOSFET chopper Rectifier module Inverter module	
4.	Switching Devices Trainer Kit	Switching frequency capability Heat sink provision PWM input interface	

N) (a) Course Curriculum Development Team (Respective Universities)

S. No.	Name and Designation	E-mail Address
1.	Purna Bahadur Pun	Purnabahadur.pun@pu.edu.np
2.	Dr. Ananta Adhikari	ananta.adhikari@pu.edu.np

(b) Course Curriculum Development Team (Academia & Experts)

S. No.	Name and Designation	E-mail Address
1.	Er. Sanjeev Thapa	sanjeevthapa@pu.edu.np
2.	Dr. Rammani Adhikari	rammaniadhikari@pu.edu.np

****

राष्ट्रीय तकनीकी शिक्षक प्रशिक्षण एवं
अनुसंधान संस्थान, भोपाल (म.प्र.)

NATIONAL INSTITUTE OF TECHNICAL TEACHERS' TRAINING AND RESEARCH, BHOPAL (M.P.)

(A Deemed to be university under distinct category)

MINISTRY OF EDUCATION, GOVERNMENT OF INDIA
SHANTI MARG, SHAMLA HILLS
BHOPAL – 462002, MADHYA PRADESH – INDIA
Tel. : +91(755) 2661600 – 602, 607 – 608,
Email ID: director@nitttrbpl.ac.in

Follow us: twitter.com/nitttrbpl facebook.com/nitttrbhopalofficial instagram.com/nitttrbhopal www.nitttrbpl.ac.in