

Outcome Based Education Curriculum

(142 credits, Regular Program, Bi-Semester)

B.Sc. in Electrical and Electronic Engineering

Disclaimer

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Department of Electrical and Electronic Engineering

Dhaka, July 2023

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Chapter 1

General Information

1.1 Title of the Academic Program

Bachelor of Science in Electrical and Electronic Engineering

1.2 Name of the University

Bangladesh University of Business and Technology

1.3 Vision of the University

The University aims is to be a leading educational institution for academic excellence, innovation and research.

1.4 Mission of the University

To provide quality education to students through innovative teaching and learning process at an affordable cost for transforming the university graduates into competent human resources.

1.4.1 Elaboration of university Mission

1. To provide quality education in affordable cost
2. To ensure innovative teaching and learning process
3. To transform students into competent human resources

1.5 Name of the Department

Department of Electrical and Electronic Engineering

1.6 Vision of the Department

The Department of Electrical and Electronic Engineering (EEE) has set up the following vision to align with the ultimate vision of the university.

1.6.1 Vision Statement

To be a prime center of Electrical & Electronic Engineering education for the creation and dissemination of technical and innovative knowledge by producing a skilled and competent graduate workforce to build the nation.

1.7 Mission of the Department

The Department of Electrical and Electronic Engineering (EEE) has designed and it is pursuing the following essential paths as a mission to successfully reach its vision.

1.7.1 Mission Statement

1. To provide state-of-the-art resources and quality education to achieve excellence in teaching-learning, research and attitudinal developments.
2. To develop professional competency and technical expertise individually and through teamwork thereby exhibiting leadership, moral and ethical values in the practical engineering field.
3. To bridge the gap between industry and academia in order to achieve the highest level of technical competence for fulfilling the growing demands of the nation through creative learning and innovation.

1.8 Objectives of the Department

The objectives of the EEE Department are:

1. To produce highly skilled EEE graduates who will be academically proficient, ethically guided and socially accountable professionals to meet the challenges of 21st century.
2. To nurture the students to develop their research-based knowledge and skills for their engagement on life-long learning in the broadest context of technological changes and sustainable development.

1.9 Name of the Degree

Bachelor of Science (B. Sc.) in Electrical and Electronic Engineering

1.10 Description of the program

Curriculum of B.Sc. in EEE program at the university is fully structured based on Outcome Based Education (OBE) system. Considering feedback from vital stakeholders including students, teachers, alumni and employers along with suggestions from Industrial Advisory Panel and Curriculum Review Committee, program curriculum is periodically reviewed and updated.

1.11 Graduate Attributes (based on need assessment)

Generic Skills for B.Sc. in EEE Program

The following 12 graduate attributes are designed to attain students' required knowledge from classroom experiences, and skills and attitudes from hands-on practices and industrial training, and co-curricular and extracurricular activities throughout the four-year program:

PLO1: Engineering knowledge

PLO2: Problem analysis

PLO3: Design/development of solutions

PLO4: Investigation

PLO5: Modern tool usage

PLO6: The engineer and society

PLO7: Environment and sustainability

PLO8: Ethics

PLO9: Individual work and teamwork

PLO10: Communication

PLO11: Project management and finance

In addition, knowledge profile, ranges of complex engineering problem solving and complex engineering activities are closely associated with and require achieving the mentioned above graduate attributes. Those are described below:

a) Knowledge Profile (K)

- K1:** A systematic, theory-based understanding of the natural sciences applicable to the discipline.
- K2:** Conceptually-based mathematics, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modeling applicable to the discipline.
- K3:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
- K4:** 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.
- K5:** Knowledge that supports engineering design in a practice area.
- K6:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
- K7:** Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the professional responsibility of an engineer to public safety; the impacts of engineering activity: economic, social, cultural, environmental and sustainability.
- K8:** Engagement with selected knowledge in the research literature of the discipline.

b) Range of Complex Engineering Problem Solving (WP)

- WP1: Depth of knowledge required:** Cannot be resolved without in-depth engineering knowledge at the level of one or more of K3, K4, K5, K6 or K8 which allows a fundamentals-based, first principles analytical approach
- WP2: Range of conflicting requirements:** Involve wide-ranging or conflicting technical, engineering and other issues
- WP3: Depth of analysis required:** Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models
- WP4: Familiarity of issues:** Involve infrequently encountered issues
- WP5: Extent of applicable codes:** Are outside problems encompassed by standards and codes of practice for professional engineering
- WP6: Extent of stakeholder involvement and conflicting requirements:** Involve diverse groups of stakeholders with widely varying needs
- WP7: Interdependence:** Are high level problems including many component parts or sub-problems.

c) Range of Complex Engineering Activities (EA)

- EA1: Range of resources:** Involve the use of diverse resources (and for this purpose resources include people, money, equipment, materials, information and technologies).
- EA2: Level of interaction:** Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues.
- EA3: Innovation:** Involve creative use of engineering principles and research-based knowledge in novel ways.
- EA4: Consequences for society and the environment:** Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation.
- EA5: Familiarity:** Can extend beyond previous experiences by applying principles-based approaches.

1.12 Program Educational Objectives (PEO)

Program Educational Objectives of B.Sc. Engineering degree in EEE at the university are stated below:

PEO 1: The graduates will be successful engineers to deal with state-of the-art technology in diverse fields of electrical and electronic engineering with their innovative knowledge and professional skills.

PEO 2: The graduates will be competent and proficient in their career with professional ethics, responsibilities and leadership.

PEO 3: The graduates will promote research and development in multidisciplinary fields with their expertise, critical thinking and life-long learning.

PEO 4: The graduates will efficiently contribute to the corporate sectors with their technical, communication and project management skills.

1.13 Program Learning Outcomes (PLO)

Program Learning Outcomes (PLOs) or Graduate Attributes are narrower statements that describe what students are expected to know and be able to do by the time of graduation. These statements relate to the knowledge, skills and attitudes acquired by students while progressing through the program. The program must demonstrate that by the time of graduation, students have achieved an acceptable minimum level of certain knowledge, skills and behavioral traits. The B.Sc. in EEE Program at the university, however, develops students to acquire the following graduate attributes as Program Learning Outcomes (PLOs as specifically required by The Board of Accreditation for Engineering and Technical Education (BAETE), Bangladesh.

PLO1-Engineering knowledge: Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization as specified in K1 to K4 respectively to the solution of complex engineering problems

PLO2-Problem analysis: Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. (K1 to K4)

PLO3-Design/development of solutions: Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. (K5)

PLO4-Investigation: Conduct investigations of complex problems using research-based knowledge (K8) and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.

PLO5-Modern tool usage: Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering problems, with an understanding of the limitations. (K6)

PLO6-The engineer and society: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems. (K7)

PLO7-Environment and sustainability: Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts. (K7)

PLO8-Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. (K7)

PLO9-Individual work and teamwork: Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings

PLO10-Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PLO11-Project management and finance: Demonstrate 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, to manage projects and in multidisciplinary environments.

PLO12-Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

In addition to incorporating the above-listed POs (graduate attributes), the Dept. of EEE at the university also includes additional outcomes in B.Sc. in EEE program. The B.Sc. in EEE program aims to attain the abovementioned POs as well as ensures the curriculum encompasses all the attributes of the Knowledge Profile (K1 – K8) as included in the PO statements. Besides, the ranges of Complex Engineering Problem Solving (P1 – P7) and Complex Engineering Activities (A1 – A5) as given in BAETE manual are also addressed in the program.

1.14 Mapping mission of the university with PEOs

PEO No.	Elaboration of BUBT Mission		
	Mission 1	Mission 2	Mission 3
PEO-1	√	√	√
PEO-2	√		
PEO-3		√	
PEO-4		√	√

1.14.1 Mapping mission of the Program with PEOs

PEO No.	Program Mission Statements		
	Mission 1	Mission 2	Mission 3
PEO-1	√		
PEO-2		√	
PEO-3			√
PEO-4			√

1.15 Mapping PLOs with the PEOs

The mappings of Program Learning Outcomes (PLOs) with Program Educational Objectives (PEOs) have been depicted in the table below:

PLO No.	PEO-1	PEO-2	PEO-3	PEO-4
PLO1	√			√
PLO2	√			√
PLO3	√		√	√
PLO4	√			√
PLO5	√		√	
PLO6	√	√	√	
PLO7	√	√		
PLO8		√		
PLO9		√		
PLO10		√	√	
PLO11			√	
PLO12				√

1.16 Mapping courses with PLOs

BNQF Course Code	Course Code	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
0533 1101	PHY 101	CO1	x											
		CO2	x											
		CO3	x											
0533 1203	PHY 103	CO1	x											
		CO2	x											
		CO3	x											
0533 1204	PHY 104	CO1			x									
		CO2				x								
		CO3					x							
		CO4						x						
		CO5							x					
		CO6								x				
0533 2105	PHY 201	CO1	x											
		CO2		x										
		CO3		x										
0533 3206	PHY 301	CO1	x											
		CO2		x										
		CO3		x										
0715 2101	MT 201	CO1												
		CO2												
		CO3												
0788 3102	CE 302	CO1	x											
		CO2		x										
		CO3					x							
		CO4										x		
0613 2101	CSE 201	CO1	x											
		CO2	x											
		CO3		x										
		CO4			x									

BNQF Course Code	Course Code	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1 2
0613 2102	CSE 202	CO1	x											
		CO2		x										
		CO3				x								
		CO4						x						
		CO5								x				
		CO6									x			
0713 1101	EEE 101	CO1	x											
		CO2		x										
		CO3		x										
0713 1202	EEE 103	CO1	x				x							
		CO2		x										
		CO3		x										
0713 1203	EEE 104	CO1	x											
		CO2	x											
		CO3			x									
		CO4				x								
		CO5									x			
		CO6										x		
0714 2101	EEE 201	CO1	x											
		CO2		x										
		CO3			x									
0713 2104	EEE 203	CO1	x											
		CO2		x										
		CO3		x										
0714 2202	EEE 207	CO1	x											
		CO2		x										
		CO3		x										
0714 2203	EEE 208	CO1			x									
		CO2				x								
		CO3					x							
		CO4						x						
		CO5							x					
		CO6								x				

BNQF Course Code	Course Code	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1 2
0713 3105	EEE 209	CO1	x											
		CO2		x										
		CO3		x										
0713 3106	EEE 210	CO1				x								
		CO2				x								
		CO3			x									
		CO4					x							
		CO5									x			
		CO6										x		
0714 3104	EEE 213	CO1	x											
		CO2		x										
		CO3		x										
0714 3105	EEE 303	CO1	x											
		CO2		x										
		CO3		x										
0714 3106	EEE 304	CO1			x									
		CO2				x								
		CO3					x							
		CO4						x						
		CO5							x					
		CO6								x				
0713 3207	EEE 305	CO1	x											
		CO2		x										
		CO3	x											
0713 3208	EEE 306	CO1				x								
		CO2				x								
		CO3			x									
		CO4					x							
		CO5									x			
		CO6										x		
0714 3207	EEE 307	CO1	x											
		CO2		x										
		CO3		x										
0714 3208	EEE 308	CO1				x								
		CO2				x								
		CO3			x									
		CO4					x							
		CO5									x			
		CO6										x		

BNQF Course Code	Course Code	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1 2
0714 4109	EEE 313	CO1	x											
		CO2		x										
		CO3		x										
0714 4110	EEE 314	CO1			x									
		CO2				x								
		CO3					x							
		CO4						x						
		CO5							x					
		CO6								x				
0714 4211	EEE 319	CO1	x											
		CO2			x									
		CO3		x										
0714 4212	EEE 320	CO1				x								
		CO2			x									
		CO3					x							
		CO4					x							
		CO5									x			
		CO6										x		
0714 3213	EEE 301	CO1	x											
		CO2		x										
		CO3	x											
0714 3214	EEE 302	CO1			x									
		CO2				x								
		CO3					x							
		CO4						x						
		CO5							x					
		CO6								x				
0713 4109	EEE 493	CO1	x											
		CO2		x										
		CO3		x										
		CO4		x										

BNQF Course Code	Course Code	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1 2
0719 4101	EEE 400	CO1	x											
		CO2		x										
		CO3			x									
		CO4				x								
		CO5					x							
		CO6						x						
		CO7							x					
		CO8								x				
		CO9									x			
		CO10										x		
		CO11											x	
		CO12												x
0714 4126	EEE 455	CO1	x											
		CO2		x										
		CO3		x										
0714 4127	EEE 463	CO1	x											
		CO2		x										
		CO3		x										
0714 4128	EEE 464	CO1				x								
		CO2				x								
		CO3			x									
		CO4					x							
		CO5									x			
		CO6										x		
0714 4121	EEE 435	CO1	x											
		CO2		x										
		CO3		x										
0714 4115	EEE 429	CO1	x											
		CO2		x										
		CO3			x									

BNQF Course Code	Course Code	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1 2
0714 4116	EEE 430	CO1			X									
		CO2				X								
		CO3					X							
		CO4			X									
		CO5				X								
		CO6									X			
0714 4223	EEE 445	CO1	X											
		CO2		X										
		CO3			X									
0714 4224	EEE 446	CO1			X									
		CO2				X								
		CO3					X							
		CO4					X							
		CO5				X								
		CO6										X		
0714 4220	EEE 433	CO1	X											
		CO2		X										
		CO3				X								
0713 4110	EEE 471	CO1	X											
		CO2			X									
		CO3	X											
0713 4214	EEE 475	CO1	X											
		CO2		X										
		CO3	X											
0713 4112	EEE 477	CO1	X											
		CO2		X										
		CO3		X										
0713 4113	EEE 478	CO1				X								
		CO2				X								
		CO3			X									
		CO4					X							
		CO5									X			
		CO6										X		

BNQF Course Code	Course Code	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1 2
0713 4216	EEE 481	CO1	x											
		CO2		x										
		CO3		x										
0713 4217	EEE 482	CO1				x								
		CO2				x								
		CO3			x									
		CO4					x							
		CO5									x			
		CO6										x		

Chapter 2

Summary of Undergraduate Courses

2.1 Structure of the Curriculum

2.1.1 Duration of the program: Years: 4 Semesters: 8

2.1.2 Admission Requirements:

For the HSC or equivalent level students:

- Science background with Mathematics, Physics and Chemistry in SSC and HSC or equivalent level.
- GPA of at least 2.50 or 2nd Division in both the SSC and the HSC examinations; OR
- GPA of at least 2.00 either in the SSC or the HSC examination, but the total GPA in both the examinations must be at least 6.00; OR
- 'O' Level with at least 5 subjects and 'A' Level with at least 3 subjects and O-level and A-level students must have an average grade of B; OR
- In case of sons/daughters of Freedom Fighters, a total GPA of at least 5.00 in both the SSC and the HSC Examinations. The official proof of the Father /Mother as a Freedom Fighter must be submitted.

Prospective students may need to sit for an admission test.

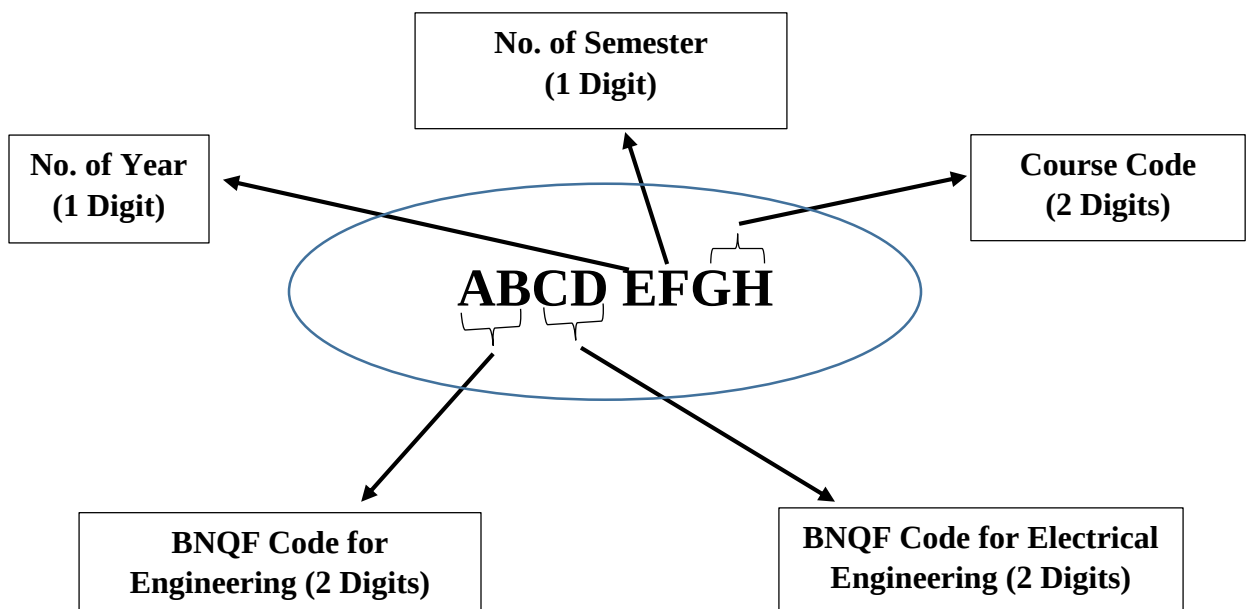
2.1.3 Total minimum credit requirement to complete the program: 142.

2.1.4 Total class weeks in a year/semester: 14

2.1.5 Minimum CGPA requirements for graduation: 2.00

2.1.6 Maximum academic years of completion: 07

2.2 Given BNQF Course Code by UGC/BAC



For Example

Electrical Circuits I

BNQF Course Code: 0713 1101

where, 07 stands for **Engineering**, 13 for **Electrical Engineering**, 1 for **first year**, 1 for **first semester** and **01** for course code.

2.3 General Education Courses:

Table-1: BNQF Code regulation according to ISCED-F 2013 for General Education

Broad field	Narrow field	Detailed Field
02 Arts and humanities	022 Humanities (except languages)	0220 Humanities (except languages) not further defined 0221 Religion and theology 0222 History and archaeology 0223 Philosophy and ethics 0229 Humanities (except languages) not elsewhere classified
	023 Languages	0230 Languages not further defined 0231 Language acquisition 0232 Literature and linguistics 0239 Languages not elsewhere classified

Table-2: BNQF Code regulation according to ISCED-F 2013 for General Education

Broad field	Narrow field	Detailed Field
03 Social sciences, journalism and information	031 Social and behavioral sciences	0310 Social and behavioral sciences not further defined 0311 Economics 0312 Political sciences and civics 0313 Psychology 0314 Sociology and cultural studies 0319 Social and behavioral sciences not elsewhere classified

Table-3: BNQF Code regulation according to ISCED-F 2013 for General Education

Broad field	Narrow field	Detailed Field
04 Business, administration and law	041 Business and administration	0410 Business and administration not further defined 0411 Accounting and taxation 0412 Finance, banking, and insurance 0413 Management and administration 0414 Marketing and advertising 0415 Secretarial and office work 0416 Wholesale and retail sales 0417 Work skills 0419 Business and administration not elsewhere classified

2.3.1 Arts and Humanities

BNQF Code	Course Code	Course Name	Credit	Pre-requisite	Yr.-Sr.
0231 1101	ENG 101	English Grammar, Reading & Writing	3.00	-- -	1-1
0231 1202	ENG 103	English Speaking & Listening	2.00	ENG 101	1-2
0231 1103	ENG 104	Technical English Communication Lab	1.50	ENG 103	1-1
0232 1104	BNG 101	Functional Bengali	2.00	---	1-1
0311 1205	ECO 101	Engineering Economics	3.00	---	1-2
0411 2206	ACT 201	Accounting Fundamentals	3.00	---	2-2
0222 1107	HUM 101	Bangladesh Studies & History of Independence	2.00	---	1-1
0413 2208	MGT 201	Industrial Management & Business Communication	3.00	---	2-2
0223 3109	EEP 301	Professional Ethics & Environmental Protection	3.00	---	3-1
Sub-Total			22.50		

Table-4: BNQF Code regulation according to ISCED-F 2013 for Basic Science

Broad field	Narrow field	Detailed Field
05 Natural sciences, mathematics, and statistics	053 Physical sciences	0530 Physical sciences not further defined 0531 Chemistry 0532 Earth sciences 0533 Physics 0539 Physical sciences not elsewhere classified

2.3.2 Basic Science

BNQF Code	Course Code	Course Name	Credit	Pre-requisite	Yr.-Sr
0533 1101	PHY 101	Physics-I (Thermodynamics, Materials, Waves and Oscillations, Optics)	3.00	---	1-1
0533 1203	PHY 103	Physics-II (Electricity and Magnetism, Modern Physics and Quantum Mechanics)	3.00	---	1-2
0533 1204	PHY 104	Physics Lab	1.50	PHY 101	1-2
0533 2105	PHY 201	Electronic Properties of Materials	3.00	PHY 103	2-1
0533 3206	PHY 301	Electromagnetic Fields and Waves	3.00	PHY 103	3-2
Sub-Total			13.50		

Table-5: BNQF Code regulation according to ISCED-F 2013 for Mathematics Courses

Broad field	Narrow field	Detailed Field
05 Natural sciences, mathematics, and statistics	054 Mathematics and statistics	0540 Mathematics and statistics not further defined 0541 Mathematics 0542 Statistics

2.3.3 Mathematics Courses

BNQF Code	Course Code	Course Name	Credit	Pre-requisite	Yr.-Sr.
0541 1101	MAT 101	Mathematics I (Differential and Integral Calculus)	3.00	---	1-1
0541 1202	MAT 102	Mathematics II (Ordinary and Partial Differential Equations)	3.00	---	1-2
0541 2103	MAT 103	Mathematics III (Co-Ordinate Geometry & Linear Algebra)	3.00	MAT 101	2-1
0541 2204	MAT 201	Mathematics IV (Vector, Complex Variable, Laplace Transform and Fourier Analysis)	3.00	MAT 103	2-2
0542 2205	STA 201	Statistics and Probability Distribution	3.00	---	2-2
0541 3106	MAT 302	Numerical Methods for Electrical Engineering Lab	1.50	---	3-1
Sub-Total			16.50		

Table-6: BNQF Code regulation according to ISCED-F 2013 for Inter-Disciplinary Engineering Courses

Broad field	Narrow field	Detailed Field
07 Engineering, manufacturing, and construction	071 Engineering and engineering trades	0710 Engineering and engineering trades not further defined 0711 Chemical engineering and processes 0712 Environmental protection technology 0713 Electricity and energy 0714 Electronics and automation 0715 Mechanics and metal trades 0716 Motor vehicles, ships, and aircraft 0719 Engineering and engineering trades not elsewhere classified
	078 Inter-disciplinary programs and qualifications involving	0788 Inter-disciplinary programs and qualifications

	engineering, manufacturing and construction	involving engineering, manufacturing and construction
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Table-7: BNQF Code regulation according to ISCED-F 2013 for Inter-Disciplinary Engineering Courses

Broad field	Narrow field	Detailed Field
06 Information and Communication Technologies (ICTs)	061 Information and Communication Technologies (ICTs)	0610 Information and Communication Technologies (ICTs) not further defined 0611 Computer use 0612 Database and network design and administration 0613 Software and applications development and analysis 0619 Information and Communication Technologies

2.3.4 Inter-Disciplinary Engineering Courses

BNQF Code	Course Code	Course Name	Credit	Pre-requisite	Yr.-Sr
0715 2101	MT 201	Mechatronic Circuits and Systems	2.00	---	2-1
0788 3102	CE 302	Engineering Service Design	2.00	---	3-1
0613 2101	CSE 201	Structured Programming Language	3.00	---	2-1
0613 2102	CSE 202	Structured Programming Language Lab	1.50	---	2-1
Sub-Total			8.50		

Table-8: BNQF Code regulation according to ISCED-F 2013 for Program Core Courses

Broad field	Narrow field	Detailed Field
07 Engineering, manufacturing, and construction	071 Engineering and engineering trades	0710 Engineering and engineering trades not further defined 0711 Chemical engineering and processes 0712 Environmental protection technology

		0713 Electricity and energy 0714 Electronics and automation 0715 Mechanics and metal trades 0716 Motor vehicles, ships, and aircraft 0719 Engineering and engineering trades not elsewhere classified
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2.3.5 Program Core Courses

BNQF Code	Course Code	Course Name	Credit	Pre-requisite	Yr.-Sr.
0713 1101	EEE 101	Electrical Circuits I	3.00	---	1-1
0713 1202	EEE 103	Electrical Circuits II	3.00	EEE 101	1-2
0713 1203	EEE 104	Electrical Circuits Lab	1.50	EEE 101	1-2
0714 2101	EEE 201	Electronic Circuits I	3.00	EEE 103	2-1
0713 2104	EEE 203	Electrical Machines I	3.00	EEE 103	2-1
0714 2202	EEE 207	Electronic Circuits II	3.00	EEE 201	2-2
0714 2203	EEE 208	Electronic Circuits Lab	1.50	EEE 201	2-2
0713 3105	EEE 209	Electrical Machines II	3.00	EEE 203	3-1
0713 3106	EEE 210	Electrical Machines Lab	1.50	EEE 203	3-1
0714 3104	EEE 213	Continuous Signals and Linear Systems	3.00	MAT 201	3-1
0714 3105	EEE 303	Digital Electronics	3.00	EEE 201	3-1
0714 3106	EEE 304	Digital Electronics Lab	1.50	EEE 201	3-1
0713 3207	EEE 305	Power System I	3.00	EEE 203, EEE 209	3-2
0713 3208	EEE 306	Power System Lab	1.50	EEE 203, EEE 209	3-2
0714 3207	EEE 307	Telecommunication Engineering	3.00	EEE 301	3-2
0714 3208	EEE 308	Telecommunication Engineering Lab	1.50	EEE 301	3-2
0714 4109	EEE 313	Digital Signal Processing I	3.00	EEE 301	4-1
0714 4110	EEE 314	Digital Signal Processing I Lab	1.50	EEE 301	4-1
0714 4211	EEE 319	Microprocessor and Interfacing	3.00	EEE 303, CSE 201	4-2
0714 4212	EEE 320	Microprocessor and Interfacing Lab	1.50	CSE 201, CSE 202	4-2

BNQF Code	Course Code	Course Name	Credit	Pre-requisite	Yr.-Sr.
0714 3213	EEE 301	Modern Control System	3.00	EEE 103, EEE 301, MAT 103	3-2
0714 3214	EEE 302	Modern Control System Lab	1.50	EEE 103, EEE 301, MAT 103	3-2
0713 4109	EEE 493	Measurement and Instrumentation	3.00	EEE 201, EEE 207	4-1
0719 4101	EEE 400	Final Year Capstone Project/Thesis	6.00	Up to 9 th Semester	4-1, 4-2
Sub-Total			61.50		

2.3.6 Elective Courses (Choose any of the four majors)

Table-9: BNQF Code regulation according to ISCED-F 2013 for Elective Courses

Broad field	Narrow field	Detailed Field
07 Engineering, manufacturing, and construction	071 Engineering and engineering trades	0710 Engineering and engineering trades not further defined 0711 Chemical engineering and processes 0712 Environmental protection technology 0713 Electricity and energy 0714 Electronics and automation 0715 Mechanics and metal trades 0716 Motor vehicles, ships, and aircraft 0719 Engineering and engineering trades not elsewhere classified

2.3.6.1 Major in Telecommunication

BNQF Code	Course Code	Course Name	Credit	Pre-requisite	Yr.-Sr.
0714 4125	EEE 451	Random Signals and Process	3.00	EEE 213, STA 201	4-1
0714 4126	EEE 455	Optical Fiber Communication	3.00	PHY 101, EEE 307	4-1
0714 4127	EEE 463	Microwave Engineering	3.00	EEE 311	4-1
0714 4128	EEE 464	Microwave Engineering Lab	1.50	EEE 311	4-1
0714 4229	EEE 453	Mobile Cellular Communication	3.00	EEE 307	4-2

BNQF Code	Course Code	Course Name	Credit	Pre-requisite	Yr.-Sr.
0714 4230	EEE 457	Digital Signal Processing II	3.00	EEE 313, EEE 451	4-2
0714 4121	EEE 435	Optoelectronics	3.00		4-1
0714 4122	EEE 436	Optoelectronics Lab	1.50		4-1
0714 4231	EEE 461	Digital Communication	3.00	EEE 307, STA 201	4-2
0714 4232	EEE 462	Digital Communication Lab	1.50	EEE 307, STA 201	4-2
0714 4233	EEE 465	Information and Coding	3.00	EEE 461	4-2
0714 4234	EEE 427	Fundamentals of IoT	3.00	EEE 307	4-2
0714 4235	EEE 428	Fundamentals of IoT Lab	1.50	--	4-2
0714 4236	EEE 459	Optical Networks		EEE 307	4-2
Sub-Total (4x3 + 2x1.5)			15.00		

Table-10: BNQF Code regulation according to ISCED-F 2013 for Elective Courses

Broad field	Narrow field	Detailed Field
07 Engineering, manufacturing, and construction	071 Engineering and engineering trades	0710 Engineering and engineering trades not further defined 0711 Chemical engineering and processes 0712 Environmental protection technology 0713 Electricity and energy 0714 Electronics and automation 0715 Mechanics and metal trades 0716 Motor vehicles, ships, and aircraft 0719 Engineering and engineering trades not elsewhere classified

2.3.6.2 Major in Power

BNQF Code	Course Code	Course Name	Credit	Pre-requisite	Yr.-Sr.
0713 4110	EEE 471	Renewable Energy	3.00	EEE 305	4-1
0713 4111	EEE 473	Energy Conversion III	3.00	EEE 209	4-1
0713 4112	EEE 477	Power Electronics	3.00	EEE 201, EEE 207	4-1

0713 4113	EEE 478	Power Electronics Lab	1.50	EEE 201, EEE 207	4-1
0713 4214	EEE 475	Power Plant Engineering	3.00	EEE 305	4-2
0713 4115	EEE 479	Power System Reliability	3.00	EEE 305, STA 201	4-1
0713 4216	EEE 481	Power System Protection	3.00	EEE 305	4-2
0713 4217	EEE 482	Power System Protection Lab	1.50	EEE 305	4-2
0713 4218	EEE 483	High Voltage Engineering	3.00	EEE 305	4-2
0713 4219	EEE 484	High Voltage Engineering Lab	1.50	EEE 305	4-2
Sub-Total (4x3 + 2x1.5)			15.00		

Table-10: BNQF Code regulation according to ISCED-F 2013 for Elective Courses

Broad field	Narrow field	Detailed Field
07 Engineering, manufacturing, and construction	071 Engineering and engineering trades	0710 Engineering and engineering trades not further defined 0711 Chemical engineering and processes 0712 Environmental protection technology 0713 Electricity and energy 0714 Electronics and automation 0715 Mechanics and metal trades 0716 Motor vehicles, ships, and aircraft 0719 Engineering and engineering trades not elsewhere classified

2.3.6.3 Major in Electronics

BNQF Code	Course Code	Course Name	Credit	Pre-requisite	Yr.-Sr.
0714 4115	EEE 429	VLSI Circuits I	3.00	EEE 303, EEE 411	4-1
0714 4116	EEE 430	VLSI Circuits I Lab	1.50	EEE 303, EEE 411	4-1
0714 4117	EEE 411	Analog Integrated Circuits	3.00	EEE 207	4-1
0714 4118	EEE 425	Biomedical Engineering	3.00	EEE 103, EEE 207, EEE 213	4-1

BNQF Code	Course Code	Course Name	Credit	Pre-requisite	Yr.-Sr.
0714 4119	EEE 437	Digital Integrated Circuit Design	3.00	EEE 429	4-1
0714 4220	EEE 433	Semiconductor Devices	3.00	EEE 211	4-2
0714 4121	EEE 435	Optoelectronics	3.00		4-1
0714 4122	EEE 436	Optoelectronics Lab	1.50		4-1
0714 4223	EEE 445	VLSI Circuits II	3.00	EEE 429	4-2
0714 4224	EEE 446	VLSI Circuits II Lab	1.50	EEE 430	4-2
0714 4225	EEE 447	Introduction to Nanotechnology	3.00		4-2
Sub-Total (4x3 + 2x1.5)			15.00		

Table-11: BNQF Code regulation according to ISCED-F 2013 for Elective Courses

Broad field	Narrow field	Detailed Field
06 Information and Communication Technologies (ICTs)	061 Information and Communication Technologies (ICTs)	0610 Information and Communication Technologies (ICTs) not further defined 0611 Computer use 0612 Database and network design and administration 0613 Software and applications development and analysis 0619 Information and Communication Technologies

2.3.6.4 Major in Computer Engineering

BNQF Code	Course Code	Course Name	Credit	Pre-requisite	Yr.-Sr.
0613 4103	CSE 409	Discrete Mathematics	3.00	---	4-1
0613 4104	CSE 411	Computer Architecture	3.00	EEE 303	4-1
0613 4205	CSE 413	Mathematical Analysis for Computer Science	3.00	CSE 409	4-2
0613 4206	CSE 415	Digital Computer Design	3.00	EEE 303	4-2
0613 4107	CSE 417	Object Oriented Programming Language	3.00	CSE 201, CSE 202	4-1
0613 4108	CSE 418	Object Oriented Programming Language Lab	1.50	CSE 201, CSE 202	4-1
0613 4109	CSE 419	Computer Networks	3.00	EEE 307, CSE 201	4-1
0613 4110	CSE 420	Computer Networks Lab	1.50	EEE 307, CSE 201	4-1

0613 4211	CSE 421	Microprocessor Based System Design	3.00	EEE 319, EEE 320	4-2
0613 4212	CSE 422	Microprocessor Based System Design Lab	1.50	EEE 319, EEE 320	4-2
Sub-Total (4x3 + 2x1.5)			15.00		

2.3.7 Courses from Minor Areas

Minor Areas (any 1 from 4 areas)	No. of Minor courses	Credit/course	Total credits
Telecommunication/Power /Electronics/Computer Engineering	1 theory course	3.0	3
	1 lab course	1.5	1.5
Sub-Total (1x3 + 1x1.5)			4.5

2.3.8 Optional Courses

BNQF Code	Course Code	Course Name	Credit	Pre-requisite	Yr.-Sr.
0719 4102	EEE 450	Industrial Training	0.00	---	

2.3.9 Summary of Program Curriculum

S/N	Type of Courses	No. of Courses	No. of Credits
1	Language	04 (1x3 + 2x2 + 1x1.5)	08.50
2	General Education	05 (4x3 + 1x2)	14.00
3	Mathematics	06 (5x3 + 1x1.5)	16.50
4	Basic Sciences	05 (4x3 + 1x1.5)	13.50
5	Interdisciplinary Engineering Courses	04 (1x3 + 2x2 + 1x1.5)	08.50
6	Program Core Courses	24 (14x3 + 9x1.5 + 1x6)	61.50
7	Courses as Major	6 (4x3 + 2x1.5)	15.00
8	Courses as Minor	2 (1x3 + 1x1.5)	04.50
9	Optional Courses	1(1x0)	0
		Total Courses: 56 (No. of theory courses = 40 No. of lab courses = 16)	Total Credits: 142

2.4 Year/Level/Semester/Term wise distribution of courses

1st Year 1st Semester

Sl. No.	BNQF Code	Course Code	Course Title	Credit	Contact Hours/Week
Theoretical Courses					
1.	0533 1101	PHY 101	Physics I	3.0	3.00
2.	0541 1101	MAT 101	Mathematics I (Differential and Integral Calculus)	3.0	3.00
3.	0713 1101	EEE 101	Electrical Circuits I	3.0	3.00
4.	0231 1101	ENG 101	English Grammar, Reading & Writing	3.0	3.00
5.	0222 1107	HUM 101	Bangladesh Studies & History of Independence	2.0	3.00
6.	0232 1101	BNG 101	Functional Bengali	2.0	3.00
Practical Courses					
7.	0231 1104	ENG 104	Technical English Communication Lab	1.5	3.00
Total				17.5	21.0

1st Year 2nd Semester

Sl. No.	BNQF Code	Course Code	Course Title	Credit	Contact Hours/Week
Theoretical Courses					
1.	0713 1205	ECO 101	Engineering Economics	3.0	3.00
2.	0533 1203	PHY 103	Physics II	3.0	3.00
3.	0541 1202	MAT 102	Mathematics II (Ordinary and Partial Differential Equations)	3.0	3.00
4.	0713 1202	EEE 103	Electrical Circuits II	3.0	3.00
5.	0231 1202	ENG 103	English Speaking & Listening	2.0	3.00
Practical Courses					
6.	0533 1204	PHY 104	Physics Lab	1.5	3.00
7.	0713 1203	EEE 104	Electrical Circuits Lab	1.5	3.00
Total				17.0	21.0

2nd Year 1st Semester

Sl. No.	BNQF Code	Course Code	Course Title	Credit	Contact Hours/Week
Theoretical Courses					
8.	0541 2103	MAT 103	Mathematics III (Co-Ordinate Geometry & Linear Algebra)	3.0	3.00
9.	0613 2101	CSE 201	Structured Programming Language	3.0	3.00
10.	0714 2101	EEE 201	Electronic Circuits I	3.0	3.00
11.	0715 2101	MT 201	Mechatronic Circuits and Systems	2.0	3.00
12.	0533 2105	PHY 201	Electronic Properties of Materials	3.0	3.00
13.	0713 2105	EEE 203	Electrical Machines I	3.0	3.00
Practical Courses					
14.	0613 2102	CSE 202	Structured Programming Language Lab	1.5	3.00
Total				18.5	21.0

2nd Year 2nd Semester

Sl. No.	BNQF Code	Course Code	Course Title	Credit	Contact Hours/Week
Theoretical Courses					
15.	0413 2208	MGT 201	Industrial Management & Business Communication	3.0	3.00
16.	0541 2204	MAT 201	Mathematics IV (Vector, Complex Variable, Laplace Transform and Fourier Analysis)	3.0	3.00
17.	0542 2205	STA 201	Statistics and Probability Distribution	3.0	3.00
18.	0411 2206	ACT 201	Accounting Fundamentals	3.0	3.00
19.	0714 2202	EEE 207	Electronic Circuits II	3.0	3.00
Practical Courses					
20.	0714 2203	EEE 208	Electronic Circuits Lab	1.5	3.00
Total				16.5	18.0

3rd Year 1st Semester

Sl. No.	BNQF Code	Course Code	Course Title	Credit	Contact Hours/Week
Theoretical Courses					
21.	0713 3105	EEE 209	Electrical Machines II	3.0	3.00
22.	0714 3104	EEE 213	Continuous Signals and Linear Systems	3.0	3.00
23.	0223 3109	EEP 301	Professional Ethics & Environmental Protection	3.0	3.00
24.	0714 3105	EEE 303	Digital Electronics	3.0	3.00
Practical Courses					
25.	0713 3106	EEE 210	Electrical Machines Lab	1.5	3.00
26.	0541 3106	MAT 302	Numerical Methods for Electrical Engineering Lab	1.5	3.00
27.	0788 3102	CE 302	Engineering Service Design	2.0	3.00
28.	0714 3106	EEE 304	Digital Electronics Lab	1.5	3.00
Total				18.5	24.0

3rd Year 2nd Semester

Sl. No.	BNQF Code	Course Code	Course Title	Credit	Contact Hours/Week
Theoretical Courses					
29.	0714 3209	EEE 313	Digital Signal Processing I	3.0	3.00
30.	0533 3206	PHY 301	Electromagnetic Fields and Waves	3.0	3.00
31.	0714 3207	EEE 307	Telecommunication Engineering	3.0	3.00
32.	0713 3207	EEE 305	Power system I	3.0	3.00
Practical Courses					
33.	0714 3210	EEE 314	Digital Signal Processing I Lab	1.5	3.00
34.	0714 3218	EEE 308	Telecommunication Engineering Lab	1.5	3.00
35.	0713 3208	EEE 306	Power system Lab	1.5	3.00
Total				16.5	21.0

4th Year 1st Semester

Sl. No.	BNQF Code	Course Code	Course Title	Credit	Contact Hours/Week
Theoretical Courses					
36.	0719 4101	EEE 400	Final Year Capstone Project/Thesis	3.0	3.00
37.	0714 4113	EEE 301	Modern Control System	3.0	3.00
38.	0713 4109	EEE 493	Measurement & Instrumentation	3.0	3.00
39.	0714 4121	EEE 435	Optoelectronics (TCom/Elec)	3.0 (Any 1)	3.00
40.	0714 4126	EEE 455	Optical Fiber Communication (TCom)		
41.	0713 4110	EEE 471	Renewable Energy (Pow)		
42.	0713 4111	EEE 473	Energy Conversion III (Pow)		
43.	0714 4118	EEE 425	Biomedical Engineering (Ele)		
44.	0613 4103	EEE 409	Discrete Mathematics (Com)		
45.	0613 4107	CSE 417	Object-Oriented Programming Language (Com)		
46.	0714 4125	EEE 451	Random Signals and Process (TCom)	3.0 (Any 1)	3.00
47.	0714 4127	EEE 463	Microwave Engineering (TCom)		
48.	0713 4112	EEE 477	Power Electronics (Pow)		
49.	0713 4115	EEE 479	Power System Reliability (Pow)		
50.	0714 4117	EEE 411	Analog Integrated Circuits (Ele)		
51.	0714 4119	EEE 437	Digital Integrated Circuit Design (Ele)		
52.	0613 4104	CSE 411	Computer Architecture (Com)		
53.	0612 4109	CSE 419	Computer Networks (Com)		
Practical Courses					
54.	0714 4114	EEE 302	Modern Control System Lab	1.5	3.00
55.	0714 4122	EEE 436	Optoelectronics Lab (TCom/Elec)	1.5 (Any 1)	3.00

56.	0714 4128	EEE 464	Microwave Engineering Lab (TCom)		
57.	0713 4113	EEE 478	Power Electronics Lab (Pow)		
58.	0613 4108	CSE 418	Object Oriented Programming Language Lab (Com)		
59.	0612 4110	CSE 420	Computer Networks Lab (Com)		
Total				18.0	21.0

4th Year 2nd Semester

Sl. No.	BNQF Code	Course Code	Course Title	Credit	Contact Hours/Week
Theoretical Courses					
60.	0719 4101	EEE 400	Final Year Capstone Project/Thesis	3.0	3.00
61.	0714 4211	EEE 319	Microprocessor and Interfacing	3.0	3.00
62.	0714 4229	EEE 453	Mobile Cellular Communication (TCom)	3.0 (Any 1)	3.00
63.	0714 4230	EEE 457	Digital Signal Processing II (TCom)		
64.	0714 4236	EEE 459	Optical Networks		
65.	0713 4214	EEE 475	Power Plant Engineering (Pow)		
66.	0713 4218	EEE 483	High Voltage Engineering (Pow)		
67.	0714 4215	EEE 429	VLSI Circuits I (Ele)		
68.	0714 4223	EEE 445	VLSI Circuits II (Ele)		
69.	0714 4225	EEE 447	Introduction to Nanotechnology		
70.	0613 4205	CSE 413	Mathematical Analysis for Computer Science (Com)		
71.	0714 4231	EEE 461	Digital Communication (TCom)	3.0 (Any 1)	3.00
72.	0714 4233	EEE 465	Information and Coding (TCom)		
73.	0714 4234	EEE 427	Fundamental of IoT (TCom)		
74.	0713 4216	EEE 481	Power System Protection (Pow)		

75.	0714 4220	EEE 433	Semiconductor Devices (Ele)		
76.	0613 4206	CSE 415	Digital Computer Design (Com)		
Practical Courses					
77.	0714 4212	EEE 320	Microprocessor and Interfacing Lab	1.5	3.00
78.	0714 4232	EEE 462	Digital Communication Lab (TCom)	1.5 (Any 1)	3.00
79.	0714 4235	EEE 428	Fundamental of IoT Lab (TCom)		
80.	0713 4217	EEE 482	Power System Protection Lab (Pow)		
81.	0713 4219	EEE 484	High Voltage Engineering Lab (Pow)		
82.	0714 4216	EEE 430	VLSI Circuits I Lab (Ele)		
83.	0714 4224	EEE 446	VLSI Circuits II Lab (Ele)		
84.	0613 4212	CSE 422	Microprocessor-Based System Design Lab (Com)		
* One theory and one lab course from minor (4.5 credits) Total				15+4.5=19.5	18.0+6.0=24.0
In Eight (8) Semesters Total Credits				142	

Chapter 3

Detailed Description of Undergraduate Courses

3.1 Core Courses

EEE 101: Electrical Circuit I

Credit: 3

BNQF Code: 0713 1101

3 hours/week

Rationale of the Course: Learning Electric Circuits is the gateway to the vast world of Electrical and Electronic Engineering. In fact, many subjects you will study in other sector of your study life depend on the sound knowledge of this subject. The primary objective of this subject is to establish a firm understanding of the basic laws of electric circuits which develop a working knowledge of the methods of analysis used most frequently in further topics of Electrical Engineering. This course also provides a comprehensive insight into the principal techniques available for characterizing circuits and networks theoretically.

Course Content:

Circuit variables and elements: Voltage, current, power, energy, independent and dependent sources, resistance.

Basic laws: Ohm's law, Kirchhoff's current and voltage laws.

Simple resistive circuits: Series and parallel circuits, voltage and current division, Wye-Delta transformation.

Techniques of circuit analysis: Nodal and mesh analysis including super node and super mesh. Network theorems: Source transformation, Thevenin's, Norton's and Superposition theorems with applications in circuits having independent and dependent sources, maximum power transfer condition and reciprocity theorem.

Energy storage elements: Inductors and capacitors, series parallel combination of inductors and capacitors. Responses of RL and RC circuits: Natural and step responses.

Magnetic quantities and variables: Flux, permeability and reluctance, magnetic field strength, magnetic potential, flux density, magnetization curve. Laws in magnetic circuits: Ohm's law and Ampere's circuital law. Magnetic circuits: series, parallel and series-parallel circuits.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO1	PLO2
CLO1	Explain basic laws, circuit theorems and methods in electric circuits.	√	
CLO2	Apply the knowledge of engineering fundamentals to the elementary electric circuits to identify and formulate mathematical problems.	√	
CLO3	Analyze and solve electric and magnetic circuits using different known methods.	√	

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 103: Electrical Circuit II

Credit: 3

BNQF Code: 0713 1202

3 hours/week

Rationale of the Course: The objective of the course is to make the student familiar with demonstration and analysis of various AC electrical circuits (1-phase & 3-phase) by various analytical methods and tools, demonstrate & evaluation of resonance circuit, passive filters, oscillators and magnetically coupled circuits.

Course Content:

- Sinusoid & Phasor: Sinusoid, phasor, impedance and admittance
- Sinusoidal steady-state analysis: Nodal & mesh analysis, superposition, Thevenin & Norton equivalent circuits

- AC power analysis: Instantaneous & average power, maximum power transfer, RMS value, apparent power, complex power and power factor
- 3-phase AC circuits: 3-phase voltages, balanced Y-Y, Y-Delta & Delta-Y connections, power in balanced system, unbalanced 3-phase system
- Magnetically coupled circuits: Mutual inductance, energy in a coupled circuit, linear & ideal transformer, ideal autotransformer and 3-phase transformer.
- Frequency response: Transfer function, decibel scale, Bode plots, series & parallel resonance, passive & active filter.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO1	PLO2
CLO1	Apply basic concepts and theories to demonstrate AC electrical and magnetic circuits.	√	
CLO2	Design circuits of basic ac devices		√
CLO3	Analyze 1-phase and 3-phase AC electrical circuits to determine voltage, current, power and losses.		√

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 104: Electrical Circuit Lab

Credit: 1.5

BNQF Code: 0713 1203

3 hours/week

Rationale of the Course: Electrical Circuits II Laboratory is one of the fundamental laboratory courses for EEE students. It aims to develop practical understanding of the student on electrical circuit related laws and different theorems for direct current (DC) and alternating current (AC). Besides this course provides the knowledge about frequency responses of the electrical circuits.

Course Content: This course will mainly focus on basics about direct current (DC) and alternating current (AC), laws of electrical circuits with respect to direct current and alternating current sources, analysis

techniques like mesh and nodal analysis for direct current and alternating current, different circuit theorems like superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem etc. for direct current and alternating current, frequency response for capacitor and inductor related circuits and their series-parallel combination etc.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO1	PLO2	PLO3	PLO4	PLO9	PLO10
CLO1	Use the various procedures and techniques for simulating electrical circuits driven by alternating current.	√					
CLO2	Verify different electrical laws and theorems for alternating current by proposing simulation procedures and by applying mathematical equations, graphical analysis to the simulated data.	√					
CLO3	Design and develop a system for real life use or for analyzing the circuit activities in depth based on electrical circuit knowledge achieved by the course.			√			
CLO4	Select modern hardware and software tools and devices for using them to solve the problems related to electrical circuits.				√		
CLO5	Work on complex engineering problems individually and in a team.					√	
CLO6	Communicate and share knowledge, data, information, results etc. with others.						√

Teaching Strategies: Lecture, Laboratory hardware and software experiments, and Project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Lab Experiment • Tutorial • Group Discussion • Lab Practice	• Mini Project Presentation • Attendance • Continuous Lab Performance • Final lab Test/Exam • Lab Report
CLO2		
CLO3		
CLO4		

CLO5		Individual/Team Work Rubrics
CLO6		Presentation, Viva and Lab Report

EEE 201: Electronic Circuits I

Credit: 3

BNQF Code: 0714 2101

3 hours/week

Rationale of the Course: To learn about different Electronic Devices like Diodes, Zener Diodes, Bipolar Junction Transistors, Field Effect Transistors, Metal Oxide Semiconductor Field Effect Transistors etc. and their applications.

Course Content:

- Semiconductor materials & their classifications, intrinsic & extrinsic semiconductor materials, Energy levels, n-type & p-type materials,
- Diode: Semiconductor diode, Ideal diode. p-n junction diode: operating principle, current-voltage characteristics, DC and AC models. Diode circuits: Half and full wave rectifiers, rectifier with capacitor filter, clipping and clamping circuits, Logic gates using diode, Zener diode and zener shunt regulator.
- Bipolar junction transistor (BJT): structure and physical operation, BJT characteristics, BJT as an amplifier, biasing BJT amplifiers, BJT as a switch. BJT small signal analysis. Semiconductor materials & their classifications, intrinsic & extrinsic semiconductor materials, Energy levels, n-type & p-type materials,
- Diode: Semiconductor diode, Ideal diode. p-n junction diode: operating principle, current-voltage characteristics, DC and AC models. Diode circuits: Half and full wave rectifiers, rectifier with capacitor filter, clipping and clamping circuits, Logic gates using diode, Zener diode and zener shunt regulator.
- Bipolar junction transistor (BJT): structure and physical operation, BJT characteristics, BJT as an amplifier, biasing BJT amplifiers, BJT as a switch. BJT small signal analysis.
- FET: FET & its classifications, Metal-oxide-semiconductor field-effect-transistor (MOSFET): structure and physical operation of enhancement type MOSFETs, current-voltage characteristics, threshold voltage and body effect, biasing MOSFET amplifiers, small signal operation and models, single-stage mid-band frequency MOSFET amplifiers with different configurations.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Explain the basic knowledge of semiconductor diodes, BJT and FET.	√		
CLO2	Explain the basic knowledge of semiconductor diodes, BJT and FET.		√	

CLO3	Design simple electronic circuits using diode, BJT and FET.		√	
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Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance
CLO2		• Class Test
CLO3		• Assignment • Mid Exam • Final Exam

EEE 203: Electrical Machine I

Credit: 3

BNQF Code: 0713 2104

3 hours/week

Rationale of the Course: This is a core course of *B.Sc. in Electrical and Electronic Engineering (EEE)* program that prepares the student with basic skills in analyzing the electromechanical systems. Besides, this course also emphasizes on the analysis of transformer, polyphase induction motors and single phase motors.

Course Content: Ideal transformer–Construction, working principle, transformation ratio, no-load and load vector diagrams; Actual transformer - construction, equivalent circuit, regulation, short circuit and open circuit tests, parallel operation; Auto transformer–Construction, working principle and applications ;Three phase induction motor- construction, Working Principle, equivalent circuit, vector diagram, torque-speed characteristics, motor torque and developed rotor power, efficiency, no-load test, blocked rotor test, starting and braking and speed control ;Single phase induction motor - Construction, principle of operation, equivalent circuit and applications.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO1	PLO2	PLO3
CLO1	Explain and demonstrate the basic principle and construction of the transformers and induction motors.	√		

CLO2	Analyze & determine the performance of the transformer: equivalent model, voltage regulation, efficiency, all day efficiency.		√	
CLO3	Analyze & determine the slip, starting & running torque, conditions for maximum starting and running torque, various types of losses and power flow through an induction motor.		√	

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 207: Electronic Circuits II

Credit: 3

BNQF Code: 0714 2202

3 hours/week

Rationale of the Course: Analysis and design of electronic circuits, Biasing of and small-signal models for transistors and frequency response of amplifiers. Feedback and stability aspects of amplifier design and operational amplifiers, active filters, oscillators, IC specification and selection.

Course Content: Operational amplifiers (Op-Amp): properties of ideal Op-Amp, inverting, non-inverting and differential amplifiers, integrator and differentiator, weighted summer and other Op-Amp circuits, effects of finite open-loop gain and bandwidth, large signal operation, DC imperfections. Differential and multistage amplifiers: basic operation of differential amplifier, large signal analysis of BJT (Power amplifiers), basic analysis of multistage amplifiers. Frequency response: amplifier transfer functions, diode and transistor high- frequency small signal models, techniques of determining 3 dB frequencies of amplifier circuits, frequency responses of single-stage, multistage and differential amplifiers. Negative feedback: properties, basic topologies, analysis of feedback amplifiers with different topologies and stability.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO1	PLO2	PLO3
CLO1	Demonstrate the basic knowledge of analog electrical devices, particularly operational amplifiers and their applications	√		
CLO2	Apply op-amp fundamentals in design and analysis of op-amps applications		√	
CLO3	Design and analysis of oscillator, power amplifier and different types of filter.		√	

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam

EEE 208: Electronic Circuits Lab

Credit: 1.5

BNQF Code: 0714 2203

3 hours/week

Rationale of the Course: To learn about different Electronic Devices like Diode, Transistor, op-amp, power amplifiers, different types of filters, multivibrators, comparators and their applications.

Course Content: This course will mainly focus on application of electronic components and its application like Rectifier, Clipper, clamper, Zener diode, inverting, non-inverting, summing amplifier, difference amplifier, low pass and high pass filter, class A and class B amplifier and class c amplifier and its applications.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

(CLOs)	CO Statements	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	Design and analyze the various	√					

	application of power amplifiers						
CLO2	Design and analyze the various linear and non-linear application of op-amp.		√				
CLO3	Design and analyze filter circuits using op-amp			√			
CLO4	Design and analyze oscillators, multivibrator and comparator circuits using op-amp				√		
CLO5	Work on complex engineering problems individually and in a team.					√	
CLO6	Communicate and share knowledge, data, information, results etc. with others.						√

Teaching Strategies: Lecture, Laboratory hardware and software experiments, and Project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Lab Experiment • Tutorial • Group Discussion • Lab Practice	• Mini Project Presentation • Attendance • Continuous Lab Performance • Final lab Test/Exam • Lab Report • Individual/Team Work Rubrics • Presentation, Viva and Lab Report
CLO2		
CLO3		
CLO4		
CLO5		
CLO6		

EEE 209: Electrical Machine II

Credit: 3

BNQF Code: 0713 3105

3 hours/week

Rationale of the Course: The main objectives of the course are to develop fundamental understanding on working principles of electrical machines. Along with basic working principles of DC machines as well as AC machines, this course will discuss on some advance features of energy conversion like DC generator, generator characteristics, voltage build up, parallel operation, DC motor principles, speed control,

different loss mechanism, efficiency limit, AC machine, synchronous generator, frequency power relationship, operation at different load, synchronous motor, operation, V curve, synchronous condenser and others important phenomena.

Course Content:

- DC generator: Operating principle, construction, classification, no-load voltage characteristics, build-up of a self-excited shunt generator, critical field resistance, load voltage characteristic, effect of speed on no-load and load characteristics and voltage regulation.
- DC motor: Operating principle, classification, torque, back emf, speed, torque-speed characteristics, starting and speed regulation.
- Synchronous Generator: excitation systems, equivalent circuit, vector diagrams at different loads, factors affecting voltage regulation, synchronous impedance, synchronous impedance method of predicting voltage regulation and its limitations. Parallel operation: necessary conditions, synchronizing, circulating current and vector diagram.
- Synchronous motor: Operation, effect of loading under different excitation condition, effect of changing excitation, V-curves.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO1	PLO2	PLO3
CLO1	Explain the basic concepts and theories of electromagnetic machine.	√		
CLO2	Analyze the working of dc machines as generators and motors.		√	
CLO3	Analyze the features of synchronous machines and to solve problems associated with them.		√	

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

Rationale of the Course: The objective of this course is to practically implement and observe the characteristics of Transformers, Generators, Motors and their applications. Machines used in the experiments are the transformers, AC synchronous machine, AC induction machine, DC series machine and DC shunt machine whereby they will function as motors and generators.

Course Content:

- Single-phase transformer: Open circuit test, short circuit test, load test
- No-load characteristics of dc generator.
- Load characteristics of dc generator.
- No Load and load characteristics of DC motors.
- Speed control of a DC motors.
- No load and load characteristics of a three-phase alternator.
- V-curve of a three-phase synchronous motor.
- No load test and blocked rotor test of three-phase induction motor.
- Construction of three-phase transformer using three single-phase transformer and observation of line voltage & phase voltage and line current & phase current relation in primary and secondary winding with balance and unbalanced loading.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO1	PLO2	PLO3	PLO4	PLO5	PLO9	PLO10
CLO1	Examine the operation and characteristics of DC Generators and Motors.				√			
CLO2	Examine the operation and characteristics of Transformers and Induction Motors.				√			
CLO3	Examine the operation and characteristics of Synchronous Generator and Motor.			√				
CLO4	Select and use modern hardware and software tools and devices					√		

CLO5	Work on complex engineering problems individually and in a team						√	
CLO6	Communicate and share knowledge, data, information, results etc. with others							√

Teaching Strategies: Lecture, Laboratory hardware and software experiments, and Project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Lab Experiment • Tutorial • Group Discussion • Lab Practice	• Mini Project Presentation • Attendance • Continuous Lab Performance • Final lab Test/Exam • Lab Report
CLO2		
CLO3		
CLO4		
CLO5		Individual/Team Work Rubrics
CLO6		Presentation, Viva and Lab0

EEE 213: Continuous Signals and Linear Systems

Credit: 3

BNQF Code: 0714 3104

3 hours/week

Rationale of the Course: This is a core course of Electrical and Electronic Engineering (EEE) program that focuses on signal processing methods and transformation, investigation and designing techniques required for related Electrical Engineering courses. This course emphasizes on the analysis of the linear time invariant (LTI) systems using Fourier series, Fourier transform and z-transform. Lastly, design of digital filters using most common and widely used methods will be studied.

Course Content:

- Introduction to digital signal processing: Types of signals, difference between digital and analog signals, advantages of digital signal processing, concept of discrete-time frequency and sinusoids, digital to analog conversion, sampling theorem, basic discrete signals.
- Discrete-time systems: Types of systems, transformation of signals, block diagram representation of discrete-time systems.

- Solution of discrete-time systems: Convolution, difference equations, solution of difference equations, correlation
- Z-transformation: z-transformation, properties of z-transformation, transformation table, rational z-transformation, poles and zeros, solving systems using z-transformation, analyzing stability of LTI systems.
- Fourier series and transformation: Concept of Fourier series and transformation and their usage, properties of Fourier series and transformation, difference between Fourier series and transformation, analyzing signals using Fourier series and transformation.
- Analysis of discrete-time systems: Frequency domain characteristics of linear time invariant systems, response of Linear time invariant systems to complex exponential and sinusoidal signals.
- Design of digital filters: Concept of digital filters, difference and advantage and disadvantages of digital filters over analog filters, FIR and IIR filters and their differences and applications, linear phase characteristics, design of FIR filters using window method and frequency sampling method, design of IIR filters using pole-zero placement method.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO1	PLO2	PLO3
CLO1	Explain and classify the continuous-time and discrete-time signals and systems	√		
CLO2	Identify, formulate and solve the problems related to LTI systems		√	
CLO3	Analyze LTI systems using Fourier Series, Fourier Transform, and Laplace Transform.		√	

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

Rationale of the Course: Digital electronics is a field of electronics involving the study of digital signals and the engineering of devices that use or produce them. This is in contrast to analog electronics and analog signals. Digital electronic circuits are usually made from large assemblies of logic gates, often packaged in integrated circuits. Complex devices may have simple electronic representations of Boolean logic functions.

Course Content:

- Switching Theory, Boolean algebra, De Morgan's theorem, Truth table, Logic Circuit simplification, Logic gates, Combinational circuits, Circuits design using NAND or NOR gates only.
- Minimization of switching functions, Algebraic simplification using Karnaugh map, Quina Mc-cluskey method.
- Fundamental on Combinational Logic and Sequential Logic circuit: Arithmetic Circuits, The half adder and full adder, Parallel adders, IC parallel adders, the 2'S complement addition and subtraction, The BCD adder, Binary multiplier.
- Flip-flop & register: Latches, S-R, J-K, D, T flip-flops, masters slave FF. Flip-flops applications, Counters: Introduction, synchronous and asynchronous ripple up and down counters, frequency counter, digital clock.
- Encoder, Decoder (BCD to decimal, BCD-to-7-segment decoder/drivers), Multiplexer, Demultiplexer and their application.
- Basic in D/A and A/D Conversions, Successive approximation, Flash and tri-state ADC, Digital to analog conversion circuits, specification, applications, Data acquisition, digital voltmeter, Sample and hold circuits,
- Integrated circuits logic families, TTI series, TTL loading rules, TTL open collector outputs, TTL, The BCL families, Digital MOSFET circuits, Characteristics, CMOS circuits, CMOS trusted logic.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO1	PLO2	PLO3
CLO1	Explain the fundamental concepts and techniques used in combinational and sequential logic circuits.	√		
CLO2	Design various combinational and sequential circuits such as decoder, encoder, multiplexer, demultiplexer, register, counter etc.		√	
CLO3	Investigate and evaluate various combinational and sequential circuits.		√	

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 304: Digital Electronics Lab

Credit: 1.5

BNQF Code: 0714 3106

3 hours/week

Rationale of the Course: On the basis of digital electronics theory course, this lab course will create a clear concept over combinational and sequential logic circuits.

Course Content: Boolean algebra, De Morgan's theorem, Truth table, Logic Circuit simplification, Logic gates, Combinational circuits, Circuits design using NAND or NOR gates only. Fundamental on Combinational Logic and Sequential Logic circuit: Arithmetic Circuits. The BCD adder, Binary multiplier. Flip-flop & register Latches, S-R, J-K, D, T flip-flops, masters slave FF. Flip-flops applications. Counters, Introduction, synchronous and asynchronous ripple up and down counters, Frequency counter, digital clock. Encoder, Decoder (BCD to decimal, BCD-to-7-segment decoder/drivers), Multiplexer, Demultiplexer and their application.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CO Statements	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	Design and develop general digital logic circuits	√					
CLO2	Examine and evaluate the operation of general digital logic circuits		√				
CLO3	Select and use modern hardware and software tools and devices			√			
CLO4	Assess societal, health, safety, legal and cultural issues involved with the mini project				√		

CLO5	Realize the impact of societal, environmental and sustainable development issues for the design solution of mini project.					√	
CLO6	Apply professional ethics and responsibilities in the implementation of mini project.						√

Teaching Strategies: Lecture, Laboratory hardware and software experiments, and Project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Lab Experiment • Tutorial • Group Discussion • Lab Practice	• Mini Project Presentation • Attendance • Continuous Lab Performance • Final lab Test/Exam • Lab Report
CLO2		Individual/Team Work Rubrics
CLO3		Presentation, Viva and Lab Report

EEE 305: Power System I

Credit: 3

BNQF Code: 0713 3207

3 hours/week

Rationale of the Course: The objective of the course is to make the student familiar with electrical power system network & analysis methods, load flow & fault analysis methods and power factor improvement techniques.

Course Content:

- Basic concepts of power system
- Transmission line: Short, medium and long transmission line.
- Complex power, single line & reactance diagram of power system and per unit representation.
- Network analysis (Y-bus, Z-bus) and Load flow studies: Gauss-Seidel method.
- Symmetrical fault analysis: Transient phenomenon, short circuit current and reactance of a synchronous machine, Bus impedance matrix
- Unsymmetrical fault analysis: symmetrical components, sequence networks and unsymmetrical fault calculation.
- Power factor improvement techniques

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO1	PLO2	PLO4
CLO1	Apply basic concepts and analytical tools for assessing electrical power system networks.	√		
CLO2	Analyze electrical power system network for normal power flow condition.		√	
CLO3	Apply basic concepts and models to electrical power system networks for various fault conditions.			√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 306: Power System Lab

Credit: 1.5

BNQF Code: 0713 3208

3 hours/week

Rationale of the Course: Power system laboratory is one of the fundamental as well as advance laboratory courses for EEE students. It aims to develop, investigate and analysis on power system networks like transmission lines, single line diagram, fault, load flow studies and power flow control that gives the student total theoretical as well as practical ideas.

Course Content:

- Software introduction: ETAP and Matlab Simulink
- Transmission line: Short, medium and long transmission line
- Per unit system: Simple and complex online diagram
- Power flow control: Tap changing transformer, shunt capacitor and Gauss-Seidal method
- Fault: Symmetrical and unsymmetrical faults

- Stability: Solution of swing equation

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO3	PLO4	PLO5	PLO9	PLO10
CO1	Measure and investigate the different parameters like voltage, current, power and power factor at different points in power system networks.		√			
CO2	Verify different power related laws and theorem on the proposed experimental power system model and investigate it.		√			
CO3	Design and develop a real life cost effective power system network on the basis of knowledge achieved by the course	√				
CO4	Select and use modern software tools for power system analysis.			√		
CO5	Work on complex engineering problems individually and in a team.				√	
CO6	Communicate and share knowledge, data, information, results etc. with others.					√

Teaching Strategies: Lecture, Laboratory hardware and software experiments, and Project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1-CL04	• Class Lecture • Lab Experiment • Tutorial • Group Discussion • Lab Practice	• Mini Project Presentation • Attendance • Continuous Lab Performance • Final lab Test/Exam • Lab Report
CLO5		Individual/Team Work Rubrics
CLO6		Presentation, Viva and Lab Report

Rationale of the Course: The main objectives of the course are to develop fundamental understanding of students on working principles of communication systems. Along with basic working principles of communication theory, this course will discuss on some advance features of communication systems like wavelength-division multiplexing(WDM), time-division multiple-access (TDMA), frequency-division multiple access (FDMA); code-division multiple-access (CDMA).

Course Content:

- Overview of communication systems: Elements of communication systems, necessity of modulation, system limitations, message source, bandwidth requirements, transmission media types, bandwidth and transmission capacity.
- Noise: Source, characteristics of various types of noise and signal to noise ratio.
- Continuous Wave Modulation: AM modulation, double side band, single side band, vestigial side band, quadrature; spectral analysis of each type, envelope and synchronous detection; angle modulation, instantaneous frequency, frequency modulation (FM) and phase modulation (PM), spectral analysis, demodulation of FM and PM.
- Pulse modulation: Sampling- sampling theorem, Nyquist criterion, aliasing, instantaneous and natural sampling; pulse amplitude modulation- principle, bandwidth requirements;
- Pulse code modulation (PCM): quantization principle, quantization noise, non-uniform quantization, signal to quantization error ratio, differential PCM, demodulation of PCM;
- Delta modulation (DM): principle, adaptive DM; line coding: formats and bandwidths.
- Digital modulation: Amplitude-shift keying- principle, ON-OFF keying, bandwidth requirements, detection, noise performance; phase-shift keying (PSK): principle, bandwidth requirements, detection, differential PSK, quadrature PSK, noise performance; frequency shift keying (FSK): principle, continuous and discontinuous phase FSK, minimum-shift keying, bandwidth requirements, detection of FSK.
- Multiplexing: Time-division multiplexing (TDM): principle, receiver synchronization, frame synchronization, TDM of multiple bit rate systems; frequency-division multiplexing (FDM): principle, de-multiplexing; wavelength-division multiplexing, multiple-access network: time-division multiple-access (TDMA), frequency-division multiple access (FDMA); code-division multiple-access (CDMA): spread spectrum multiplexing, coding techniques and constraints of CDMA. • Communication system design: design parameters, channel selection criteria and performance simulation.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO1	PLO2	PLO3
CLO1	Define, explain and characterize the basic concepts and theories of communication systems.	√		
CLO2	Apply and analyze communication theories for problems solving.		√	

CLO3	Analyze features of digital communication systems and to solve problems related to digital communications.		√	
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Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 308: Telecommunication Engineering Lab

Credit: 1.5

BNQF Code: 0714 3208

3 hours/week

Rationale of the Course: Since human voice spectrum is from 300Hz to 3400Hz (very low range of frequency) and analog as well, this course envisions to develop theoretical and practical understanding of the student on modulation, demodulation and conversion of analog and digital signals.

Course Content:

This course will mainly focus on analog communication system emphasizing on different analog modulation and demodulation techniques i.e. Amplitude Modulation: DSB-C, DSB-SC and SSB, Angle Modulation: Frequency Modulation and phase modulation. In addition, this course will also be discussed on TDM, FDM, analog to digital converter(A/D), digital to analog converter(D/A), line code encoder and decoder, ASK, FSK, PSK, PCM, PWM, delta modulation (DM), and adaptive delta modulation (ADM) and demodulation.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO3	PLO4	PLO5	PLO9	PLO10
CO1	Measure and investigate the performance of different analog and digital modulation and demodulation		√			
CO2	Examine the analog to digital and digital to analog conversion process		√			
CO3	Design and develop communication systems using different modulation techniques and evaluate the performance	√				
CO4	Select and use modern hardware and software tools and devices			√		

CO5	Work on complex engineering problems individually and in a team				√	
CO6	Communicate and share knowledge, data, information, results etc. with others					√

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1-CL04	• Class Lecture • Lab Experiment • Tutorial • Group Discussion • Lab Practice	• Mini Project Presentation • Attendance • Continuous Lab Performance • Final lab Test/Exam • Lab Report
CLO5		Individual/Team Work Rubrics
CLO6		Presentation, Viva and Lab Report

EEE 313: Digital signal processing I

Credit: 3

BNQF Code: 0714 4109

3 hours/week

Rationale of the Course: This is a core course of Electrical and Electronic Engineering (EEE) program that focuses on signal processing methods and transformation, investigation and designing techniques required for related Electrical Engineering courses. This course emphasizes on the analysis of the linear time invariant (LTI) systems using Fourier series, Fourier transform and z-transform. Lastly, design of digital filters using most common and widely used methods will be studied.

Course Content:

- Introduction to digital signal processing: Types of signals, difference between digital and analog signals, advantages of digital signal processing, concept of discrete-time frequency and sinusoids, digital to analog conversion, sampling theorem, basic discrete signals.
- Discrete-time systems: Types of systems, transformation of signals, block diagram representation of discrete-time systems.
- Solution of discrete-time systems: Convolution, difference equations, solution of difference equations, correlation
- Z-transformation: z-transformation, properties of z-transformation, transformation table, rational z-transformation, poles and zeros, solving systems using z-transformation, analyzing stability of LTI systems.
- Fourier series and transformation: Concept of Fourier series and transformation and their usage, properties of Fourier series and transformation, difference between Fourier series and transformation, analyzing signals using Fourier series and transformation.

- Analysis of discrete-time systems: Frequency domain characteristics of Linear time invariant systems, response of Linear time invariant systems to complex exponential and sinusoidal signals.
- Design of digital filters: Concept of digital filters, difference and advantage and disadvantages of digital filters over analog filters, FIR and IIR filters and their differences and applications, linear phase characteristics, design of FIR filters using window method and frequency sampling method, design of IIR filters using pole-zero placement method.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO1	PLO2	PLO3
CLO1	Interpret and describe discrete-time signals, systems mathematically and graphically and apply convolution and difference equation solving techniques to calculate system outputs.	√		
CLO2	Perform z-transform and Fourier transform to analyze signals and systems.		√	
CLO3	Design Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) filters to meet expected system specifications.		√	

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 314: Digital Signal Processing I Lab

Credit: 1.5

BNQF Code: 0714 4110

3 hours/week

Rationale of the Course: This course will introduce the basic concepts and techniques for processing signals. Students will be familiar with the most important methods in DSP, including digital filter design and transform-domain processing and analyzing. The computer-based experiments extend better understanding and develop practical problem-solving skills.

Course Content:

- Signal generation and visualization, transformations on signals.
- Convolution and correlation and their application.
- z-transformation, analysis systems using z-transformation
- Fourier series and transformation, analysis of signals and systems using Fourier series and transformation
- Design of digital filters.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	Use MATLAB to generate signals, describe systems, apply different types of signal transformations	√					
CLO2	such as shifting, scaling, folding and perform convolution and correlation		√				
CLO3	Evaluate and characterize the output of various digital signals			√			
CLO4	Analyze discrete time systems using signal processing and symbolic toolboxes of MATLAB				√		
CLO5	Design different discrete time systems to meet specific practical requirements and limitations					√	
CLO6	Work on complex engineering problems individually and in a team						√

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1-CL03	• Class Lecture • Lab Experiment • Tutorial • Group Discussion • Lab Practice	• Mini Project Presentation • Attendance • Continuous Lab Performance • Final lab Test/Exam • Lab Report
CLO4		Individual/Team Work Rubrics
CLO5, CLO6		Presentation, Viva and Lab Report

EEE 319: Microprocessor and Interfacing**Credit: 3****BNQF Code: 0714 4211****3 hours/week**

Rationale of the Course: This is a core course of Electrical and Electronic Engineering (EEE) program that prepares the student with basic skills in microprocessor and assembly language programming. In addition, this course also emphasizes on the interfacing of different types of peripheral devices with processor.

Course Content:

- Introduction to microprocessors. Intel 8086 microprocessor: Architecture, addressing modes, instruction sets, assembly language programming, system design and interrupt.
- Interfacing: programmable peripheral interface, programmable timer, serial communication interface, programmable interrupt controller, direct memory access, keyboard and display interface. Introduction to micro-controllers.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO1	PLO2	PLO3
CLO1	Demonstrate by explaining different features, advantages and disadvantages of the 8086 microprocessor architecture and its instruction set	√		
CLO2	Formulate solution to various mathematical and engineering problems in 8086 assembly language			√
CLO3	Analyze the connections, parallel data transfer methods, handshaking and interfacing of peripheral I/O devices with the 8086 microprocessor.		√	

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 320: Microprocessor and Interfacing Lab**Credit: 1.5****BNQF Code: 0714 4212****3 hours/week**

Rationale of the Course: This is a core course of Electrical and Electronic Engineering (EEE) program that prepares the student with basic skills in microprocessor and assembly language programming. In addition, this course also emphasizes on the interfacing of different types of peripheral devices with processor.

Course Content:

Introduction to microprocessors. Intel 8086 microprocessor: Architecture, addressing modes, instruction sets, assembly language programming, system design and interrupt. Interfacing: programmable peripheral interface, programmable timer, serial communication interface, programmable interrupt controller, direct memory access, keyboard and display interface. Introduction to micro-controllers.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO3	PLO4	PLO5	PLO9	PLO10
CO1	Apply assembly language programming to solve various mathematical and engineering problems.		√			
CO2	Construct higher level language structures (conditional, looping statements, array and string datastructures) in 8086 assembly language.	√				
CO3	Design innovative projects using modern microprocessors such as Arduino, Raspberry Pi etc.			√		
CO4	Use modern engineering tools to emulate DOS based processors in modern computers.			√		
CO5	Work on complex engineering problems individually and in a team				√	
CO6	Communicate and share knowledge, data, information, results etc. with others					√

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
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CLO1-CL04	• Class Lecture • Lab Experiment • Tutorial • Group Discussion • Lab Practice	• Mini Project Presentation • Attendance • Continuous Lab Performance • Final lab Test/Exam • Lab Report
CLO5		Individual/Team Work Rubrics
CLO6		Presentation, Viva and Lab Report

EEE 301: Modern Control System

Credit: 3

BNQF Code: 0714 3213

3 hours/week

Rationale of the Course: By the end of this course, the student will be able to analyze and design some real control systems- manual and automatic, open and closed-loop. They will have sufficient ability to apply the knowledge earned in the course materials to improve thinking, problem solving and making decision.

Course Content:

Brief History of Control Systems, Simple Examples of Control Systems, Mathematical Modeling, State Variables for Dynamic Systems, Performance Analysis of First and Second Order Systems, Transient and Steady State Responses, Stability Analysis and Design. Linear system models: transfer function, block diagram and signal flow graph (SFG). State variables: SFG to state variables, transfer function to state variable and state variable to transfer function. Effect of additional pole and zero on the system response and system types and steady state error. Routh stability criterion. Analysis of feedback control system: Root locus method and frequency response method. Design of feedback control systems.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO1	PLO2	PLO3
CLO1	Demonstrate the basic understanding of dynamic systems i.e., the systems that evolves with time, the differences between open-loop and closed-loop (feedback) control systems; how input affects output, represent systems in various forms like block diagram, signal flow graph and determine transfer function of control systems.	√		
CLO2	Develop the mathematical models (in ODE and SS) of physical systems in forms suitable for use in the analysis and design of control systems.	√		
CLO3	Analyze the time and frequency-domain responses of first and second order systems to standard input signals (such as step and sinusoidal (and to some extent, ramp) inputs; analyze the	√		

	performance and stability of control systems; design systems that will demonstrate desired behavior.			
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Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 302: Modern Control System Lab

Credit: 1.5

BNQF Code: 0714 3214

3 hours/week

Rationale of the Course: This is a core course of B. Sc. in Electrical and Electronic Engineering (EEE) program that envisions to develop theoretical and practical understanding of the students on mathematical modeling, performance analysis, feedback control, stability analysis, and controller design in Time and/or Frequency domain for different systems.

Course Content:

- Mathematical Modeling of control systems
- Performance Analysis of First, Second and Higher Order Systems, Transient and Steady State Responses
- Linear system models: transfer function, block diagram algebra
- State Space: transfer function to state variable and state variable to transfer function representation.
- Stability Analysis, Generating Root Locus and Nyquist Plotting
- Controller Design for obtaining desired performance for Closed Loop Systems

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO3	PLO4	PLO5	PLO9	PLO10
CO1	Design and develop closed-loop and open-loop control systems for various engineering applications. [PO3]		√			

CO2	Test and evaluate various closed-loop and open-loop control systems to justify the performance. [PO4]		√			
CO3	Select and use modern hardware and software tools and devices. [PO5]	√				
CO4	Assess societal, health, safety, legal and cultural issues involved with the mini-project. [PO6]			√		
CO5	Realize the impact of societal, environmental and sustainable development issues for the design solution of mini-project. [PO7]				√	
CO6	Apply professional ethics and responsibilities in the implementation of mini-project. [PO8]					√

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1-CL04	• Class Lecture • Lab Experiment • Tutorial • Group Discussion • Lab Practice	• Mini Project Presentation • Attendance • Continuous Lab Performance • Final lab Test/Exam • Lab Report
CLO5		Individual/Team Work Rubrics
CLO6		Presentation, Viva and Lab Report

EEE 493: Measurement and Instrumentation

Credit: 3.0

BNQF Code: 0713 4109

3 hours/week

Rationale of the Course: This is an interdisciplinary engineering course of Electrical and Electronic Engineering (EEE) program that prepares the student with basic skills in measuring technique and instruments used for electronic measurement. Besides, this course also emphasizes on the transducer and data acquisition system.

Course Content:

Measuring Instruments: Classification, Absolute and secondary instruments, indicating instruments, control, balancing and damping, constructional details, characteristics, errors in measurement. Ammeters,

voltmeters: (DC/AC) PMMC, MI, Electrodynamometer type Wattmeters: Electrodynamometer type, induction type, single phase and three phase wattmeter, compensation, Energy meters: AC. Induction type single phase and three phase energy meter, compensation, creep, error, testing, Instrument Transformers: Potential and current transformers, ratio and phase angle errors, phasor diagram, methods of minimizing errors; testing and applications. Galvanometers: General principle and performance equations of D'Arsonval Galvanometers, Vibration Galvanometer and Ballistic Galvanometer. Potentiometers: DC Potentiometer, Crompton potentiometer, construction, standardization, application. AC Potentiometer, Drysdale polar potentiometer; standardization, application. DC/AC Bridges: General equations for bridge balance, measurement of self-inductance by Maxwell's bridge (with variable inductance & variable capacitance), Hay's bridge, Owen's bridge, measurement of capacitance by Schering bridge, errors, Wagner's earthing device, Kelvin's double bridge. Transducer: Strain Gauges, Thermistors, Thermocouples, Linear Variable Differential Transformer (LVDT), Capacitive Transducers, Piezo-Electric transducers, Optical Transducer, Torque meters, inductive torque transducers, electric tachometers, photo-electric tachometers, Hall Effect Transducer. Measurement of non-electrical quantities: Temperature, pressure, flow, level, strain, force and torque. Basic elements of DC and AC signal conditioning: Instrumentation amplifier, noise and source of noise, noise elimination compensation, function generation and linearization, A/D and D/A converters, sample and hold circuits. Data Transmission and Telemetry: Methods of data transmission, DC/AC telemetry system and digital data transmission. Recording and display devices. Data acquisition system and microprocessor applications in instrumentation.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO1	PLO2	PLO3
CLO1	Understand the physics of pressure, temperature, level and flow measurement mechanical and electrical aspects of instruments used to control dynamics of processes.	√		
CLO2	Analyze the operation of different measurement instruments for measuring electrical power, energy, voltage, current, resistance, capacitance, and inductance.		√	
CLO3	Analyze the operation of transducers for strain, pressure, temperature and fluid flow measurement & components of basic analog and digital data acquisition systems.		√	

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 400: Final Year Capstone Project**Credit: 4.5****BNQF Code: 0719 4101**

Rationale of the Course: The course is designed to encourage students to think critically, solve challenging problems, and develop skills such as oral communication, public speaking, research skills, media literacy, teamwork, planning, self-sufficiency and goal setting. It strengthens the ability to the students to identify and apply the suitable solutions for the given real world problem and work individually and in group for them. It enables them to gain knowledge in practical applications of theoretical studies and enables them about social responsibilities. It teaches them to successfully complete the projects within financial and ethical boundaries and to be able to gain an insight of the latest trends and applications ongoing in the respective fields and to communicate with the society and professionals both in verbal and written form in a successful manner.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11	PLO 12
CLO1	Apply engineering knowledge in practical eng problem design solution. [PO1]	√											
CLO2	Analyze complex engineering problem to make a conclusion. [PO2]		√										
CLO3	Develop design solution for complex engineering problems in real life application. [PO3]			√									
CLO4	Evaluate complex engineering problems and its solution to provide a valid conclusion. [PO4]				√								
CLO5	Apply proper engineering models or tools to complex engineering problem solution and activities. [PO5]					√							
CLO6	Assess societal and health issues whenever designing						√						

	solutions to the complex engineering problems. [PO6]												
CLO7	Assess the impact of design solution on the environment and long-term sustainability. [PO7]							√					
CLO8	Apply professional engineering ethics and responsibilities in complex engineering activities. [PO8]								√				
CLO9	Work individually or in a team for diverse environments of complex engineering activities. [PO9]									√			
CLO10	Communicate and share information & data to others effectively for complex engineering activities. [PO10]										√		
CLO11	Deal with project management & finance in a multidisciplinary environment of complex engineering activities. [PO11]											√	
CLO12	Be motivated and ready for life-long learning to cope with challenges and technological changes. [PO12]												√

Teaching Strategies: Maximum topics will be covered from the handouts. For the rest of the topics, reference online materials will be followed. Some class notes will be uploaded on the Google classroom. Multimedia projector and a PC will be used for the convenience of the students to understand study materials practically. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture	Attendance and Assignment
CLO2	• Audio-Visual	Methodology, simulation and hardware design
CLO3		

CLO4	• Group Discussion • Literature Review • Project Proposal Writing • Oral Presentation • Problem analysis	Societal and health issues Test, result and analysis Tools and technique used Final report Final presentation
CLO5		
CLO6		
CLO7		
CLO8		
CLO9		
CLO10		
CLO11		
CLO12		

3.2 Elective courses

3.2.1 Major in Communication

EEE 451: Random Signal Processing

Credit: 3

BNQF Code: 0714 4125

3 hours/week

Rationale of the Course: The course is designed to give the student an introduction to the important subject of random processes. Random signals play a very important role in the fields of communications and signal processing, as well as in many other fields, as far-fetched as the stock market and biological sciences.

Course Content: The course starts with probability theory. It then deals with the basic understanding of random processes followed by Autocorrelation Functions Stationary Processes, Ergodic Functions, Wiener-Khintchine-Einstein Theorem, Power Spectral Density, Linear Operations on a Random Process, Cross-correlation Functions, Gaussian Processes, White Gaussian Noise Bandlimited Random Processes, Narrowband Noise, Hilbert Transform, Analytic Signals, Analog Modulation Signal-to-Noise Ratio in DSB, SSB, AM and FM.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Understand the concept of random processes and determine covariance and spectral density of stationary random processes [PO1]	√		
CLO2	Characterize probability models and function of random variables based on single & multiples random variables[PO2]		√	

CLO3	Apply the fundamental methods of probability and random signals to develop an awareness of the key models and their interrelationships [PO3]			√
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Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 455: Optical Fiber Communication

Credit: 3

BNQF Code: 0714 4126

3 hours/week

Rationale of the Course: The main aim of the course is to provide a strong background on fundamental elements of optical communication by exploring typical optical systems (Transmission, Channel, and Detection) from a top-down approach. Additionally, this course will emphasize on optical fiber design, optical transmission and link budget estimation.

Course Content:

- Introduction of fiber optics, light propagation through optical fiber, optical fiber waveguides: Step-index fiber, Graded index fibers and single mode fibers
- Optical fiber cables and connection: Fiber splices, connectors and couplers
- Light sources: Light emitting diodes and laser diodes.
- Detector: PIN photo-detector and avalanche photo-detectors.
- Receiver analysis: Direct detection and coherent detection, noise and limitations.
- Transmission characteristics of optical fibers: Attenuation, material absorption and scattering losses and dispersion.
- Optical fiber systems: optical receiver, optical transmission and power budget estimation.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2
CLO1	Explain, characterize and classify the basic concepts and theories of the fundamental elements of optical fiber communication system.	√	
CLO2	Identify, formulate and solve the problems related to dielectric waveguides, optical fibers, and semiconductor devices.		√
CLO3	Analyze and determine the dielectric waveguides, LEDs, photodetectors and power budget.		√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	- Class Lecture - Audio-Visual - Home Assignment - Class Exercise - Group Discussion	- Attendance & class performance - Class Test - Assignment - Mid Exam - Final Exam
CLO2		
CLO3		
CLO3		

EEE 463: Microwave Engineering

Credit: 3

BNQF Code: 0714 4127

3 hours/week

Rationale of the Course: The main objective of this course is to prepare the students with basic skills in analyzing microwave systems. This course emphasizes on the analysis of the transmission line, microwave waveguide, amplifier and microwave antenna.

Course Content:

- Basic microwave technology, transmission lines, voltage standing wave ratio, voltage reflection coefficient
- Infinite transmission line and sending end impedances under different conditions
- Microwave resonators – series and parallel
- Microwave waveguides – parallel, circular and rectangular, impedance matching

- Microwave tubes RF filters, RF amplifiers, and passive RF and microwave devices (mixers, diplexers, etc.)
- An introduction to antenna design, Friis transmission, antenna field zones
- RF/microwave communications link design, Smith chart etc.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO3	PLO4	PLO5	PLO9	PLO10
CLO1	Simulate and investigate the performance of different microwave antenna types (e.g. loaded dipole antenna, half wave-monopole and dipole antenna, helix antenna etc).		√			
CLO2	Simulate and study various types of microwave antenna characteristics and its performances under loaded conditions.		√			
CLO3	Design and simulate microwave antenna communication and performance evaluation.	√				
CLO4	Select and use modern hardware and/or software tools and devices.			√		
CLO5	Work on complex engineering problems individually and/or in a team				√	
CLO6	Communicate and share knowledge, data, information, results etc. with others					√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

	• Group Discussion	
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EEE 464: Microwave Engineering Lab

Credit: 1.5

BNQF Code: 0714 4128

3 hours/week

Rationale of the Course: This course envisions to develop theoretical understanding and simulation capabilities on characteristics of different antenna types and how to design various antennas using 4NEC2 software.

Course Content:

- Introduction to 4NEC2 software
- Design and simulation of different antenna types (e.g. loaded dipole antenna, half wave monopole and dipole antenna, helix antenna etc) over different ground conditions (e.g. free space, realistic ground etc)
- Broad side linear array with uniform spacing and amplitude using 4NEC2
- Designing and simulating 3-element beam antenna using 4NEC2

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO3	PLO4	PLO5	PLO9	PLO10
CLO1	Simulate and investigate the performance of different microwave antenna types (e.g. loaded dipole antenna, half wave-monopole and dipole antenna, helix antenna etc).		√			
CLO2	Simulate and study various types of microwave antenna characteristics and its performances under loaded conditions.		√			
CLO3	Design and simulate microwave antenna communication and performance evaluation.	√				
CLO4	Select and use modern hardware and/or software tools and devices.			√		
CLO5	Work on complex engineering problems individually and/or in a team				√	
CLO6	Communicate and share knowledge, data, information, results etc. with others					√

Teaching Strategies: Lecture, Laboratory software simulation, Project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Lab Experiment-Simulation • Tutorial • Group Discussion • Lab Practice	• Mini Project Presentation • Attendance • Continuous Lab Performance • Final lab Test/Exam • Lab Report
CLO2		
CLO3		

EEE 453: Mobile Cellular Communication

Credit: 3

BNQF Code: 0714 4229

3 hours/week

Rationale of the Course: This course is to provide a comprehensive background of modern cellular and mobile communication networks. The students will conceptualize the cellular design concepts such as cell, frequency reuse, propagation pattern, modulation techniques, large scale fading and small scale fading, multi-access techniques. The students will have comprehensive understanding of two modern cellular design concepts such as GSM system and CDMA system. In addition, the students will familiarize the advance features of cellular mobile communication such as GPRS, EDGE, OFDM, mm Wave communication, and beamforming techniques.

Course Content: Introduction to wireless communication systems, evolution of mobile radio communication, examples of wireless communication system, second Generation (2G) cellular networks, evolution to 2.5G networks, third Generation (3G) system. Familiarize with the cellular system design concepts such as cell, frequency reuse, channel assignments strategy, handoff strategy, interference and system capacity, trunking and grade of service. Mobile Radio propagation models such as largescale path loss model and small scale fading and multi-path propagation. Digital Modulation concepts and techniques, Multiple access techniques such as FDMA, TDMA, CDMA, SDMA, ALOHA system. GSM system architecture, Functions of MSC, BSC, BTS and other functional components of GSM system, channel structures and traffic channels, control channels and burst structure, handover techniques of GSM system, Enhancement of GSM for Data transmission (GPRS and EDGE). An introduction to CDMA 2000 system. Brief introduction of 3G, 4G and beyond cellular systems.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes(CLO)	CLO Statement	PLO1	PLO2	PLO3

CLO1	Explain and familiarize the concepts and evaluation of mobile radio communications.	√		
CLO2	Familiarize the advance features of cellular mobile communication such as GPRS, EDGE, CDMA, mm Wave communication, and beamforming techniques.		√	
CLO3	Design cellular system considering cell, frequency reuse, channel assignments strategy, handoff strategy, interference and system capacity, trunking and grade of service.			√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used most of the time. Multimedia projector and a PC will be used for the convenience of the students to understand codes practically. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	Class Lecture	Attendance & class performance
CLO2	Audio-Visual	- Class Test - Assignment
CLO3	- Home Assignment - Class Exercise - Group Discussion	- Mid Exam - Final Exam

EEE 457: Digital Signal Processing II

Credit: 3

BNQF Code: 0714 4230

3 hours/week

Rationale of the Course: Digital Signal Processing (DSP) is at the heart of many applications in a wide array of fields: speech and audio processing, system monitoring and fault detection, biomedical signal analysis, mobile and internet communications, radar and sonar, vibration measurement and analysis, seismograph analysis, image/video coding and decoding etc. The objective of this course is to strengthen the students' knowledge of DSP fundamentals, and to familiarize them with the practical aspects of DSP algorithm development and implementation

Course Content: Spectral estimation of random processes: classical methods, minimum variance method, parametric methods: Levinson-Durbin algorithm, super resolution techniques: Pisarenko, and MUSIC. Adaptive signal processing: Applications, e.g., equalization, interference suppression, acoustic echo

cancellation. FIR and IIR adaptive filters. Recursive least squares algorithm, steepest descent and Newton algorithm, least mean-square (LMS) algorithm, convergence analysis. Variable step-size LMS algorithm. Multirate DSP: Interpolation and decimation, single-stage and multistage implementation, design of anti-aliasing and anti-imaging filters. Polyphase representation of multi-rate systems. Multirate implementation of ideal LP filter, digital filter banks, narrow band filters. Perfect reconstruction filters banks. Short time Fourier transform, sub band decomposition and wavelet transform, CWT, DWT, inter-scale relationship of DWT coefficients.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes(CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Demonstrate the ability to manipulate signals using analytical techniques& algorithms to implement discrete-time systems [PO1]	√		
CLO2	Apply techniques in time and transform domains to the analysis of discrete-time systems [PO2]		√	
CLO3	Design digital filters and apply them to real-world applications of information processing [PO3]			√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 435: Optoelectronics

Credit: 3

BNQF Code: 0714 4121

3 hours/week

Rationale of the Course: The main aim of the course is to provide a strong background on fundamental elements of optoelectronic devices and optical communication by exploring typical optical systems (Transmission, Channel, and Detection) from a top-down approach. Additionally, this course will

emphasize on optical properties in semiconductor, optical fiber design, optical semiconductor devices and link budget estimation.

Course Content:

- Introduction of fiber optic communication and semiconductor devices- light propagation through optical fiber, optical fiber waveguides.
- Light sources: Light emitting diodes, laser diodes and quantum well lasers.
- Detector: PIN photo-detector and avalanche photo-detectors.
- Receiver analysis: Direct detection and coherent detection, noise and limitations.
- Optical fiber cables and connection: Fiber splices, connectors and couplers
- Optical fiber systems: optical receiver, optical transmission and power budget estimation.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Explain, characterize and classify the basic concepts and theories of the fundamental elements of optoelectronic devices and optical fiber communication system.	√		
CLO2	Identify, formulate and solve the problems related to dielectric waveguides, optical fibers, and semiconductor devices.		√	
CLO3	Analyze and determine the dielectric waveguides, LEDs, photodetectors and power budget.			√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 436: Optoelectronics Lab**Credit: 1.5****BNQF Code: 0714 4122****3 hours/week**

Rationale of the Course: This lab course is associated with the theory course (EEE 435) on the principles, design, and applications of optoelectronic devices. Basic specifications of key optoelectronic devices, including photodiodes, Light-Emitting Diodes (LEDs), diode lasers, LED and Liquid Crystal Displays are experimentally studied by the students. The experiments include both DC (static) and AC (dynamic) characteristics of the devices and emphasize both the electrical and optical figures of merit. The advantages and disadvantages of various types of photodetectors and light sources are experimentally and quantitatively studied in the lab.

Course Content: Ray Theory, Lenses & Optical Waveguides. Single mode & Multimode Fibers. Optical Connectors, Couplers & Attenuators. Features of Semiconductor Diodes and Introduction to Light-Emitting Diodes (LEDs). Features and Characteristics of Laser Diodes. Fiber optic Communication System using WDM. Introduction to Optiperformer: Attenuation, Dispersion and Power Budget. PIN & APD Photodetectors. Photoconductor - Optoelectronic effect for light detection. Photodiode: PIN photodetector

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO3	PLO4	PLO5	PLO9	PLO10
CLO1	Verify various theoretical concepts learned in the lecture class		√					
CLO2	Understand how the fundamental concepts affect the performance of practical optoelectronic devices		√					
CLO3	Learn measurement techniques to characterize optoelectronic devices				√	√		
CLO4	Experiment with basic devices used in equipment for various applications				√	√		
CLO5	Work on complex engineering problems individually and in a team.						√	
CLO6	Communicate and share knowledge, data, information, results etc. with others.							√

Teaching Strategies: Lecture, Laboratory software experiments, Mini-Project developments. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Simulation • Tutorial • Group Discussion • Lab Practice	• Mini Project Presentation • Continuous Lab Performance • Final lab Exam • Lab Report • Attendance
CLO2		
CLO3		
CLO4		
CLO5		
CLO6		

EEE 461: Digital Communication

Credit: 3

BNQF Code: 0714 4231

3 hours/week

Rationale of the Course: This course provides a comprehensive introduction to basic principles and techniques of digital communication. Lecture topics include: PCM, baseband transmission, power spectrum density analysis, inter symbol interference, matched filters, noise analysis, digital modulation, coherent and non-coherent detections.

Course Content: Communication systems, analog and digital messages, Classification of signals Sampling Theorem, Signal Reconstruction from Uniform Sample, Pulse Code Modulation (PCM), Transmission Bandwidth and the Output SNR, Digital telephony: PCM in TI carrier systems', Digital Multiplexing, Differential Pulse Code Modulation (DPCM), Adaptive Differential PCM (ADPCM), Delta Modulation, line coding, pulse shaping, scrambling, digital receivers and regenerative repeaters, Inter-symbol interference, eye diagram, PAM, Digital Carrier systems, Fundamentals of Probability Theory, Communication Link Analysis, Frequency Hopping Spread Spectrum (FHSS) systems, Digital Modulation: Signal space, signal space analysis of Digital Passband Modulation, PSK, ASK, QAM, BER analysis, coherent and non-coherent, detections and transceivers

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes(CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Use communication engineering knowledge to realize and design digital communication systems; understand and evaluate the performance of digital communication systems under various conditions.	√		

CLO2	Develop mathematical models to predict the behavior of digital communication systems and compare with read world/simulated data and propose improvements.		√	
CLO3	Use communication engineering knowledge to realize and design digital communication systems.		√	

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	- Class Lecture - Audio-Visual - Home Assignment - Class Exercise - Group Discussion	- Attendance & class performance - Class Test - Assignment - Mid Exam - Final Exam
CLO2		
CLO3		

EEE 462: Digital Communication Lab

Credit: 1.5

BNQF Code: 0714 4232

3 hours/week

Rationale of the Course: This course gives students deep knowledge in digital communication systems at the practical level. This lab focuses the fundamental concepts on TDM, Pulse modulations, various digital modulation and demodulation techniques.

Course Content: This course provides a hands on experience to various digital modulation and demodulation techniques of PCM, PWM, ASK, PSK, FSK, BPSK, TDM etc. It also covers matched filtering and bit error rate.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO3	PLO5	PLO9	PLO10
CLO1	Demonstration of theorems used in digital communication systems.	√				

CLO2	Measure and investigate the performance of different digital modulation and demodulation schemes using different modules of communication systems.	√				
CLO3	Design and develop communication systems using digital modulation techniques and evaluate the performance of designed systems.		√			
CLO4	Select and use modern hardware and software tools and devices			√		
CLO5	Work on complex engineering problems individually and in a team				√	
CLO6	Communicate and share knowledge, data, information, results etc. with others					√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	- Class Lecture - Lab Experiment - Tutorial - Group Discussion - Lab Practice	- Mini Project Presentation - Attendance - Continuous Lab Performance - Final lab Test/Exam - Lab Report
CLO2		
CLO3		
CLO4		
CLO5		
CLO6		

EEE 465: Information and Coding

Credit: 3

BNQF Code: 0714 4233

3 hours/week

Rationale of the Course: The course aims to make students familiar with the advanced knowledge of coding and information theory used in the modern wireless systems and applications, and to enable them to work on relevant projects in wireless systems with some research skills.

Course Content: Most of the course material will be covered from the textbook and this course will provide advanced knowledge of coding and information theory widely applied in modern wireless systems. It includes the classical information theory (entropy, mutual information, channel coding theorem and channel capacity), channel coding techniques (block coding and convolutional coding), advanced MIMO theory (MIMO capacity, space-time coding, BLAST), OFDM technique (transmitter/receiver design, space-frequency coding), MIMO-OFDM system & applications (Wireless LAN, WiMAX, LTE-A, etc.)

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes(CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Evaluate performance of various coding techniques over fading channels.	√		
CLO2	Recognize advances of coding theory in next generation broadband communication systems.		√	
CLO3	Perform independent work in wireless system design with some creative problem-solving ability.			√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 427: Fundamentals of IoT**Credit: 3****BNQF Code: 0714 4234****3 hours/week**

Rationale of the Course: The purpose of this course is to provide students with an overview of the issues that arise in Designing of IoT architecture as well as to throw light upon the significant theoretical developments and tools that are deep rooted into Electronics and Computer science. The purpose of this course is to provide students with an overview of the issues that arise in designing of IoT architecture as well as to throw light upon the significant theoretical developments and tools that are deep rooted into Electronics and Computer science.

Course Content: This course provides the basic concepts of IoT, protocols of IoT, communication models based on IoT. This course also deals with various sensor network and actuation. It provides a firm

understanding to the problems related to the problems related wireless sensor networks, signal processing and cloud analytics.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3
CLO1	√		
CLO2		√	
CLO3			√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 428: Fundamentals of IoT Lab

Credit: 1.5

BNQF Code: 0714 4235

3 hours/week

Rationale of the Course: The purpose of this course is to provide students with an hands on approach to designing IoT based architecture in a practical way as well as to throw light upon the significant theoretical developments and tools that are deep rooted into Electronics and Computer science

Course Content: This course provides the concepts related the basic understanding electronic prototyping devices and SBCs such as arduino and raspberry pi. It deals with the use of various devices such as Temperature sensor and LED bar, IR senso, stepper motor, X-bee module and cloud interfacing SBCs.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	√									
CLO2	√									
CLO3			√							
CLO4					√					
CLO5									√	
CLO6										√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Lab Experiment • Tutorial • Group Discussion • Lab Practice	• Mini Project Presentation • Attendance • Continuous Lab Performance • Final lab Test/Exam • Lab Report
CLO2		
CLO3		
CLO4		
CLO5		
CLO6		

EEE 459: Optical Networks**Credit: 3****BNQF Code: 0714 4236****3 hours/week**

Rationale of the Course: To provide students with practical knowledge and research background in optical networks. The emphasis will be on problems at the network layer that are unique to optical networks

Course Content: Motivation for optical networking. Wavelength division multiplexing (WDM) networks. Routing and wavelength assignment for wavelength-routed networks. Distributed lightpath setup and release. Recovery from link and node failure. Traffic grooming for access networks. Multiple access control (MAC) for local networks. Optical burst switching (OBS) and optical packet switching (OPS).

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Understand basic optical networks such as WDM and their principle.	√		
CLO2	Apply optical WDM networks, Transmissions, Wavelength-Routed WDM Networks, Traffic Grooming in WDM Networks, Future Optical Networks.		√	
CLO3	Explain the applications of basic optical WDM networks, Transmissions, Wavelength-Routed WDM Networks, Traffic Grooming in WDM Networks, Future Optical Networks.		√	

Teaching Strategies: Lecture, Laboratory software experiments, Mini-Project developments. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	- Class Lecture - Audio-Visual - Home Assignment - Class Exercise - Group Discussion	- Attendance & class performance - Class Test - Assignment - Mid Exam - Final Exam
CLO2		
CLO3		
CLO4		
CLO5		
CLO6		

3.2.2 Major in Power

EEE 471: Renewable Energy

Credit: 3

BNQF Code: 0713 4110

3 hours/week

Rationale of the Course: Clean energy will be a challenge for the next generation. To meet the current energy crisis and develop system for clean energy, use of renewable energy is increasing day by day. Sources of renewable energy, exploitation of these sources are the key features of this course.

Course Content: The aim of this course is to provide students with the

- Knowledge that is required to understand the principle of operation of solar cells, design of solar system for rural households (S.H.S) and design of MW range solar PV plant. Provide the students with the knowledge on basis of bio-gas plant.
- Knowledge on operation of wind turbines
- Harnessing power from solar concentrator, waves etc.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes(CLO)	CLO Statement	PLO1	PLO2	PLO4
CLO1	Thoroughly understand principle of operation of solar cells and solar panels with their characteristics. [PO1]	√		
CLO2	Design of small and large scales solar PV system through simulation software.		√	
CLO3	Develop knowledge on other renewable on other renewable, sources and their applications is generating energy. [PO1]			√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 473: Energy Conversion III

Credit: 3

BNQF Code: 0713 4111

3 hours/week

Rationale of the Course: The course is designed to give the student an understanding of different types of special machines and their control mechanisms.

Course Content: Special machines: series universal motor, permanent magnet DC motor, unipolar and bipolar brush less DC motors, stepper motor and control circuits. Reluctance and hysteresis motors with drive circuits, switched reluctance motor, electro static motor, repulsion motor, synchros and control transformers. Permanent magnet synchronous motors. Acyclic machines: Generators, conduction pump and induction pump. Magneto hydrodynamic generators. Fuel Cells, thermoelectric generators, flywheels. Vector control, linear motors and traction. Photovoltaic systems: stand alone and grid interfaced. Wind turbine generators: induction generator, AC-DC-AC conversion.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2
CLO1	Explain the basic concepts and theories of electromagnetic machine.	√	
CLO2	Analyze the performance and control mechanisms of special motors and generators.		√
CLO3	Analyze the features of special machines and to solve problems associated with them		√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 477: Power Electronics**Credit: 3****BNQF Code: 0713 4112****3 hours/week**

Rationale of the Course: The primary aim of this course is to prepare the students with rudimentary competences in analyzing power electronics system. This course also emphasizes on the analysis of controlled diodes, rectifiers both controlled and uncontrolled, inverters, voltage regulators, DC-DC converters etc.

Course Content:

- Power semiconductor switches and triggering devices: BJT, MOSFET, SCR, IGBT, GTO TRIAC, UJT, and DIAC.

- Rectifiers: Uncontrolled and controlled single phase and three phase.
- Regulated power supplies: Linear-series and shunt, switching buck, buck-boost, boost and Cuk regulators.
- AC voltage controllers: single and three phase. Choppers. DC motor control.
- Single phase cycloconverter.
- Inverters: Single phase and three phase voltage and a current source.
- AC motor control. Stepper motor control. Resonance inverters. Pulse width modulation control of static converters.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes(CLO)	CLO Statement	PLO1	PLO2
CLO1	Explain, characterize, and classify different types of power electronics circuits- rectifier, chopper, inverter and motor driver.	√	
CLO2	Identify, formulate and solve the problems related to the mathematical modeling of different types of power electronics circuits.		√
CLO3	Analyze different types of power electronics circuits such as rectifier, inverter, chopper, ac voltage controller, driver circuit, etc.		√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 478: Power Electronics Lab

Credit: 1.5

BNQF Code: 0713 4113

3 hours/week

Rationale of the Course: The course envisions to develop theoretical understanding and simulation capabilities to determine the characteristics of power electronics devices; analyze the operation of rectifier/chopper/inverter, and designing motor driver circuit.

Course Content:

- Power semiconductor switches and triggering devices: BJT, MOSFET, SCR, IGBT, GTO, TRIAC, UJT, DIAC and Solid State Relay (SSR).
- Rectifiers: Uncontrolled and controlled single phase and three phase.
- Regulated power supplies: Linear-series and shunt, switching buck, buck-boost, boost and Cuk regulators.
- AC voltage controllers: single and three phase. Choppers. DC motor control. Single phase cycloconverter.
- Inverters: Single phase and three phase voltage and a current source. AC motor control. Stepper motor control. Resonance inverters. Pulse width modulation control of static converters.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes(CLO)	CLO Statement	PLO3	PLO4	PLO5	PLO9	PLO10
CLO1	Simulate and investigate the performance of various designed converters such as AC-DC, DC-DC, AC- AC, DC-AC and so on.		√			
CLO2	Design different converter circuits using PSIM and/or Proteus software.		√			
CLO3	Simulate, modelling, design and develop different rectifiers using Simulink/Pspice.	√				
CLO4	Select and use modern hardware and software tools and devices			√		
CLO5	Work on complex engineering problems individually and in a team				√	
CLO6	Communicate and share knowledge, data, information, results etc. with others					√

Teaching Strategies: Lecture, Laboratory hardware and software experiments, Project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Lab Experiment • Tutorial • Group Discussion • Lab Practice	• Mini Project Presentation • Attendance • Continuous Lab Performance • Final lab Test/Exam • Lab Report
CLO2		
CLO3		

EEE 475: Power Plant Engineering**Credit: 3****BNQF Code: 0713 4214****3 hours/week**

Rationale of the Course: The objective of the course is to make the student familiar with sources of energy, mechanism of various electrical power plants, power generation management with variable load demands, economy & tariff of electrical power.

Course Content:

- Sources of energy: fossil, renewable, nuclear, calorific value
- Power plants: General layout and Working principles: steam turbine, gas turbine, combined cycle gas turbine, hydro and nuclear.
- Power plant instrumentation.
- Selection of location: Technical, economic and environmental factors.
- Impact of Load variation: load curve, load factor, demand factor, plant factor, grid interconnection
- Generation Scheduling: deterministic and probabilistic.
- Economics of Power Generation
- Tariff of Electricity: formulation and types.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes(CLO)	CLO Statement	PLO1	PLO2	PLO4
CLO1	Estimate thermodynamic and electrical performance of various electrical power plants. [PO1]	√		
CLO2	Analyze economics and performance of electrical power plants for variable load conditions. [PO2]		√	
CLO3	Apply various analytical methods to estimate economics and tariffs of electrical power and energy. [PO1]			√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise	• Class Test • Assignment • Mid Exam
CLO2		

CLO3	• Group Discussion	• Final Exam
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EEE 479: Power System Reliability

Credit: 3

BNQF Code: 0713 4125

3 hours/week

Rationale of the Course: The course gives an introduction to the main principles and objectives of power system reliability analysis: Basic terms and definitions, applications, overview of methodologies for contingency analysis and reliability analysis, reliability models, input data (from fault statistics), reliability indicators, and state-of-the-art. Further, select-few topics from the following are covered in detail: Contingency analysis and reliability analysis of generation, transmission and distribution systems. Final curriculum will be determined by course start.

Course Content: General reliability modeling and evaluation: introduction to probability and stochastic processes; system modeling for reliability; methods of reliability assessment: state space, cut-set and tie-set analysis, decomposition; Monte Carlo simulation: non-sequential and sequential; synchronous and asynchronous timing. Reliability modeling and analysis of electric power systems: bulk power systems, distribution systems, and industrial systems. Component modeling: generator modeling, transmission line modeling, load modeling; capacity outage table; probability and frequency distributions; unit addition algorithm; load modeling algorithm. Generation adequacy assessment using discrete convolution: discrete convolution of generation and load models; generation reserve model; determination of LOLP, LOLF, EUE. Reliability of multi-node systems: methods for multi-area and composite system analysis; contingency enumeration/ranking; equivalent assistance; stochastic probabilistic load flow; state space decomposition; Monte Carlo simulation, sequential and non-sequential. Analysis of risk in power systems; understanding of causes and remedial measures.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes(CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Describe the general reliability modeling of power system.	√		
CLO2	Analyze the reliability modeling of single and multimode power system, distribution system and industrial system.		√	
CLO3	Analysis of risk in power systems; understanding of causes and remedial measures.		√	

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
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CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 481: Power System protection

Credit: 3

BNQF Code: 0713 4216

3 hours/week

Rationale of the Course: This core course of Electrical and Electronic Engineering (EEE) program prepares the student with basic skills in analyzing switchgear and protection. In addition, this course also emphasizes on the analysis of the Circuit breakers, Fuses, protective relay, protection of alternator, transformer, bus bar, transmission lines and protection of sub stations.

Course Content:

- Introduction to Power System Protection, Description, Operation, maintenance, advantages, disadvantages and application of different types of circuit breakers.
- Desirable Characteristics of Fuse Elements, Important terms in Fuses, Types of Fuses, operation of different types of fuses.
- Types and operation of Electromagnetic and Static Relays, Relays Classification: Instantaneous, DMT and IDMT types, Overcurrent, Direction relays, Differential Relays and Percentage Differential Relays, Universal torque equation, Distance Relays: Impedance, Reactance and Mho Characteristics of Distance Relays and Comparison.
- Feeder and Bus-Bar Protection: Over Current, Carrier Current and Three-zone distance relay protection using Impedance relays, Translay Relay.
- Protection of Bus bars – Differential protection.
- Generator Protection: Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions, Restricted Earth fault and Inter-turn fault Protection, Numerical Problems on % Winding Unprotected.
- Transformer Protection: Protection of transformers: Percentage Differential Protection, Numerical Problem on Design of CT s Ratio, Buchholtz relay.
- Over Voltage protection.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes(CLO)	CLO Statement	PLO1	PLO2

CLO1	Describe the basic concepts, and principles of protection including protective devices, surge diverters, surge absorbers, neutral grounding in a protection system.	√	
CLO2	Analyze the basic characteristics of the various protective device, and surge voltage.		√
CLO3	Design a simple protection system using CT, PT, relay, and CB in order to protect the rotating machines, busbars, transformers, transmission lines, and distribution network.		√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 482: Power System Protection Lab

Credit: 1.5

BNQF Code: 0713 4217

3 hours/week

Rationale of the Course: The main objectives of this course are to develop fundamental understanding of students on working power system protection. This course will discuss on different parts of power system protection like circuit breakers, relays, fuses etc.

Course Content: This course will mainly focus on different types of relays and their operations i.e. max. min. current relay, voltage relay, frequency relay, phase sequence and three-phase voltage asymmetry relay etc. In addition, this course will also be discussed on auxiliary relay as interface to control large power flows, auxiliary relay as interface for remote optical/ acoustic signaling of the protection relays operation, timer with different time function to extend the protection relays operation.

- Current relay: fixed time maximum current relay, Minimum or maximum current relay (alternated or continuous current), maximum current directional relay for maximum current.

- Voltage relay: maximum and minimum voltage relay in a three-phase line with neutral, Minimum or maximum voltage relay (alternated or continuous voltage), a phase sequence and three-phase voltage asymmetry relay.
- Phase sequence and three-phase voltage asymmetry relay
- Maximum or minimum frequency relay
- Auxiliary relay as interface to control large power flows
- Auxiliary relay as interface for remote optical/ acoustic signaling of the protection
- Timer with different time function to extend the protection relays operation

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes(CLO)	CLO Statement	PLO3	PLO4	PLO5	PLO9	PLO10
CLO1	Design and develop power system protection schemes using relays, CTs and CBs and timers and evaluate the performance of designed schemes.		√			
CLO2	Examine the operation of relays and summarize the benefits of implementing relays in protection schemes.		√			
CLO3	Select and use modern hardware and software tools and devices	√				
CLO4	Assess societal, health, safety, legal and cultural issues involved with the mini project			√		
CLO5	Realize the impact of societal, environmental and sustainable development issues for the design solution of mini project.				√	
CLO6	Apply professional ethics and responsibilities in the implementation of mini project.					√

Teaching Strategies: Lecture, Laboratory hardware and software experiments, and Project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Lab Experiment • Tutorial • Group Discussion • Lab Practice	• Mini Project Presentation • Attendance • Continuous Lab Performance • Final lab Test/Exam • Lab Report
CLO2		
CLO3		
CLO4		
CLO5		
CLO6		Individual/Team Work Rubrics
		Presentation, Viva and Lab Report

EEE 483: High Voltage Engineering**Credit: 3****BNQF Code: 0713 4218****3 hours/week**

Rationale of the Course: This course has a novel approach in describing the fundamental concept of “field-dependent behavior of dielectrics” when subjected to different types of high voltages. The contents begin with a systematic classification of electric fields and the techniques of field estimation. In-depth coverage of performance/ behavior of gaseous, solid and liquid dielectrics has been made in this course. The basics of high voltage laboratory techniques, non-destructive testing, measurement of high test voltages and dielectric properties are also covered in detail.

Course Content: Course contents are evolved over the lectures in classrooms involving active interaction and discussions with the students. Course content is able to cover the syllabus of all major Institutions/Universities:

- Electric Field Strength
- Gaseous Dielectrics
- Properties of Liquid and Solid Dielectrics
- Breakdown in Liquid and Solid Dielectrics
- Generation of High Test Voltages
- Measurement of High Test Voltages
- Non-destructive High Voltage Testing and Quality Control
- Insulation Coordination and Over Voltages in Power Systems
- Introduction National and International standards such as IEC-60060-1, 60-2, etc.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes(CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Describe the basic concept of electric field and different dielectric materials.	√		
CLO2	Analyze the generation of high voltage and measure the parameters of it.		√	
CLO3	Test of high voltage equipment and insulation test.		√	

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture	

CLO2	• Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO3		

EEE 484: High Voltage Engineering Lab

Credit: 1.5

BNQF Code: 0713 4219

3 hours/week

Rationale of the Course: Hands on experience on performance/behavior of gaseous, solid and liquid dielectrics has been made in this course. The basics of high voltage laboratory techniques, non-destructive testing, measurement of high test voltages and dielectric properties are also covered in detail.

Course Content: Course contents are evolved over the lectures in classrooms involving active interaction and discussions with the students. Course content is able to cover the syllabus of all major Institutions/Universities:

- Electric Field Strength
- Gaseous Dielectrics
- Properties of Liquid and Solid Dielectrics
- Breakdown in Liquid and Solid Dielectrics
- Generation of High Test Voltages
- Measurement of High Test Voltages
- Non-destructive High Voltage Testing and Quality Control
- Insulation Coordination and Over Voltages in Power Systems
- Introduction National and International standards such as IEC-60060-1, 60-2, etc.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	Measure and investigate the performance of different methods of generation of high voltage.	√					
CLO2	Examine the test of dielectric of different materials such as solid, liquid and gas.		√				
CLO3	Select and use modern hardware and software tools and devices			√			

CLO4	Assess societal, health, safety, legal and cultural issues involved with the mini project				√		
CLO5	Realize the impact of societal, environmental and sustainable development issues for the design solution of mini project.					√	
CLO6	Apply professional ethics and responsibilities in the implementation of mini project.						√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problem solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Lab Experiment • Tutorial • Group Discussion • Lab Practice	• Mini Project Presentation • Attendance • Continuous Lab Performance • Final lab Test/Exam • Lab Report • Individual/Team Work Rubrics • Presentation, Viva and Lab Report
CLO2		
CLO3		
CLO4		
CLO5		
CLO6		

3.2.3 Major in Electronics

EEE 429: VLSI Circuits I

Credit: 3

BNQF Code: 07144115

3 hours/week

Rationale of the Course: This is a course which covers basic theories and techniques of digital VLSI design in CMOS technology. In this course, the students will study the fundamental concepts and structures of designing digital VLSI systems include CMOS devices and circuits, standard CMOS fabrication processes, CMOS design rules, static and dynamic logic structures, interconnect analysis, CMOS chip layout, simulation and testing, low power techniques, design tools and methodologies, VLSI architecture.

Course Content:

IC trends, technology and design approaches. MOS device: structure, operation, threshold voltage and characteristics. Ratioed circuits: NMOS inverter with resistive and transistor load, Pseudo NMOS inverter. Ratio-less circuits: CMOS inverters: operation, transfer characteristics, design for equal rise and fall time, propagation delay, rise time, fall time and power consumption estimation. NMOS pass transistor and CMOS pass gate circuits. Buffer chain design to drive large capacitive load. Integrated circuit fabrication technology: photolithography, CMOS process flow, design rules. Estimation of resistance and capacitance from layout. Layout matching. Stick diagram and area estimation from stick diagram. Reliability issues: Latch-up, electromigration. Basic logic gates in CMOS. Synthesis of arbitrary combinational logic in CMOS, pseudo-NMOS, dynamic CMOS, clocked CMOS and CMOS domino logic. Structured design: Parity generator, bus arbitration logic, multiplexers-based design, programmable logic array (PLA) design. Clocked sequential circuit design: two phase clocking, dynamic shift register. CMOS latches and flip flops. Memory elements design: System timing consideration, three transistors and one transistor dynamic memory cell. Pseudo-static RAM/register cell. 4-transistor dynamic and 6-transistor static CMOS memory cell. 4x4 bit register array and 16-bit static CMOS memory array.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Demonstrate the basic operation of MOSFETs, different devices based on CMOS technology and fabrication process	√		
CLO2	Analyze different types of devices based on various MOS technology, their circuit characteristics and performances		√	
CLO3	Design various logic circuits using CMOS technology			√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 430: VLSI Circuits I Lab

BNQF Code: 0714 4116

Credit: 1.5

3 hours/week

Rationale of the Course: This course is an introduction to concepts associated with the analysis and design of integrated circuits (IC) in the state-of-the-art CMOS technologies. Continuous advances in microelectronics and Very Large Scale of Integration (VLSI) made an entire electronic system on a single chip (SoC) possible. Modern VLSI ICs contain more than two billion components per chip. Design and manufacturing of semiconductor devices present unique challenges, especially at the conceptual and design levels, therefore computer-assisted design (CAD) methods are sought to help manage these complex designs. In particular, this course introduces CMOS semiconductor devices, physical principles behind IC design, design and analysis of digital logical gates, and the use of professional CAD tools for analog IC design.

Course Content: In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 329. They will learn the schematic & physical layout of CMOS Inverter, NAND2 & NOR2, NAND3 & NOR3 with Equal Rise & Fall Resistance, Compound gates like AOI-22, OAI-31, OAI-22; 2:1 Inverting MUX, CMOS XOR2, CMOS Full Adder with mirror topology, 4-bit Ripple-Carry Adder. In the second part, students will design simple systems using the principles learned in EEE 329.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO3	PLO4	PLO5	PLO9
CLO1	Analyze the CMOS layout levels, how the design layers are used in the process sequence, and resulting device structures	√			
CLO2	Test and evaluate the CMOS design layers in process sequence, resulting device structures and output performance		√		
CLO3	Experience designing integrated circuits using Computer Aided Design (CAD) tools			√	
CLO4	Design static CMOS combinational and sequential logic at the transistor level, including mask layout	√			
CLO5	Identify the interactions between process parameters, device structures, circuit performance, and system design		√		
CLO6	Complete a significant VLSI design project having a set of objective criteria and design constraints				√

Teaching Strategies: Lecture, Laboratory software experiments, Mini-Project developments. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	Class Lecture	Mini Project Presentation
CLO2	Simulation	

CLO3	• Tutorial • Group Discussion • Lab Practice	• Continuous Lab Performance • Final lab Exam • Lab Report • Attendance
CLO4		
CLO5		
CLO6		

EEE 411: Analog Integrated Circuit

Credit: 1.5

BNQF Code: 0714 4117

3 hours/week

Rationale of the Course: This course introduces the principles of analog circuits and explain the analysis techniques used in the design of analog integrated circuit. Upon completion of this course students will have a clear understanding on the inner workings of analog ICs such as operational amplifiers.

Course Content: This course introduces the students to operation models of BJT and MOS, frequency response analysis, active Loads & Current Sources, ideal op- amps, output stages of an integrated system, basic two stage MOS operational amplifiers, non-linear Analog circuits and various performance parameters of analog integrated circuits

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2
CLO1	Explain the basic working principles of integrated analog circuit components	√	
CLO2	Explain various characteristics of analog circuit components with proper analysis methodology.		√
CLO3	Analysis of noise and frequency response of linear and non-linear analog integrated circuit.		√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual	• Attendance & class performance • Class Test
CLO2		

CLO3	• Home Assignment • Class Exercise • Group Discussion	• Assignment • Mid Exam • Final Exam
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EEE 425: Biomedical Engineering

Credit: 3

BNQF Code: 0714 4118

3 hours/week

Rationale of the Course: The course provides an introduction to several areas of research found in Biomedical Engineering. Topics include basic biomechanics, bioinstrumentation systems, circuit elements and concepts, linear network analysis, bio-potentials, biosensors, various imaging techniques, fundamentals of bioinformatics and molecular engineering. A required class project will help students identify and formulate solutions to a problem found in the biomedical engineering field.

Course Content: Vectors; Free Body Diagrams; Forces, Equilibrium; Biomechanical Modeling; Biomechanical Testing Techniques; Biomechanical Problem Solving Methodology; Basic Bioinstrumentation System; Basic Circuit Elements and Concepts; Linear Network Analysis; The Origin of Bio-potential Signals; How Biosensors Record Signals in the Human Body; Imaging Techniques; Fundamentals of Bioinformatics; Fundamental of Molecular Engineering.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2
CLO1	Explain, characterize and classify the primary concepts and theories of biomedical devices and biomechanical system.	√	
CLO2	Identify, devise and solve the problems related to biomedical instrumentations and imaging techniques.		√
CLO3	Analyze and determine the characterization of biosensors and bio-potential signal.		√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment	• Attendance & class performance • Class Test • Assignment

CLO2	• Class Exercise • Group Discussion	• Mid Exam • Final Exam
CLO3		

EEE 437: Digital Integrated Circuit Design

Credit: 3

BNQF Code: 0714 4119

3 hours/week

Rationale of the Course: The course is designed to give the student an understanding of the different design steps required to carry out a complete digital integrated circuit design.

Course Content: Introduction to VLSI Systems:

- CMOS logic, fabrication and layout
- MOS Transistor theory
- Layout Design Rules
- Circuit characterization and performance estimation
- Circuit Simulation
- Combinational and sequential circuit design
- Memory system design
- Design methodology and tools

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Explain and familiarize the concepts and evaluation of digital integrated circuit design.	√		
CLO2	Familiarization with different design steps required to carry out a complete digital integrated circuit design.		√	
CLO3	Designing of digital integrated circuits by implementing advanced techniques.			√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 433: Semiconductor Devices

Credit: 3

BNQF Code: 0714 4220

3 hours/week

Rationale of the Course: This course provides the insight useful for understanding the physics of the semiconductor properties and electronic devices and also prepares students to advanced courses in solid state and quantum electronics. Topics include the background of solid state physics and basic principles of operation of electronic devices (P-N junction diode, FET, JFET, MOS structure, Metal Semiconductor junction) based on physical effect.

Course Content:

- Review of introductory Quantum Mechanics (from Schrodinger's equation to the concept of Density of states and Energy Bands).
- Semiconductors in equilibrium: Energy bands, intrinsic and extrinsic semiconductors, Fermi levels, electron and hole concentrations, temperature dependence of carrier concentrations and invariance of Fermi level.
- Carrier transport processes and excess carriers: Drift and diffusion, generation and recombination of excess carriers, Einstein relations, continuity and diffusion equations for holes and electrons and quasi-Fermi level.
- PN junction: Basic structure, equilibrium conditions, contact potential, equilibrium Fermi level, space charge, non-equilibrium condition, forward and reverse bias, carrier injection, minority and majority carrier currents, transient and AC conditions.
- Bipolar Junction Transistor: Basic principle of pnp and npn transistors, emitter efficiency, base transport factor and current gain, coupled-diode model and charge control analysis, Ebers-Moll equations and circuit synthesis.
- Junction Field-Effect-Transistor: qualitative theory of operation, current-voltage relationship.
- Metal-semiconductor junction: Energy band diagram of metal semiconductor junctions, rectifying and ohmic contacts, Semiconductor Heterostructures.
- MOS structure: MOS capacitor, energy band diagrams and flat band voltage, threshold voltage, static C-V characteristics, qualitative theory of MOSFET operation, body effect and current-voltage relationship of a MOSFET.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO4
CLO1	Illustrate the various properties, physical phenomena & quantities of Semiconductor materials and devices.	√		
CLO2	Apply standard device model to analyze the different types of semiconductor junctions.		√	
CLO3	Investigate the governing equations and functional parameters of BJT, FET & MOS structures.			√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Presentation • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 435: Optoelectronics
BNQF Code: 0714 4121

Credit: 3
3 hours/week

Rationale of the Course: The main aim of the course is to provide a strong background on fundamental elements of optoelectronic devices and optical communication by exploring typical optical systems (Transmission, Channel, and Detection) from a top-down approach. Additionally, this course will emphasize on optical properties in semiconductor, optical fiber design, optical semiconductor devices and link budget estimation.

Course Content:

- Introduction of fiber optic communication and semiconductor devices- light propagation through optical fiber, optical fiber waveguides.
- Light sources: Light emitting diodes, laser diodes and quantum well lasers.
- Detector: PIN photo-detector and avalanche photo-detectors.
- Receiver analysis: Direct detection and coherent detection, noise and limitations.
- Optical fiber cables and connection: Fiber splices, connectors and couplers
- Optical fiber systems: optical receiver, optical transmission and power budget estimation.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Explain, characterize and classify the basic concepts and theories of the fundamental elements of optoelectronic devices and optical fiber communication system.	√		
CLO2	Identify, formulate and solve the problems related to dielectric waveguides, optical fibers, and semiconductor devices.		√	
CLO3	Analyze and determine the dielectric waveguides, LEDs, photodetectors and power budget.			√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 436: Optoelectronics Lab**Credit: 1.5****BNQF Code: 0714 4122****3 hours/week**

Rationale of the Course: This lab course is associated with the theory course (EEE 435) on the principles, design, and applications of optoelectronic devices. Basic specifications of key optoelectronic devices, including photodiodes, Light-Emitting Diodes (LEDs), diode lasers, LED and Liquid Crystal Displays are experimentally studied by the students. The experiments include both DC (static) and AC (dynamic) characteristics of the devices and emphasize both the electrical and optical figures of merit. The advantages and disadvantages of various types of photodetectors and light sources are experimentally and quantitatively studied in the lab.

Course Content: Ray Theory, Lenses & Optical Waveguides. Single mode & Multimode Fibers. Optical Connectors, Couplers & Attenuators. Features of Semiconductor Diodes and Introduction to Light-Emitting Diodes (LEDs). Features and Characteristics of Laser Diodes. Fiber optic Communication System

using WDM. Introduction to Optiperformer: Attenuation, Dispersion and Power Budget. PIN & APD Photodetectors. Photoconductor - Optoelectronic effect for light detection. Photodiode: PIN photodetector

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO3	PLO4	PLO5	PLO9	PLO10
CLO1	Verify various theoretical concepts learned in the lecture class		√					
CLO2	Understand how the fundamental concepts affect the performance of practical optoelectronic devices		√					
CLO3	Learn measurement techniques to characterize optoelectronic devices				√	√		
CLO4	Experiment with basic devices used in equipment for various applications				√	√		
CLO5	Work on complex engineering problems individually and in a team.						√	
CLO6	Communicate and share knowledge, data, information, results etc. with others.							√

Teaching Strategies: Lecture, Laboratory software experiments, Mini-Project developments. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Simulation • Tutorial • Group Discussion • Lab Practice	• Mini Project Presentation • Continuous Lab Performance • Final lab Exam • Lab Report • Attendance
CLO2		
CLO3		
CLO4		
CLO5		
CLO6		

EEE 445: VLSI Circuits II

Credit: 3

BNQF Code: 0714 4223

3 hours/week

Rationale of the Course: This is a course which covers some advanced theories and techniques of digital VLSI design in CMOS technology. In this course, the students will study the advanced concepts and structures of designing digital VLSI systems include CMOS device robustness, combinational circuit design, sequential circuit design, datapath subsystems, array subsystems, finite state machines. They will also learn how to write hardware description language for any algorithm.

Course Content: Scaling of MOS transistor and interconnect: RC delay modeling, repeaters and cascaded drives. Advanced CMOS nanometer process flow and enhancement of CMOS process, technology related CAD issues and manufacturing issues, design margin and PVT corners. Circuit characterization: delay estimation and transistor sizing for minimum delay, crosstalk and noise analysis. High speed digital circuit design techniques, circuit families. Architecture for high-speed design: Carry select, carry skip, carry look ahead and tree adders. Modified Booth algorithm. Sequential circuit design: sequencing methods, maximum and minimum delay constraints, clock skew. Design of latches and flip-flops, clock Generation and synchronization, High-speed clock generation and distribution. Algorithm and architecture for digital processors in Verilog, system Verilog and system-C: building block for signal processors, digital filters and signal processors, pipelined architecture. Architecture for arithmetic processors: addition, subtraction, multiplication and division. Complete design of a simple RISC processor. Post-synthesis design validation: timing verification, fault simulation and testing, design for test. High speed and low power memory circuit design: advanced topics in DRAM and SRAM.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Interpret different types of CMOS combinational and sequential circuit, their performance and robustness.	√		
CLO2	Analyze trade-offs between speed, density, programmability, ease of design, and other variables for datapath and array subsystems.		√	
CLO3	Design finite state machine and different subsystems of digital processor.			√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEE 446: VLSI Circuits II Lab**Credit: 1.5****BNQF Code: 0714 4224****3 hours/week**

Rationale of the Course: In this course, students will learn a new hardware description language – Verilog. With this language, they will design various digital circuits that have been taught throughout EEE 329. They will be accustomed to new software that can compile and run Verilog modules. RTL Verilog will be thoroughly discussed in this lab. In the second part of this course, students will design simple systems using the principles learned in EEE 445.

Course Content: In the first part, students will be accustomed to Verilog. They will learn the behavioral, gate-level & data-flow model abstraction. Throughout the lab manual, they will learn Verilog Constructs, Concurrent Functionality (Operators, Continuous Assignment), Sequential Functionality (Procedural Assignment, Constructs: if-else, case(x/z), loops), Sequential Circuits (D Latch, D Flip-flop, Register). At last, they will learn about Finite State Machine (FSM). In the second part, students will design RTL FSM mini-projects using the principles learned in EEE 445.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO3	PLO4	PLO5	PLO10
CLO1	Model digital systems in hardware description language at different levels of abstraction	√			
CLO2	Test and evaluate CMOS combinational and sequential logic circuits developed by hardware description language		√		
CLO3	Experience designing integrated circuits using Computer Aided Design (CAD) tools			√	
CLO4	Simulate and verify finite state machine using hardware description language			√	
CLO5	Transfer a digital design from a simulatable version to a synthesizable version		√		

CLO6	Complete a significant VLSI design project having a set of objective criteria and design constraints				√
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Teaching Strategies: Lecture, Laboratory software experiments, Mini-Project developments. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	- Class Lecture - Simulation - Tutorial - Group Discussion - Lab Practice	- Mini Project Presentation - Continuous Lab Performance - Final lab Exam - Lab Report - Attendance
CLO2		
CLO3		
CLO4		
CLO5		
CLO6		

EEE 447: Introduction to Nanotechnology

Credit: 3

BNQF Code: 0714 4225

3 hours/week

Rationale of the Course: Explanation of crystallography, materials in nanoscale, atomic models, quantum number. Mechanism of Scanning Tunneling Microscopes (STM), Scanning Electron microscopes (SEM), Tunneling Electron Microscopes (TEM), Atomic Force Microscope (AFM). Description of cleanroom, Spintronics, Magnetic Logic Gate (MLG), Giant Magnetoresistance (GMR) devices, Nano-safety. Detection of crystal growths by e-beam and X-ray diffraction.

Course Content: Definition and scope of nanotechnology, Special properties of materials in nanoscale, Current status of Moore's Law, Basic crystallography, Atomic models and quantum numbers, Wafer cleaning techniques, Vacuum techniques, Electron beam evaporation, Sputtering, Chemical Vapor Deposition (CVD), Molecular Beam Epitaxy (MBE), Patterning of nanoscale devices (Lithography). Detection of crystal growths by e-beam and X-ray diffraction, Contacts in ICs, Cleanroom, Scanning Tunneling Microscopes (STM), Visualization of atoms. IBM's experiment for moving atoms, Scanning Electron microscopes (SEM), Tunneling Electron Microscopes (TEM), Atomic Force Microscope (AFM), The World's highest resolution electron microscope from Hitachi, Conduction of electrons in bulk and nanostructures, Single Electron Transistor (SET), Introduction to Spintronics, Magnetic Logic Gate (MLG), Giant Magnetoresistance (GMR) devices, The advancement in data storage devices, Forthcoming breakthroughs in nanotechnology, Nano-safety

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statements	PLO1	PLO2	PLO3
CLO1	Demonstrate a basic knowledge of nanotechnology, crystallography, atomic models, and some properties of materials.	√		
CLO2	Apply the Current status of Moore's and Bragg's law of X-ray diffraction.		√	
CLO3	Investigate of Scanning Tunneling Microscopes (STM), Scanning Electron microscopes (SEM), Tunneling Electron Microscopes (TEM), Atomic Force Microscopy (AFM).		√	

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

3.2.4 Major in Computer Engineering

CSE 409: Discrete Mathematics

Credit: 3

BNQF Code: 0613 4103

3 hours/week

Rationale of the Course: This course will provide student to develop logical thinking and its application to computer science. This course focuses on computational problems precisely and the use of mathematical operations such as sets, functions, relations, orders, and sequences etc. It also provides a basic knowledge of graphs representation and tree operation. It emphasizes on the importance of proving statements correctly. The subject enhances one's ability to reason and ability to present a coherent and mathematically accurate argument.

Course Content: Introduction to Logic and Proofs: Propositional Logic, Conditional Statement, Sentence Translation using Propositional Logics; Propositional Equivalences; Predicates and Quantifiers; Nested

Quantifiers; Rules of Inference; Introduction to Proofs; Basic Structures: Sets, Functions, Sequences; Number Theory: Divisibility and Modular Arithmetic, Integer Representations, Primes and Greatest Common Divisors; Induction and Recursion; Counting: Basics of Counting, Pigeonhole Principle; Permutations and Combinations; Relations ; Graphs: Graph Models, Representing Graphs, Connectivity, Euler and Hamilton Paths, Planar Graphs , Graph Coloring; Trees: Applications of Trees such as binary search tree, infix prefix postfix notation; Tree Traversal; Spanning Trees.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Understand the fundamentals of discrete mathematics such as a logical relation in terms of predicates, quantifiers, and logical connectives.	√		
CLO2	Explain the basic principles of sets, functions, relations, recurrence, concepts of tree and graph and their various operations.	√		
CLO3	Apply proof techniques, number theory, counting principles for solving problem.			√
CLO4	Analyze graphs, trees and their various properties for real life applications.		√	

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. Multimedia projector and a PC will be used for the convenience of the students to understand codes practically. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	- Class Lecture - Audio-Visual - Home Assignment - Class Exercise - Group Discussion	- Attendance & class performance - Class Test - Assignment - Mid Exam - Final Exam
CLO2		
CLO3		
CLO4		

CSE 411: Computer Architecture

Credit: 3

BNQF Code: 0613 4104

3 hours/week

Rationale of the Course: This course introduces the basic organization and architecture of digital computers (CPU, memory, I/O, software). This will also help the students to learn about digital logic and

microprogramming. Such knowledge leads to better understanding and utilization of digital computers, and can be used in the design and application of computer systems or as foundation for more advanced computer-related studies.

Course Content: Fundamentals of computer design, quantifying cost and performance; Instructions and data access methods: operations and operands of computer hardware, instruction set architecture, Addressing styles; Arithmetic logic unit operations: multiplication and division operation, floating point representation and operation; Processor data-paths: single cycle and multi-cycle implementation, Control Unit design : hardware and micro programmed; Pipelining, Hazard : different type of hazards and their solution ; Memory organization : Memory hierarchies and performance, cache, virtual memory ; DMA and Interrupts; Buses; Multiprocessors: types of multiprocessors, performance, single bus multiprocessors, multiprocessors connected by network, clusters.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Understand computer architecture and its related terms to gain the basic ideas of computer processor, performance, instruction, memory hierarchy, data path and hazard etc.	√		
CLO2	Apply the techniques to compute processor performance and knowledge of computer language for logical operations	√		
CLO3	Analyzing the knowledge between different types of computer arithmetic systems, pipelining techniques, memory organization and hazards.		√	
CLO4	Design and implement the architecture of computer circuitry including pipelining techniques.			√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. Students must participate in classroom discussions for problems solving.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		
CLO4		

CSE 413: Mathematical Analysis for Computer Science

Credit: 3
3 hours/week

BNQF Code: 0613 4205

Rationale of the Course: The course introduces the fundamental concepts of concrete mathematics. In particular, the course will cover the basic concepts of mathematical techniques, algorithm, notations and recurrence relations. This course focuses on different recurrence related problems such as Tower of Hanoi, Lines in the plane, Josephus Problem and probability theory etc. This course provides a solid and relevant base of mathematical skills which utilizes the students to learn how to solve complex mathematical problems.

Course Content: Recurrence Relation, Tower of Hanoi, Lines in the plane, Josephus Problem, Notations, Sums and Recurrences, Manipulations of Sums, Iverson's convention, Multiple sums, General Methods, Floor, Ceiling, Floor/Ceiling Applications, MOD: The Binary Operation, Divisibility, Factorial, Prime Numbers, Euclid Numbers, Mersenne Numbers, Relative Prime Numbers, GCD: Euclidean algorithm, LCM, MOD: The Congruence Relation, Introduction to Probability, sample space, Events, Conditional Probability, Independent events, Bayes formula, Random variables, Discrete Random Variables, Continuous Random Variables, Markov chain, Stochastic process, Random Walk, Chapman-Kolmogorov equations.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO3
CLO1	Understand different mathematical techniques, algorithm, notations and recurrence relations.	√	
CLO2	Analyze recurrence methods using mathematical induction and iterative approach.	√	
CLO3	Apply different mathematical techniques for solving real life problems.		√
CLO4	Compute the probability of different statistical problems using probability theory.		√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. Students must participate in classroom discussions for problems solving.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance
CLO2		• Class Test
CLO3		• Assignment
CLO4		• Mid Exam
		• Final Exam

CSE 415: Digital Computer Design**Credit: 3****BNQF Code: 0613 4206****3 hours/week**

Rationale of the Course: The main objectives of this sessional course are to reinforce the theory presented in the CSE 205 Digital Logic Design course by allowing students to experiment with digital logic in a hands-on manner. And also understand both logical and electrical characteristics of digital design.

Course Content: Digital systems: Digital computers and digital systems; binary, octal and hexadecimal number systems; complements; signed binary numbers; decimal and binary codes; introduction to binary logic. Boolean algebra: basic definitions, theorems and properties of Boolean algebra; Boolean functions; standard forms of Boolean functions; logic operations. Simplification of Boolean functions: Karnaugh map method; don't care condition; NAND and NOR implementation; exclusive-OR function. Combinational circuits: analysis and design procedures; adders, subtractors, multilevel NAND/NOR circuits and code conversion; transistor switches and practical design considerations; TTL, MOS, CMOS, IIL logic gates and their circuit's. MSI and PLD devices: magnitude comparators, decoders, encoders, multiplexers, de-multiplexers. Analysis of synchronous sequential circuits: flip-flops; analysis of clocked sequential circuits; Design of sequential circuits: flip-flop excitation tables, design procedures, counter designs. Registers, counters and memory devices: shift registers; ripple counters, synchronous counters.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Understand the fundamental concepts of digital logic, number systems, code conversion, logical gates, Boolean algebra and Boolean functions etc.	√		
CLO2	Apply different methods (i.e. Boolean Algebra, K-map etc.) to simplify logic functions.	√		
CLO3	Design different combination logic circuits and sequential logic circuits.			√
CLO4	Analyze the properties and operations of different digital logic systems.		√	

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. Multimedia projector and a PC will be used for the convenience of the students to understand codes practically. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture	• Attendance & class performance
CLO2	• Audio-Visual	

CLO3	• Home Assignment • Class Exercise • Group Discussion	• Class Test • Assignment • Mid Exam • Final Exam
CLO4		

CSE 417: Object Oriented Programming Language

Credit: 3

BNQF Code: 0613 4107

3 hours/week

Rationale of the Course: The Course- “Object Oriented Programming Language” provides in-depth coverage of object-oriented programming principles and techniques using C++. The course is designed to perform object oriented programming to develop solutions to problems demonstrating usage of control structures, modularity, I/O and other standard language constructs. Also to demonstrate adeptness of object oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation and inheritance.

It is expected that by the end of the course the students will be able to prepare object-oriented design for small/medium scale problems, demonstrate the differences between traditional imperative design and object oriented design, explain class structures as fundamental modular building blocks, understand the role of inheritance, polymorphism, dynamic binding and generic structures in building reusable code.

Course Content: Philosophy of object oriented programming (OOP); advantages of OOP over structured programming; encapsulation, classes and objects, access specifiers, static and non-static members; constructors, destructors and copy constructors, in-line functions; array of objects, object pointers and object references, new and delete, friend function; polymorphism: overloading, default arguments; operator overloading : overloading binary, relational, logical, unary operator; inheritance: single and multiple inheritance, abstract classes, virtual functions and overriding; exceptions; object oriented I/O; template functions and classes; multi-threaded programming; class libraries; I/O systems; string handling; exception handling; run-time type identification and the casting operators; namespaces, conversion functions; standard template library: container classes, vectors, lists, string class.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Describe Object Oriented Programming concepts and its features.	√		
CLO2	Understand how object oriented programming concepts are used to solve a problem.	√		
CLO3	Apply OOP concepts (inheritance, interface, polymorphism, encapsulation, function overloading, operator overloading etc.) to solve different problems.			√
CLO4	Analyze real life problem scenarios to design a solution using key features (abstraction, inheritance, polymorphism, encapsulation,		√	

	exception handling, and template, multi-threading) of OOP using C++.			
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Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. Multimedia projector and a PC will be used for the convenience of the students to understand codes practically. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		
CLO4		

**CSE 418: Object Oriented Programming Language
Lab**

Credit: 1.5

3 hours/week

BNQF Code: 0613 4108

Rationale of the Course: This sessional (lab) course is based on the theory course CSE-121 Object-Oriented Programming Language. This course provides practical implementation aspects of object-oriented programming principles and techniques using C++. The course is designed to perform object-oriented programming to develop problem solutions using features of C++.

Course Content: Philosophy of object oriented programming (OOP); advantages of OOP over structured programming; encapsulation, classes and objects, access specifiers, static and non-static members; constructors, destructors and copy constructors, in-line functions; array of objects, object pointers and object references, new and delete, friend function; polymorphism: overloading, default arguments; operator overloading : overloading binary, relational, logical, unary operator; inheritance: single and multiple inheritance, abstract classes, virtual functions and overriding; exceptions; object oriented I/O; template functions and classes; multi-threaded programming; class libraries; I/O systems; string handling; exception handling; run-time type identification and the casting operators; namespaces, conversion functions; standard template library: container classes, vectors, lists, string class.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Identify and implement classes and objects from the given problem description using C++.	√		

CLO2	Implement friend function, function overloading, operator overloading, and inheritance etc. to solve different problems using C++.		√	
CLO3	Design and implement solutions of real life problems by using key features of OOP (Encapsulation, Inheritance, Polymorphism, Abstraction etc.) in C++.			√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. Multimedia projector and a PC will be used for the convenience of the students to understand codes practically. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance
CLO2		• Class Test • Assignment
CLO3		• Mid Exam • Final Exam

CSE 419: Computer Networks

Credit: 3

BNQF Code: 0613 4109

3 hours/week

Rationale of the Course: The course objectives include learning about computer network organization and implementation, obtaining a theoretical understanding of computer networks. Students are introduced to network design and its operations, and discuss the following topics: Open Systems Interconnection (OSI) communication model; error detection and recovery; local area networks; bridges, routers and gateways; network naming and addressing; and local and remote procedures. In addition to that, students are taught server configurations such as HTTP, FTP, DNS, DHCP server etc.

Course Content: Computer networks & Internet, Types of Network, Establishing Communication rules, Quality of communication, Converged network, QoS, Common communication tools & elements, Circuit switching & Packet switching, Important networking terms, TCP/IP model and end-to-end communication process, PDU & Encapsulation process, Addressing and layered architecture in the network, Overview of delay in packet switched network, Throughput in computer networks, Layered Architecture, Encapsulation, Client-server architecture, P2P network and application model, API and Socket addressing, Application Layer Protocols: DNS services, E-Mail services, SMTP, POP, POP3, IMAP, MIME, Comparison between SMTP and HTTP, FTP, Telnet, DHCP, SMB protocol, WWW and HTTP: Persistent and Non-persistent connection, Request and response message, Web caching, cookies, Transport Layer Protocols: Controlling conversation, The TCP and UDP, Port addressing, TCP congestion control, Network Security: Major security goals, Symmetric key cryptography, Public key cryptography (RSA), Message Integrity and Digital Signatures, Network Layer Protocols: IPV4 Packet

header, Overview of IPV6, Routing Process: Overview of Static and Dynamic routing, Inter-LAN Communication: Default gateway and default route, Autonomous system, Addressing the Network: Types of communications, Reserved IPV4 address ranges, Historic network classes, NAT, Classless addressing, Network Address Management: Internet Assigned Numbers Authority (IANA), ISP roles, Anatomy of IPV4 address, The subnet mask, Subnetting: Basic Terminology, Subnetting a subnet or VLSM, Routing Protocols: Popular routing algorithms and metric, Flooding technique, The distance vector routing (DVR) protocol, Link-state routing, RIP and its drawback, Border gateway protocol (BGP), OSPF, MAC Protocols: Chanel partitioning, random access, taking turns, RTS/CTS protocols, Address resolution protocol (ARP), Wireless & Mobile Networks: 802.11 Architecture, MAC protocols, frame, Advanced features in 802.11, Wi-Fi & Wi-max architecture, Mobile IP, Routing calls to mobile user.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Describe networks layers, protocols, and related terms for designing computer networks.	√		
CLO2	Understand different application layer protocols and network routing algorithms for effective design of computer networks.	√		
CLO3	Design computer networks by applying the knowledge of computer network fundamentals such as logical addressing, routing protocols, network security etc.			√
CLO4	Analyze the complex computer networks and the entities involved with the day to day running of the Internet.		√	

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. Multimedia projector and a PC will be used for the convenience of the students to understand codes practically. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		
CLO4		

Rationale of the Course: This lab course is based on “CSE 319: Computer Networks” theory course. This lab course provides a practical approach to various types of Ethernet/Internet networking design, configure and manage network using protocols. Also, students will able to get some hands-on experience in network control security.

Course Content: Computer networks & Internet, Types of Network, Establishing Communication rules, Quality of communication, Converged network, QoS, Common communication tools & elements, Circuit switching & Packet switching, Important networking terms, TCP/IP model and end-to-end communication process, PDU & Encapsulation process, Addressing and layered architecture in the network, Overview of delay in packet switched network, Throughput in computer networks, Layered Architecture, Encapsulation, Client-server architecture, P2P network and application model, API and Socket addressing, Application Layer Protocols: DNS services, E-Mail services, SMTP, POP, POP3, IMAP, MIME, Comparison between SMTP and HTTP, FTP, Telnet, DHCP, SMB protocol, WWW and HTTP: Persistent and Non-persistent connection, Request and response message, Web caching, cookies, Transport Layer Protocols: Controlling conversation, The TCP and UDP, Port addressing, TCP congestion control, Network Security: Major security goals, Symmetric key cryptography, Public key cryptography (RSA), Message Integrity and Digital Signatures, Network Layer Protocols: IPV4 Packet header, Overview of IPV6, Routing Process: Overview of Static and Dynamic routing, Inter-LAN Communication: Default gateway and default route, Autonomous system, Addressing the Network: Types of communications, Reserved IPV4 address ranges, Historic network classes, NAT, Classless addressing, Network Address Management: Internet Assigned Numbers Authority (IANA), ISP roles, Anatomy of IPV4 address, The subnet mask, Subnetting: Basic Terminology, Subnetting a subnet or VLSM, Routing Protocols: Popular routing algorithms and metric, Flooding technique, The distance vector routing (DVR) protocol, Link-state routing, RIP and its drawback, Border gateway protocol (BGP), OSPF, MAC Protocols: Chanel partitioning, random access, taking turns, RTS/CTS protocols, Address resolution protocol (ARP), Wireless & Mobile Networks: 802.11 Architecture, MAC protocols, frame, Advanced features in 802.11, Wi-Fi & Wi-max architecture, Mobile IP, Routing calls to mobile user.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO3	PLO4	PLO5
CLO1	Demonstrate details and functionality of layered network architecture and principles of computer networking, network design and troubleshooting topics and introduction to required modern hardware and software.			√
CLO2	Analyze performance of various communication and security protocols, configuration of router, switch and various servers (DHCP, HTTP, SMTP, DNS, and FTP) and practice packet /file transmission between nodes.		√	
CLO3	Design and build a wireless LAN, LAN, VLAN and implement a network security policy using access control lists.	√		

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. Multimedia projector and a PC will be used for the convenience of the students to understand codes practically. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

CSE 421: Microprocessor Based System Design

Credit: 3

BNQF Code: 0613 4211

3 hours/week

Rationale of the Course: This course will build up student's ability to understand fundamental concepts of microprocessor and microcontroller based embedded systems. Also, discuss about architecture and programming concepts of 8086 based microprocessor family as well as different microcontrollers (8051, Arduino, etc.). Analyze different tools for integrating hardware and software components in microcontroller based embedded systems. This course will emphasize different techniques & tools and how to apply them as a solution of real life problem.

Course Content: This course provides basic concept of architecture of 8086 microprocessor family, addressing mode, data movement instructions, interfacing of bus, memory and I/O with microprocessor, handling of interrupts and direct memory access (DMA). The 8051 Microcontrollers: Microcontrollers and embedded processor, introduction to 8051 assembly programming, PSW, register bank, stack, jump, loop and control instructions, I/O port programming, addressing modes, arithmetic & logic instructions. 8051 hardware connection and intel hex file, 8051 timer & serial port programming in assembly and C, LCD & keyboard interfacing & sensor interfacing. Motor control: relay, PWM, DC & stepper motor. Mapping between languages and hardware; Embedded Systems Hardware/ Software Co-design, Introduction to Arduino and Arduino based application.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Describe different microprocessor and microcontroller's internal architecture, pin diagram and its operation in the area of embedded system.	√		

CLO2	Understand the 8086 based assembly & 8051 Microcontroller assembly language program, data movement instructions, different addressing mode, register banks, arithmetic logic instructions and various others functions etc.	√		
CLO3	Apply the knowledge of microprocessor and microcontroller fundamentals and different components of embedded system to design a solution for a given problem.			√
CLO4	Design and Analyze the real world problems with Microcontrollers based Embedded systems.		√	

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. Multimedia projector and a PC will be used for the convenience of the students to understand codes practically. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		
CLO4		

Credit: 1.5

CSE 422: Microprocessor-Based System Design Lab

3 hours/week

BNQF Code: 0613 4212

Rationale of the Course: This course will build up student's ability to understand fundamental concepts of microprocessor and microcontroller based embedded systems. Also, discuss about architecture and programming concepts of 8086 based microprocessor family as well as different microcontrollers (8051, Arduino, etc.). Analyze different tools for integrating hardware and software components in microcontroller based embedded systems. This course will emphasize different techniques & tools and how to apply them as a solution of real life problem.

Course Content: This course provides basic concept of architecture of 8086 microprocessor family, addressing mode, data movement instructions, interfacing of bus, memory and I/O with microprocessor, handling of interrupts and direct memory access (DMA). The 8051 Microcontrollers: Microcontrollers and embedded processor, introduction to 8051 assembly programming, PSW, register bank, stack, jump, loop and control instructions, I/O port programming, addressing modes, arithmetic & logic instructions. 8051 hardware connection and intel hex file, 8051 timer & serial port programming in assembly and C, LCD & keyboard interfacing & sensor interfacing. Motor control: relay, PWM, DC & stepper motor. Mapping

between languages and hardware; Embedded Systems Hardware/ Software Co-design, Introduction to Arduino and Arduino based application.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO3	PLO9
CLO1	Demonstrate the functionality of different types of microcontroller for designing different embedded systems.	√		
CLO2	Analyze various standard techniques and apply it to make a proper design for real life problem solution.		√	
CLO3	Implement a microcontroller based embedded system project.			√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. Multimedia projector and a PC will be used for the convenience of the students to understand codes practically. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

3.3 Arts and Humanities

ENG 101: English Grammar, Reading & Writing

Credit: 3

BNQF Code: 0231 1101

3 hours/week

Rationale of the Course: The objective of this course is to provide an introduction to English Language with four basic skills i.e. reading, writing, listening and speaking. Special emphasis will be given to the use of different parts of speech, tense, voice, and modals. A systematic way of developing a good writing and speaking skills will be practiced.

Course Content: Parts of speech, Noun and its classification, Pronoun and its classification, Tense and its classification, Verb and its classification, Voice change, Basic rules of writing paragraph, Writing formal letter and Developing speaking skill:

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO10
CLO1	Achieve competence in all the four skills of English - listening, speaking, reading and writing.	√
CLO2	Develop the ability to respond, discuss, describe, and analyze any reading or listening contents.	√
CLO3	Use different parts of speech, correct sentence structures appropriately	√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. Multimedia projector and a PC will be used for the convenience of the students to understand codes practically. Students must participate in classroom discussions for answering the questions regarding different kinds of grammatical topic and developing speaking skill.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

ENG 103: English Speaking and Listening

Credit: 3

BNQF Code: 0231 1202

3 hours/week

Rationale of the Course: Extending fluency and confidence in speaking and listening for a range of personal, educational, and/or employment purposes.

Course Content: This course will primarily engage the students in the pragmatic, authentic and functional use of English for meaningful purposes. Speaking and Listening skills will be taught in an integrative way. The students will be equipped with a variety of activities and exercises by which they will focus on their own learning process.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO10
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CLO1	Demonstrate basic understanding of communication in simple contexts (e.g., conversations and instructions).	√
CLO2	Communicate basic information in simple contexts (as above) about familiar everyday topics.	√
CLO3	Recognize cohesive devices and the communicative functions of utterances.	√
CLO4	Converse with a total stranger as well as someone with whom they are quite familiar and initiate oral communication	√
CLO5	Use a range of vocabulary in academic and everyday life in speaking and writing.	√
CLO6	Monitor and apply strategies to a specified level of accuracy in grammar, sentence structure, word choice, and pronunciation elements.	√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board or Live Classroom Board will be used for most of the time. Multimedia projector will also be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Experiment • Tutorial • Group Discussion • Practice	• Class Test • Viva • Final Exam • Presentation
CLO2		
CLO3		
CLO4		
CLO5		
CLO6		

ENG 104: Technical English Communication LAB

Credit: 1.5

BNQF Code: 0231 1103

3 hours/week

Rationale of the Course: English Communication LAB can be beneficial for the learners of English language. The course would help the students to build their English communicative competence in an effective manner. It has been designed to improve both the comprehension (reading & listening) and the production (writing & speaking) skills of the students.

Course Content: This course will primarily engage the students in the pragmatic, authentic and functional use of English for meaningful purposes. All the skills will be taught in an integrative way. The students will be equipped with a variety of activities and exercises by which they will focus on their own learning process.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO10
CLO1	Infer the objectives of the speaker through the speech event, the context, and the content	√
CLO2	Assign both a literal and intended meaning to the utterances	√
CLO3	Recognize cohesive devices and the communicative functions of utterances	√
CLO4	Converse with a total stranger as well as someone with whom they are quite familiar and initiate oral communication	√
CLO5	Use a range of vocabulary in academic and everyday life in listening, speaking, reading and writing.	√
CLO6	Skim the text for main ideas; scan for specific information	√
CLO7	Conduct business transactions, writing and/or responding to documents such as application, emails, report etc.	√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board or Live Classroom Board will be used for most of the time. Multimedia projector will also be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Lab Experiment • Tutorial • Group Discussion • Lab Practice	• Continuous Lab Performance • Final lab Test/Exam • Lab Report • Individual/Team Work • Rubrics Presentation • Viva
CLO2		
CLO3		
CLO4		
CLO5		
CLO6		
CLO7		

BNG 101: Functional Bengali

Credit: 2

BNQF Code: 0232 1104

2 hours/week

Rationale of the Course: বাংলা ভাষা ও সাহিত্য, বাংলা ব্যাকরণ ও এর আলোচ্য বিষয়, ধ্বনিতত্ত্ব, ধ্বনির পরিবর্তন, বাংলা ও ইংরেজির তুলনা, সাধু ও চলিতরীতি, বিরামচিহ্ন প্রয়োগ, প্রমিত বাংলা বানানের নিয়ম (বাংলা একাডেমী), মুক্তিযুদ্ধ, বাংলার উৎসব, ষড়ঋতু, বাংলা নববর্ষ, বাংলার লোকসংস্কৃতি, বাংলা কবিতা, প্রবন্ধ, ছোটগল্প ও নাটক-বাংলা ভাষা ও সাহিত্যের এই উপাদানগুলো শিক্ষার্থীদের পরিপূর্ণ মানুষ হয়ে ওঠার ক্ষেত্রে গুরুত্বপূর্ণ ভূমিকা পালন করবে। শিক্ষার্থীরা বাংলা ভাষা এবং এর শব্দতত্ত্বের বিভিন্ন পদ ও পরিভাষায় মনোনিবেশ করতে পারবে। এছাড়াও এই কোর্সটি নিজেদের মধ্যে তুলনা করার যোগ্যতা বাড়িয়ে দিবে, যুক্তিবোধ তৈরি করতে এবং নতুন সিদ্ধান্ত নিতে সহায়তা করবে।

Course Content: The objectives for the course are as follows:

- বাংলা ভাষা ও ব্যাকরণের বিভিন্ন পদ, শব্দের সনাক্তকরণ এবং ব্যাখ্যা।
- বাংলা ধ্বনিবিদ্যা, শব্দবিজ্ঞানের বিভিন্ন শর্তাদি, পরিভাষা সনাক্ত ও ব্যাখ্যা।
- বাংলা সাহিত্যের প্রাথমিক বিষয়গুলো সম্পর্কে তাদের জ্ঞান প্রদর্শন করতে পারবে।
- বাংলা এবং ইংরেজি সাহিত্যের একটি তুলনামূলক বিশ্লেষণ করতে পারবে।
- বাংলা সাহিত্যের প্রাথমিক, মধ্যযুগ ও আধুনিক যুগের সাহিত্য সম্পর্কে জ্ঞান লাভ করতে পারবে।

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO10
CLO1	ভাষার উৎস, বিকাশ ও বিবর্তন সম্পর্কে জ্ঞান বৃদ্ধি করতে সমর্থ হবে ও ভাষার বিভিন্ন তত্ত্ব সম্পর্কে জ্ঞান বৃদ্ধি পাবে।	✓
CLO2	সমাজ ভাষাবিজ্ঞান সম্পর্কে সম্যক ধারণা লাভ করবে, বাংলা ব্যাকরণের আলোচ্য বিষয়গুলো স্বয়ংক্রিয়ভাবে শেখবে।	✓
CLO3	ছাত্র-ছাত্রীদের গবেষণার বিষয়ে সহায়তায় এবং সৃজনশীল রচনায় আগ্রহ সৃষ্টি হবে।	✓

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	- Class Lecture - Audio-Visual	Attendance & class performance
CLO2	- Home Assignment - Class Exercise	- Class Test - Assignment
CLO3	Group Discussion	Mid Exam

		Final Exam
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ECO 101: Engineering Economics

Credit: 3

BNQF Code: 0311 1205

3 hours/week

Rationale of the Course: This course introduces students to fundamental economic concepts and theory, including demand, supply, and the formation of equilibrium prices in product and resource markets, aggregate demand & supply, market equilibrium, national income accounting, theories of income determination, money and banking, and fiscal and monetary policies. This knowledge is very important for maintaining and organizing the real life.

Course Content: The Course has therefore been designed in a manner

- To acquaint students with Overview of Definition, Micro and Macro-economics and their relative importance in the formulation of national policies,
- To evaluate different terms as Demand function, demand curve, Law of demand, Elasticity of demand, Supply analysis, Supply function, Factors influencing supply, Law of supply, Elasticity of supply.; and their purpose;
- To apply the impact of Income effect, price effect, Substitution effect, Production function, Factors of production, Production possibility curves, Cost & Revenue, Total, Average, and Marginal in the contemporary society.
- To use Natural Income, GNP, GDP and NNP, Income circular flow diagram, Methods of measuring national income, Function of money, Value and inflation, International Trade, Terms of trade, Free trade and protection, Public Finance, Public income, Public expenditure, Public debt, Direct and indirect tax, on the Planning in economic development.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO2
CLO1	Understand the knowledge on the economic behavior of firms and individuals with a focus on the financial dimensions of economic systems.	√
CLO2	Apply the key elements of the demand and supply model & use the model to critically analyze real world examples.	√
CLO3	Utilize the contemporary banking and monetary system and analyze the role of money, credit and central bank monetary policy.	√

Teaching Strategies: Teaching learning process of the course is set strategically to achieve its intended learning outcomes. Classrooms tools like multimedia projectors with desktop computer, whiteboard and overhead projector are used carefully to make the teaching-learning process stimulating, effective and comprehensive. Teaching and learning primarily be achieved through delivering classroom lectures. Maximum topics of the syllabus are covered from the lecture notes. For the rest of the topics, text books and reference books are followed. All class note soft copies will be supplied by email and hard copies in the classroom. Elaborative classroom discussion of the contents implementing power point presentation, solving problems using whiteboard-marker and homework/home-study, extra-hour counseling are provided

to achieve targeted knowledge level of the students. Formative assessment of individual students is done by making inside and outside classroom discussions, clicker questions, eye-contact, providing homework or home-study, student's feedback and course end survey, and summative assessment is performed by observing class participation and performance, providing assignments as well as taking class tests and quizzes, midterm and final examinations.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • PPP & WBT* • Class Discussion • Class Exercise • Self-study	• Formative: In class discussion, clicker question, course counseling, student's feedback, course end survey • Summative: Class participation, assignment, quiz, class test and midterm and final examinations
CLO2		
CLO3		

ACT 201: Accounting Fundamentals

Credit: 3

BNQF Code: 0411 2206

3 hours/week

Rationale of the Course: This course introduces students to fundamental accounting and financial concepts related to recording process (Transactions identifications, Journal, Ledger, Trial balance), accounting cycle completion including financial statements preparation. This course also introduces management accounting concept of manufacturing company as a financial decision making for every company. This knowledge is very important for maintaining and organizing the real life.

Course Content: Introduction: Definition of accounting, Three major activities of Accounting, Objectives of accounting, Importance of accounting, Accounting as an information system, accounting & its relationship with EEE; Basic accounting equation, Transaction analysis & its impact on accounting equation; Transaction analysis & its impact on accounting equation; Preparation of Financial Statements; Double entry system: Rules for debit & credit; The recording process: recording transactions in general journal; Recording transactions in general journal; Classifying the transactions, types of accounts in ledger; posting the transactions in ledger, Chart of accounts, preparing trial balance, Timing issues in accounting: Revenue recognition principle & Expense recognition principle; need for adjusting entries, Adjusting entries for Prepayments, Adjusting entries for Accruals, Preparation of Adjusted Trial Balance, Accounting cycle: financial statements, Financial statements analysis & interpretation: ratio analysis, Cost & Management accounting: cost concept & classification, Job order costing: job cost sheet & quotation price, Cost-volume-profit analysis, Relevant and differential cost analysis

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO2	PLO11
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CLO1	Explain the steps of accounting cycle.	√	
CLO2	Evaluate the financial performance of an organization using financial report.	√	
CLO3	Analyze and evaluate financial information relating to product or service costs and contribution to profit.		√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used most of the time. Multimedia projector and a PC will be used for the convenience of the students to understand codes practically. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	- Class Lecture - PPP & WBT* - Class Discussion - Class Exercise - Self-study	- Formative: In class discussion, clicker question, course counseling, student's feedback, course end survey - Summative: Class participation, assignment, quiz, class test and midterm and final examinations
CLO2		
CLO3		

HUM 101: Bangladesh Studies and History of Independence

Credit: 3

3 hours/week

BNQF Code: 0222 1107

Rationale of the Course: This course is designed for the students of first semester of EEE department. It is a one semester course covering history, politics, culture, religion, festivals, geography, economy, ethnic groups and gender equity, development aspects, problems and prospects of Bangladesh.

Course Content: The course intends to equip students with factual knowledge and analytical skills that will enable them to learn and critically appreciate history, politics, and economy of Bangladesh. It will trace the historical root of Bangladesh as an independent state focusing on the social, economic and political developments that have taken place since its independence. It will also identify the major socio-economic, political, environmental and developmental issues that have arisen during this period, before assessing the progress over time.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO6	PLO8
CLO1	Identify specific stages of Bangladesh's political history, through the ancient, medieval, colonial and post-colonial periods and critically analyze plurality of cultural identities of Bangladesh.	√	
CLO2	Critically analyze how different constitutional bodies and socio-political institutions operate and how their behavior impact on political governance.		√
CLO3	Explain the economy and patterns of economic changes through qualitative and quantitative analysis. This will increase their awareness on global issues of development processes and the nature of environmental challenges including ways to address them effectively.	√	

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used most of the time. Multimedia projector and a PC will be used for the convenience of the students to understand codes practically. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • PPP & WBT* • Class Discussion • Class Exercise • Self-study	• Formative: In class discussion, clicker question, course counseling, student's feedback, course end survey • Summative: Class participation, assignment, quiz, class test and midterm and final examinations
CLO2		
CLO3		

MGT 201: Industrial Management and Business Communication

Credit: 3

3 hours/week

BNQF Code: 0413 2208

Rationale of the Course: This is a general course of B.Sc. in EEE program that prepares the students with basic knowledge of industrial management and communication within the workplace. Theoretical insights and practical tools within the area of management and organization of Industrial Corporation are the main

topics to be studied. The students will gain basic knowledge about industry as well as planning, organizing, HR management, leadership, and control functions in an industrial organization. Moreover, this course will also provide students to know about the basic communication principles, concepts and tools which are essential components for ensuring effective organizational behavior.

Course Content: Management, Functions of management, Managerial Role, 14 principles of management. planning & Decision Making, meaning and process of organizing, manager Vs. leader, theories of motivation, steps in controlling process, definition & types of industrial dispute. Activities of collective bargaining, meaning of communication & business communication; types of communication, communication cycle, tools of internal communication, report writing, job searching process and how to develop resume etc.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO9	PLO10	PLO11
CLO1	Acquire the theoretical knowledge of management and communication and gain practical skills and competencies that is required for managerial positions.			√
CLO2	Recognize the major functions of industrial manager e.g. planning, organizing, staffing, leading & controlling and how these functions can be executed in a variety of circumstances.	√		
CLO3	Recognize the internal and external tools of communication e.g. different types of reports, Office memorandum; Office circular; Office order, Notice, Preparation of CV and Resume etc.		√	

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases white board multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies and problems solving.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

EEP 301: Professional Ethics & Environmental Protection

BNQF Code: 0223 3109

Credit: 3
3 hours/week

Rationale of the Course: This course introduces students to the relevance and importance of ethics and social responsibility for engineers. Students will be familiarized with the dominating ethical theories of morality in such a way so that they can prepare themselves intellectually and morally to handle the pressing ethical issues of practical life. In case study, critical analysis, investigate local and global issues of importance will make students aware of the complex understanding of ethical dilemmas. The ultimate intent is to make students better equipped to identify, think critically about, and resolve ethical issues that are encountered in one's working life at the individual, organizational, and societal levels.

Course Content: Professional Ethics: Definition and scopes of Ethics. Different branches of Ethics. Social change and the emergence of new technologies. History and development of Engineering Ethics. Science and Technology- necessity and application. Study of Ethics in Engineering. Applied Ethics in engineering. Human qualities of an engineer. Obligation of an engineer to the clients. Attitude of an engineer to other engineers. Measures to be taken in order to improve the quality of engineering profession. Ethical Expectations: Employers and Employees; inter-professional relationship: Professional Organization-maintaining a commitment of Ethical standards. Desired characteristics of a professional code. Institutionalization of Ethical conduct. Environmental Protection: Environmental ethics, Environmental laws, Sustainable development.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO8
CLO1	Gain practice with ethical decision-making, to gain ethical knowledge and to have more experience and resources to improve ethical decision-making within engineering.	√
CLO2	Learn about relevant moral theories, professional codes of ethics, animal protections, intellectual (software) property rights and field guidance perspectives to deal with engineering ethics and sustainable development.	√
CLO3	Realize the moral standing of the environment and make balance between professional and environmental obligations to comply with sustainable development.	√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies and problems solving.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	Class Lecture	Formative: In class discussion, clicker question, course
CLO2		

CLO3	• PPP & WBT* • Class Discussion • Class Exercise • Self-study	counseling, student's feedback, course end survey • Summative: Class participation, assignment, quiz, class test and midterm and final examinations
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3.5 Basic Science

PHY 101: Physics I (Thermodynamics, Materials, Waves and Oscillations, Optics)

Credit: 3

3 hours/week

BNQF Code: 0533 1101

Rationale of the Course: This course will give an overview and understanding of basic Physics with moderate use of mathematical formalism and a quick introduction to waves and oscillations, thermodynamics, optics and nature of light.

Course Content:

Waves and Oscillations: Simple harmonic motion, combination of simple harmonic oscillation, Lissajous' figures, Damped oscillation.

Heat & Thermodynamics: Equation of state for a perfect gas, Kinetic theory of gases, laws of thermodynamics, Heat engine.

Structure of Matter: Crystalline, Band theory of solid, Defects in solids.

Physical Optics: Theories of light, Interference of light, Diffraction of light and Polarization of light.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1
CLO1	Characterize the concepts of waves and oscillations, thermodynamics' laws, crystal, interference, diffraction and polarization, etc.;	√
CLO2	Explain physical natural phenomena related to waves and oscillations, thermodynamics, interference, diffraction and polarization in a clear manner;	√
CLO3	Solve problems in the areas of waves and oscillations, thermodynamics, interference, diffraction and polarization, etc.	√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the

students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

PHY 103: Physics II (Electricity and Magnetism, Modern Physics and Quantum Mechanics)

Credit: 3

3 hours/week

BNQF Code: 0533 1203

Rationale of the Course: The course gives a quick introduction to modern physics: electric charge and electric field, current, voltage and resistance, magnetic field, electromagnetic waves, atom, nucleus and elementary particles, radioactivity and radiation and quantum mechanics.

Course Content: Electric charge and Coulomb's law, Electric field, concept of electric flux and the Gauss's law- some applications of Gauss's law, Electric potential, relation between electric field and electric potential, capacitance and dielectrics, Laplace's and Poisson's equations, Current, resistivity, the magnetic field, Ampere's law, Biot-Savart law and their applications, Laws of electromagnetic induction- Maxwell's equation.

Galilean relativity and Einstein's special theory of relativity; Lorentz transformation equations, Length contraction, Time dilation and mass-energy relation, Photoelectric effect, Compton effect; De Broglie matter waves and its success in explaining Bohr's theory, Pauli's exclusion principle, Nuclear binding energy, different types of radioactivity, radioactive decay law; Nuclear reactions & Nuclear Reactors.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1
CLO1	Characterize the concepts of electric charge, electric and magnetic fields, current and resistance, etc.	√
CLO2	Explain physical phenomena related to electricity, magnetism, special relativity and quantum physics in a clear manner.	√
CLO3	Solve for problems in the areas of electricity and magnetism, special relativity and quantum physics (developing the knowledge capability dimension).	√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be

used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

PHY 104: Physics Lab

Credit: 1.5

BNQF Code: 0533 1204

3 hours/week

Rationale of the Course: This course will provide *practical knowledge by applying the experimental methods to correlate with the Physics theory* and the ideas of different measuring devices and meters to record the data with precision.

Course Content:

Electricity: Specific resistance of a wire, emf of one cell and compare e.m.f. of two cell, verify the laws of resistance by P. O. Box, Mechanical equivalent of heat ‘J’

Properties of Matter: Moment of Inertia of a Fly-Wheel

Physical Optics: Newton’s ring, Specific rotation of sugar solution, wavelength of various spectral lines

Sound: Frequency of a tuning fork

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	To apply the various procedures and techniques for the experiments, mathematical equations, and graphical analysis to the experimental data to obtain quantitative results;	√					
CLO2	To develop intellectual communication skills through working in groups in performing the laboratory experiments and by interpreting the experimental results;		√				

CLO3	Select and use modern hardware and software tools and devices			√			
CLO4	Assess societal, health, safety, legal, and cultural issues involved with the mini project				√		
CLO5	Realize the impact of societal, environmental, and sustainable development issues for the design solution of the mini-project.					√	
CLO6	Apply professional ethics and responsibilities in the implementation of the mini-project.						√

Teaching Strategies: Lecture, Laboratory hardware and software experiments, Project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Lab Experiment • Tutorial • Group Discussion • Lab Practice	• Mini Project Presentation • Attendance • Continuous Lab Performance • Final lab Test/Exam • Lab Report • Individual/Team Work Rubrics • Presentation, Viva and Lab Report
CLO2		
CLO3		
CLO4		

PHY 201: Electronic Properties of Materials

Credit: 3

BNQF Code: 0533 2105

3 hours/week

Rationale of the Course: The objective of this course is to make the students familiar with the correlation between crystal structure and property of solids, microscopic behavior of electron in terms of quantum theory and mechanism of dielectric, magnetic and superconducting behavior of materials.

Course Content: The concept of solids: Classification of Solids, Some simple crystal structure. Introduction to Quantum Mechanics: Schrodinger's equation, one-dimensional quantum problems, Energy band, density of states.

Modern Theory of solids: Determination of Fermi energy and average energy of electrons in metals and semiconductors.

Dielectric Properties of Materials: Dielectric polarization, Clausius-Mossotti equation, and piezoelectricity.

Magnetic Properties of Materials: Magnetic moment and different types of magnetic materials.

Introduction to Superconductivity.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes(CLO)	CLO Statement	PLO1	PLO2	PLO4
CLO1	Apply basic concepts and theories of crystal structure, quantum mechanics and energy band for electrical and electronic materials	√		
CLO2	Analyze electrical and electronic materials and devices in terms of crystal structure, quantum theory, dielectric, magnetic and superconducting properties		√	
CLO3	Assess electrical and electronic materials for appropriate application in electronic devices			√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

PHY 301: Electromagnetic Fields and Waves

Credit: 3

BNQF Code: 0533 3206

3 hours/week

Rationale of the Course: This course provides the foundations required to understand, develop, and formulate various engineering applications involving electromagnetic theory (i.e. electrostatics, magnetostatics). Besides, this course includes the engineering applications in modern communications using Maxwell's equations, electromagnetic circuit theory and electromagnetic wave propagation in transmission lines.

Course Content:

- Review of Vector Analysis: Vector calculus, Gradient, Divergence, Curl of vector field, Divergence theorem, Stokes's theorem.
- Curvilinear co-ordinates: rectangular, cylindrical and spherical co-ordinates, solutions to static field problems; Graphical field mapping with applications, solution to Laplace's equations.
- Electrostatics: Coulomb's & Gauss's theorem and its application, electrostatic potential, Laplace's and Poisson's equations, method of images, energy of an electrostatic system, conductor and dielectrics. Equation of continuity and Kirchhoff's Current law.
- Magnetostatics: Ampere's Law, Biot-Savart law, vector magnetic potential, energy of magnetostatic system, mechanical forces and torques in electric and magnetic fields,
- Maxwell's equations: continuity of charges, concepts of displacement current. Boundary conditions for time-varying systems. Potentials used with varying charges and currents. Retarded potentials.
- Relation between circuit theory and field theory: Circuit concepts and the derivation from the field equations, High frequency circuit concepts, circuit radiation resistance. Skin effect and circuit impedance, Concept of good and perfect conductors and dielectrics, Current distribution in various types of conductors, depth of penetration, internal impedance, power loss, calculation of inductance and capacitance.
- Propagation and reflection of electromagnetic waves in unbounded media: Plane wave propagation, polarization, power flow and Poynting's theorem.
- Transmission line analogy (microwave): Transmission line parameters, transmission line equations, wave characteristics of finite transmission lines, plane wave propagation through the ionosphere.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Apply the fundamental principles of electromagnetic waves, electrostatics and magnetostatics.	√		
CLO2	Analyze electrical & magnetic properties in Electrostatic and magnetostatic systems		√	
CLO3	Evaluate the engineering applications using Maxwell's equations, electromagnetic circuit theory and electromagnetic wave propagation in transmission lines.		√	

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance
CLO2		• Class Test
CLO3		• Assignment • Mid Exam • Final Exam

3.4 Mathematics

MAT 101: Mathematics I (Differential and Integral Calculus)

Credit: 3

3 hours/week

BNQF Code: 0541 1101

Rationale of the Course: Calculus, defined as the mathematical study of change, was developed independently by Isaac Newton and Gottfried Wilhelm von Leibniz in the 17th century. The course aims to provide an introduction to differential calculus and integral calculus that include the concepts of function, limit, continuity, differentiability, indefinite integration, definite integration etc. These resources cover aspects of differentiation and integration, often used in the field of engineering. This course provides the basic knowledge of calculus to the students.

Course Content:

Function: domain, range, one-one function, onto function, into function, inverse function, Limit, continuity, differentiability.

Differentiation: derivatives by first principle, rules of derivatives, successive differentiations
Theorems: Leibnitz's Theorem, Rolle's Theorem, Mean value theorem, Taylor's Theorem, McLaurin's theorem.

Partial differentiation: Rules of partial derivatives, Tree Diagram

Applications: tangent and normal, optimization

Anti-derivatives and Indefinite integration: Rules of Integration, Integration by Substitutions, Integration by parts, Standard integrals, Integration by Partial Fraction.

Definite integrals: Fundamental theorem of Calculus, Properties and use in summing series.

Applications: Area of surface of revolution and application of integral calculus in real life.

Special functions: Beta function and Gamma function.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2
CLO1	Remembering the basic concepts of calculus.	√	
CLO2	Applying the differentiation to solve real life problems.		√
CLO3	Remembering the integration and its uses.	√	
CLO4	Applying the integration to solve the problems in the engineering fields		√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		
CLO4		

MAT 102: Mathematics II (Ordinary and Partial Differential Equations)

Credit: 3

3 hours/week

BNQF Code: 0541 1202

Rationale of the Course: Differential equations is a branch of mathematics and first came into existence with the invention of calculus by English physicist Isaac Newton (1676) and German mathematician Gottfried Leibniz (1693). It starts with one, or many, recorded observations of change and ends with one, or many, functions that predict future outcomes. An algebraic equation, such as a quadratic equation, is solved with a value or set of values whereas a differential equation, by contrast, is solved with a function or a class of functions. It is considered as a core requirement for a simple reason and a fantastic tool for modeling situations in any field or industry. The goal of differential equations relates one or more functions and their derivatives. In applications, the functions generally represent physical quantities, the

derivatives represent their rates of change, and the differential equation defines a relationship between the two. Electrical and Computer engineers use these for system design. Moreover, differential equations are used in a wide variety of disciplines, from biology, economics, physics, chemistry and engineering. In general, they can use for modeling of the variation of a physical quantity, such as temperature, pressure, displacement, velocity, stress, strain, current, voltage, or concentration of a pollutant, with the change of time or location, exponential growth and decay, the population growth of species or the change in investment return over time etc.

Course Content: *Differential Equations and Their Solutions:* Introduction to differential equations, Classification of Differential equations, Order and degree of a Differential Equation, Formation of ordinary differential equation. *First-Order Equations for which Exact Solutions Are Obtainable:* Ordinary differential equations of first order and first degree, Solutions of ordinary differential equations by the method variable separable, Solutions of homogeneous ordinary differential equations, Exact differential equations and Integrating factor, Solutions of homogeneous ordinary differential equations, Exact differential equations and Integrating factor, Linear differential Equation, Bernoulli Equations and Special Integrating Factor (IF). *Applications of First-Order Equations:* Orthogonal Trajectories. *Explicit Methods of Higher- Order Linear Differential Equations:* Linear differential equation with constant coefficient, Linear differential equation with variable coefficients, Initial value problem, Boundary value problem, Application of second order linear differential equations with constant coefficient, Higher order linear differential equations with constant coefficients, Variation of parameter. *System of Linear Differential Equations:* Methods of Undetermined Coefficients and Variation of Parameters, Reduction of Order, Solution in Series, Simple cases of Non-Linear Differential Equations, System of Linear Ordinary Differential Equations. *Partial Differential Equations:* Basic concept of Partial Differential equations, Linear partial differential equations of order one, Homogenous and non-homogenous partial differential equations with constant coefficients.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2
CLO1	Remembering the principles and concepts of coordinate geometry.	√	
CLO2	Understanding the use of 2D and 3D geometry.	√	
CLO3	Understanding the vectors in $\mathbb{R}^n$ and $\mathbb{C}^n$, system of linear equations and matrix algebra including their various operations.	√	
CLO4	Applying the ideas of system of linear equations, matrix algebra and transformations to solve problems in engineering fields.		√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture	

CLO2	• Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO3		
CLO4		

MAT 103: Mathematics III (Co-ordinate Geometry and Linear Algebra)

Credit: 3

3 hours/week

BNQF Code: 0541 2103

Rationale of the Course: This is a basic course of *B.Sc. in Electrical and Electronic Engineering (EEE)* program that prepares the student with basic knowledge of geometrical shapes of particles and analyzing the co-ordinate systems. Besides, this course also emphasizes on the understanding of Algebra of matrices, System of linear equations, Vector spaces, subspaces, Eigenvalues and eigenvectors, linear transformation (LT), geometry of LT, standard plane LT.

Course Content:

- **Plane Co-ordinate:** Co-ordinates, Polar Co-ordinates, The Straight Lines, Change of Axes, Pair of Straight Line, General equation of Second Degree, Circles, Parabola, Ellipse, Hyperbola.
- **Solid Geometry:** Rectangular Co-ordinates, Plane, Straight Line.
- **Algebra of Matrices:** Matrices, Types of Matrix, Matrix addition and scalar multiplication, Matrix multiplication, Inverse Matrix, **Row** Echelon Form and Canonical form of Matrix, Rank of Matrix.
- **System of Linear Equations:** Homogeneous and Non-homogeneous system, Solutions, Systems in Triangular and Echelon Form, Gaussian Elimination.
- **Vector Spaces:** Vector Spaces, Subspaces, Linear Combinations, Spanning Sets, Linear Dependence and Independence, Basis and Dimension.
- **Linear Mappings:** Mappings, Functions, Linear Transformations, Kernel and Image of a Linear Transformations.
- **Diagonalization:** Eigenvalues and Eigenvectors.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2
CLO1	Understanding the differential equations with their various solution methods.	√	
CLO2	Understanding the o first order, second order and higher order differential equations.	√	

CLO3	Applying ODE to solve engineering problems.		√
CLO4	Understanding PDE and its application in different fields of engineering.	√	

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		
CLO4		

MAT 201: Mathematics IV (Vector Analysis, Complex Variable, Laplace Transformation and Fourier Analysis)

Credit: 3

3 hours/week

BNQF Code: 0541 2204

Rationale of the Course: The course aims to provide an introduction to Vector Analysis, Complex Variable, Fourier Analysis and Laplace Transform that include the concepts of basic and applied knowledge of Engineering Mathematics to the students.

Course Content:

- **Vectors and Scalars:** Vectors, Scalars, Laws of Vector Algebra, Unit Vectors, Rectangular Unit Vectors, Components of Vectors, Vector Fields, Scalar Fields.
- **Vector Product:** Dot or Scalar Products, Cross or Vector Products. Triple Products.
- **Vector Differentiation:** Ordinary Derivatives of Vectors, Differentiation formulae, Partial Derivatives of Vectors, The vector differential operator Del, Gradient, Divergence and Curl.
- **Vector Integration:** Ordinary Integrals of Vectors, Line Integral, Surface Integrals, Volume Integral.
- **Complex Variables:** Complex Number System, Modulus and Argument of Complex Numbers, Graphical Representation of Complex Number, Polar form of Complex Number, De Moivre's Theorem, Euler's Formulae, Variable and Functions, Limits, Continuity, Uniform Continuity.

- **Complex Differentiation:** Derivatives, Analytic Functions, Cauchy Riemann Equations, Harmonic Functions, Geometric Interpretation of the derivatives, Higher Order Derivatives, Singular Points.
- **Complex Integration and Theorem:** Complex Line Integrals, Simply and Multiply Connected regions, Green's Theorem, Cauchy's Theorem, Cauchy-Goursat Theorem, Cauchy's Integral Formulae, Morera's Theorem, Cauchy's Inequality, Liouville's Theorem. Fundamental Theorem of Algebra, Maximum Modulus Theorem and Minimum Modulus Theorem
- **Taylor's and Laurent's Series:** Sequences of Functions, Series of Functions, Taylor's, Theorem, Some Special Series, Laurent's Theorem, Classification of Singularities.
- **The Residue Theorem:** Residues, Calculation of Residues, the Residue Theorem, Evaluation of Definite Integrals.
- **The Laplace Transform:** Definition, Existence, and Basic Properties of Laplace Transform, The Inverse Transform and the convolution, Solution of Linear Differential Equations with Constant Coefficients, Laplace Transform Solution of System of LDE.
- **Fourier Analysis:** Periodic Functions, Fourier Series, Trigonometric Series, Fourier Sine and Cosine Series, Process of Determining Coefficients, Real and Complex form of Fourier series, Finite Transform, Fourier Integral, Fourier transform and their uses in solving boundary Value problems of Wave Equations.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2
CLO1	Remembering the vector calculus.	√	
CLO2	Understanding the complex functions and its applications in practical field.		√
CLO3	Understanding the Fourier analysis and its applications.		√
CLO4	Understanding the Laplace transform including its inverse with applications.		√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		
CLO4		

STA 201: Statistics and Probability Distribution**Credit: 3****BNQF Code: 0542 2205****3 hours/week**

Rationale of the Course: Statistics and probability deals with uncertainty, measuring and quantifying uncertainty and making decisions under uncertainty. The course aims to provide an introduction to statistics, how to analyze data, use of probability models in the face of uncertainty in real life situations. This course also provides basic knowledge of stochastic model building and drawing inference about population based on sample data. This course is a pre-requisite to Digital communication and Signal processing, Reliability Engineering, Stochastic process and Statistical Quality Control (SQC) as well in Data Science.

Course Content: Statistics: Definition, data, population and sample, descriptive and inferential statistics, role of statistics and probability in engineering field, collecting engineering data. Descriptive statistics: Measures of location-mean, median, mode, percentiles, quartiles, five number summaries, Measures of variation-range, inter-quartile-range (IQR), variance and standard deviation, coefficient of variation, graphical presentation of data-frequency histogram, Box-and-Whisker plot, outlier detection, stem-and-leaf plot, scatter plot. Probability: Basic concept of probability, Baye's theorem, application probability in reliability of series and parallel system. Random variable: Concept of random variable, discrete versus continuous probability distribution, probability mass function and probability density function, cumulative distribution function, mathematical expectation of random variable. Probability distribution: Bernoulli and binomial distribution, Geometric and Negative binomial distribution, Poisson distribution, Uniform (continuous), exponential, gamma and log-normal distribution, Normal (Gaussian) distribution, Central limit theorem, applications. Inferential statistics: Sampling and sampling distribution-Sampling distribution of sample mean, sample proportion, Central limit theorem (revisit), Interval estimation and sample size determination, Tolerance limit, t , χ^2 and F -distributions with their uses, hypothesis test. Correlation and regression analysis: Concept and definition, correlation coefficient, simple linear regression Stochastic process: Introduction of stochastic process and Markov chain (MC), Transition Matrices of MC, h-step transition probability, Long-term behavior of MC, Continuous time MC and simple birth-death process, M/M/1 Queue.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2
CLO1	Explain descriptive statistics and probabilistic models to analyse data in engineering process.	√	
CLO2	Analyse cause and effect phenomena, estimate and infer population parameter.		√
CLO3	Apply stochastic model and queuing systems in real world situation.		√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases, multimedia projector will be used for the convenience of the students. A statistical package **R** or **Python** will be used to clarify theory with simulated data. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		

MAT 302: Numerical Methods for Electrical Engineering Lab

Credit: 1.5

3 hours/week

BNQF Code: 0541 3106

Course Content:

- Important functions, commands, operators and different programming logics in MATLAB.
- Solution of linear equation, nonlinear equation, ordinary differential equation, numerical integration, numerical differentiation and curve fitting using MATLAB.
- Design and simulate various electrical and electronic circuits using Simulink.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2
CLO1	Explain the basic concepts of different numerical analysis methods.	√	
CLO2	Identify and solve the linear, nonlinear and ordinary differential equations related to electrical and electronic engineering problems.		√
CLO3	Apply numerical differentiation, integration and curve fitting methods for the solution of different electrical and electronic engineering problems.		√

Teaching Strategies: Lecture, AutoCAD Drafting, Project development.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Lab Experiment	• Mini Project Presentation • Attendance
CLO2		

CLO3	• Tutorial • Group Discussion • Lab Practice	• Continuous Lab Performance • Final lab Test/Exam • Lab Report
CLO4		
CLO5		
CLO6		

3.6 Inter-Disciplinary Engineering Courses

MT 201: Mechatronic Circuits and Systems

Credit: 2

BNQF Code: 0715 2101

3 hours/week

Rationale of the Course: This is an interdisciplinary course of B.Sc. in EEE program that prepares the student with basic knowledge of mechatronic engineering. Theory, laws, formula, and mathematical problem-solving techniques related to mechatronic system, sensors, transducers etc. are the main topics to be studied. The students will also gain basic knowledge about modelling of different mechanical, electrical, fluid and thermals systems along with actuation systems, which are widely used in different industries.

Course Content: Introduction: Definitions of Mechatronics, Overview of different Mechatronic systems, Scope and applications of Mechatronics. Sensors and transducers: Basic principles of potentiometer, op-amps, Wheatstone bridge, introduction to sensors and transducers, sensor terminologies, sensor characteristics, classification of sensors, Proximity sensors. System Modelling and Control: Introduction to signals and systems, Modelling of Mechanical, Electrical, Fluid and Thermal systems, Linearization of nonlinear systems, Rotational-translational systems, Electro-Mechanical systems and Hydraulic-Mechanical System. Basic components of Control system, Types of control system, System representation, System responses, Time constant, Measurement of system performance, Transfer function, Block diagram and Illustrative examples.

Actuation systems: Linear and rotary actuators. Fluid power actuators and Smart actuators. Recent trends in Mechatronic systems.

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Explain the basic concepts regarding mechatronic systems and different type of sensors, transducers.	√		

CLO2	Discuss the modelling and control of different electrical, mechanical and thermal systems			√
CLO3	Discuss the basic concepts of various actuation systems as well as recent trends of mechatronic systems.		√	

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases white board multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies and problems solving.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test
CLO2		• Assignment
CLO3		• Mid Exam • Final Exam

CE 302: Engineering Service Design

Credit: 2

BNQF Code: 0788 3102

3 hours/week

Rationale of the Course: Engineering drawing is the language of engineering. To communicate design ideas and construct any structure or machine correctly and methodically, the knowledge of technical drawing for an electrical engineer is indispensable. The scope of the course involves introduction to basics of technical drawing skills for drawing basic geometric shapes and graphical projection techniques as well as advanced engineering design project.

Course Content: This course will mainly focus on free hand sketching, lettering and dimensioning; plane geometry, projections of solid objects-orthographic, auxiliary, sectional and isometric drawing. In addition to that plan, elevation and section of engineering structures; pattern of laying reinforcement in structural members; plumbing and electrification details will also be discussed in this course. Finally, the course will end with an introduction to Computer Aided Design (CAD).

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO5	PLO10
CLO1	Comprehend engineering drawings of different objects and structures.	√			

CLO2	Interpret physical objects and structures using projection drawings		√		
CLO3	Create CAD models (parts, drawings, assemblies)			√	
CLO4	Communicate and share ideas, data, information etc. with others				√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. For some cases white board multimedia projector will be used for the convenience of the students. Students must participate in classroom discussions for case studies and problems solving.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • Audio-Visual • Home Assignment • Class Exercise • Group Discussion	• Attendance & class performance • Class Test • Assignment • Mid Exam • Final Exam
CLO2		
CLO3		
CLO4		

CSE 201: Structured Programming Language

Credit: 3

BNQF Code: 0613 2101

3 hours/week

Rationale of the Course: This course introduces the fundamental concepts of structured programming language. In this course, students will be able to develop logics which will help them to create programs and applications using C programming language. It emphasizes that the students learn to determine suitable logic for solving programming related problems using C language and start preparing themselves for the competitive programming world.

Course Content: Fundamentals of C, Basic syntax of C, Operator and expression, Control Statements: Conditional statement and Loop, Function: Built-in function, user defined function and recursive function, Arrays: One-dimensional array, Multidimensional Arrays and array with function, String: String manipulation, Pointers: Fundamentals, Pointers and One-Dimensional Arrays, Pointers and strings, Dynamic Memory

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO3
CLO1	Understand the basic programming concepts and terms related to structured programming languages.	√		

CLO2	Explain different conceptual programming problems such as flow control, function and array etc.	√		
CLO3	Analyze different problem scenarios to solve them.		√	
CLO4	Apply different programming syntax and structure to solve different types of basic problems.			√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used most of the time. Multimedia projector and a PC will be used for the convenience of the students to understand codes practically. Students must participate in classroom discussions for case studies, problems solving and project developments.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	- Class Lecture - PPP & WBT* - Class Discussion - Class Exercise - Self-study	- Formative: In class discussion, clicker question, course counseling, student's feedback, course end survey - Summative: Class participation, assignment, quiz, class test and midterm and final examinations
CLO2		
CLO3		
CLO4		

CSE 202: Structured Programming Language Lab

Credit: 3

BNQF Code: 0613 2102

3 hours/week

Rationale of the Course: This sessional (lab) course is based on the theory course CSE 201: Structured Programming Language. This course provides students with basic programming and how to apply them combined with various problem solving techniques to solve problems of different levels and categories. With a brief introduction to competitive programming, this course also aims to introduce solving problems with various constraints i.e. time, space, etc.

Course Content: Fundamentals of C, Basic syntax of C, Operator and expression, Control Statements: Conditional statement and Loop, Function: Built-in function, user defined function and recursive function, Arrays: One-dimensional array, Multidimensional Arrays and array with function, String: String manipulation, Pointers: Fundamentals, Pointers and One-Dimensional Arrays, Pointers and strings, Dynamic Memory

Mapping Course Learning Outcomes (CLOs) with the PLOs:

Course Learning Outcomes (CLO)	CLO Statement	PLO1	PLO2	PLO4
CLO1	Demonstrate basic structure of C programming, declaration and logic development.	√		
CLO2	Implement basic programming knowledge to solve various topics related problems such as condition, loop, function, array, string, file handling, structure, and union etc. efficiently.		√	
CLO3	Apply programming techniques for solving scenario based online judge's problems (ACM problems).			√

Teaching Strategies: Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. Multimedia projector and a PC will be used for the convenience of the students to understand codes, programming language practically. Students must participate in classroom discussions for case studies, problems solving and solve ACM problems.

Mapping Course Learning Outcomes (CLOs) with the Teaching Learning & Assessment Strategy:

CLOs	Teaching Learning Strategy	Assessment Strategy
CLO1	• Class Lecture • PPP & WBT* • Class Discussion • Class Exercise • Self-study	• Formative: In class discussion, clicker question, course counseling, student's feedback, course end survey • Summative: Class participation, assignment, quiz, class test and midterm and final examinations
CLO2		
CLO3		

Chapter 4: Grading & Evaluation

4.1 Grading Scale

The Evaluation of each course is made on 100 marks and the distribution of weightage is given below:

I.	Attendance	5%
II.	Quizzes	5%
III.	Class Tests & Tutorial	10%
IV.	Assignment/Presentation/Lab/ Project	10%
V.	Mid-Term Exam (Middle of the Semester)	30%
VI.	Final Exam (End of the Semester)	40%
	Total:	100%

4.2 Grades

Numerical Grade	Letter Grade		Grade Point
80% and above	A+	(A Plus)	4.00
75% to less than 80%	A	(A regular)	3.75
70% to less than 75%	A-	(A Minus)	3.50
65% to less than 70%	B+	(B Plus)	3.25
60% to less than 65%	B	(B regular)	3.00
55% to less than 60%	B-	(B Minus)	2.75
50% to less than 55%	C+	(C Plus)	2.50
45% to less than 50%	C	(C regular)	2.25
40% to less than 45%	D		2.00
Less than 40%	F		0.00

In the Transcript/Grade Sheet, the Letter Grade and the Corresponding Grade Points against every course will be shown and finally, the CGPA but not the numerical marks, will be shown.

4.3 Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA)

Every course has a certain number of credit hours which indicate its weightage. The credit hours of a theoretical course and the credit hours of a practical/ sessional course refer to contact hours per week and half of the contact hours per week of the courses respectively. The number of credit hours a student has completed satisfactorily and the weighted average of the grade points he/she has maintained evaluate the performance of the student. Calculation of Grade Point Average (GPA) can be explained as follows:

$$\text{Grade Point Average (GPA)} = \frac{\sum G \times C}{\sum C}; G = \text{Grade Point}, C = \text{Credit Hour}$$
$$= \frac{\text{Summation (Total) of (Grade points earned in a course} \times \text{Credit hours in that course)}}{\text{Total Number of credit hours completed}}$$

Suppose, a student has completed five courses in a semester and obtained the following grades:

Course	Grade earned	Grade Point (G)	Credit hour (C)	G x C
Course 1	A+	4	3	12
Course 2	B	3	3	9
Course 3	A	3.75	3	11.25
Course 4	B+	3.25	2	6.50
Course 5	A-	3.50	1	3.50
		Total =	12	42.25

$$\text{GPA} = \frac{\sum G \times C}{\sum C} = \frac{42.25}{12} = 3.52$$

4.4 Course Withdrawal

A student may withdraw from a course within 15 days from the date of starting the semester. Permission from the appropriate authority must be obtained for withdrawal.

4.5 Incomplete Courses

For incomplete course work, a student may be assigned an incomplete grade, which will be recorded as "I". A student is allowed to complete an incomplete course in the following semester. If a student fails to complete the course work, he will automatically earn an "F" or the alternative grade (if submitted by the faculty).

4.6 Retake

Students scoring 'F' grade in any course shall have to pay full tuition fees for repeating the course. Students with grade lower than "A" in any course may retake the course to improve their grades and shall have to pay half of the tuition fees for the course/courses.

4.7 Grade Improvement

If a student obtains a grade lower than A in a course, s/he will be allowed to repeat the course for the purpose of grade improvement subject to the availability of that course. The courses cannot be retaken as self-study. The course repeated / retaken must carry the same course code, course title, and course contents or its equivalent. The student retaking the course must attend the classes, take all the exams and do other tasks for the course like other regular students. Under all circumstances, the higher grade will be taken into account in calculating the final CGPA. A student taking the advantage of retake policy will not be eligible for receiving Gold Medal or any Award.

4.8 Dropout

- i) A student can drop his / her semester, subject to the permission of the Chairperson of the department.
- ii) If a student is willing to withdraw from all course / semester, s/he must follow the official semester drop process of the university. As per the academic calendar, the student must write an application in prescribed form to the Chairperson and his / her application will be forwarded to Registrar's office to complete the formalities.
- iii) A student, who leaves the University without officially withdrawing a semester in the manner mentioned above, will get a failed grade (F) in each course registered in that semester.