

**HITEC UNIVERSITY, TAXILA**



# **SELF ASSESSMENT REPORT**

**BS Electrical Engineering**

**Faculty of Engineering and Technology**

**HITEC UNIVERSITY, TAXILA, PAKISTAN**

**MAY 2023**

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## **1.0 Executive Summary**

This self-assessment report is being prepared for BS Electrical Engineering from the Department of Electrical Engineering as prescribed by Higher Education Commission. Quality Enhancement Cell was formed in HITEC University in 2011. Program Team and Assessment Team of electrical engineering department were formulated by university to collaborate with QEC to accomplish the following report in line with HEC guidelines with the support of Vice Chancellor and Department Heads.

This self-assessment report provides an analysis and evaluation of the academic standards followed and implemented by BS Electrical Engineering Program. HEC prescribed Self-Assessment Manual is used as a reference and the program is being evaluated based on 8 criteria and 31 standards of quality improvement. First the Program teams of Electrical Department made the report and then it was further assessed by the assessment team. The report finds the prospects of maintaining and continually enhancing academic standards and student's learning.

This report also investigates the strong and weak areas and other improvements needed by the department. Feedback is then provided in the form of corrective actions and implementation plan for quality assurance and improvement of academic programs in the future.

### **Objectives**

- a** To initiate the quality improvement process through self-assessment as outlined by Higher Education Commission of Pakistan in order to improve the quality in higher education.
- b** To implement Self-Assessment Manual in BS Electrical Engineering program with a view to improve program quality.
- c** To identify the areas requiring improvements and prepare the remedial actions in the form of an implementation plan.

## **Execution**

The hierarchy of the execution tree was fundamental to the efficient working of all the stakeholders. Formulation of PT and AT was the very first step towards the goal.

The Self-Assessment Manual was distributed to all the faculty members for awareness and especially to the Program and Assessment Teams for SAR. Lectures and workshops were arranged for senior faculty members along with the Registrar, Treasurer, Controller of Examination, Deans and Vice-Chancellor, where qualified professionals of their respective fields taught the role of Quality and Accountability in education and especially in Higher Education.

The senior faculty members then became mentors for the junior faculty members and the knowledge of the subject spread to each and every faculty member along with supporting individuals/groups, until all were on the same page.

Following the lecturing and mentoring, a task distribution seminar was arranged by the chair of the Program Team. In this seminar, 8 criteria with 31 standards in total were distributed as tasks to various faculty members. An internal deadline of one month was given to all the task holders.

All task holders were instructed on the procedure of procurement of information for the completion of tasks. The information from various concerned departments of the university was to be obtained in written form along with initials of the information provider.

Once the criteria were ready, the task holder sent the soft copy for review and proof reading, to the chair of the Program Team. The chair reviewed and proofread in company with the Quality Representative of the respective Department. Once all the corrections and revisions were done in line with the Self-Assessment Manual, the task holders sent a signed hard copy and a soft copy to the chair of the Program Team who then incorporated the



finished criteria into a single report and the report was given the shape of a draft.

This draft was then sent as a soft copy to the Quality Enhancement Cell, Chairman Electrical Engineering Department, Dean and Vice-Chancellor who gave their valuable inputs. Once the draft was finalized, QEC arranged for the Self-Assessment Report of the BS Electrical Engineering Program to be assessed by the Assessment Team in the third week of June 2023.

The findings of the Assessment Team are given in the annexure-G. It outlines the improvements required in the infrastructure, syllabi and training of the faculty and supporting staff. The implementation plan (annexure G) was prepared after discussion with all the stakeholders, and it indicates the resources required to improve the quality.

# Self-Assessment Report

## 2.0 Introduction

Heavy Industries Taxila Education City (HITEC) University is a private sector university. It was established in 2007 and chartered in 2009 by the Government of Punjab. The University is sponsored by Heavy Industries Taxila Education Welfare Trust (HITEWT). The university was established with a vision to produce skilled, moral, ethical and patriotic professionals who can serve the society and who will be the guardians of national, social and religious values.

### University Mission Statement

HITEC University will be a center of excellence in teaching, learning and research. We shall instill and inspire intellectual curiosity, lifelong quest of knowledge and a keen urge for social and moral responsibility. The University will establish strong linkages with industry ensuring innovative research leading to economic prosperity of Pakistan.

### Department of Electrical Engineering

Department of Electrical Engineering is currently running following intakes of the BS Electrical Engineering Program.

- |    |                           |              |
|----|---------------------------|--------------|
| a. | BS Electrical Engineering | Session 2019 |
| b. | BS Electrical Engineering | Session 2020 |
| c. | BS Electrical Engineering | Session 2021 |
| d. | BS Electrical Engineering | Session 2022 |

In addition to above program, department also offers MS and PhD programs in Electrical Engineering.

### Program Selected

HITEC University has selected the **BS Electrical Engineering Program** as first model program for Self-Assessment Report (SAR) under the directives of Higher Education Commission (HEC). The selected program has been accredited by Pakistan Engineering Council (PEC).

## **Program Evaluation**

The program is evaluated based on 8 criteria and 31 standards as given in the Self-Assessment Manual provided by HEC.

### **3.0 Criterion 1: Program Mission, Objectives and Outcomes**

#### **Standard 1-1**

**The program must have documented measurable objectives that support institution mission statements.**

#### **Program Mission Statement**

Electrical Engineering program aims to provide quality education at undergraduate level, thereby producing proficient engineers and scientists to cater for societal needs in the country and abroad.

#### **Program Objectives**

The program is designed to achieve the following objectives:

1. To prepare the students to pursue higher education in universities of repute.
2. To enable the students to pursue career in the field of Electrical Engineering.
3. To impart technical skills (designing, solution definition, implementation) to the students.
4. To prepare the students to step into research and development activities in the related fields.
5. To enable students to work within the domain of ethical values for the betterment of the society at large.
6. To develop the skills of self-management, better presentation and effective communication in the students.

#### **Alignment of Program Objectives with Mission Statements**

Program objectives intend to impart not only technical information to students but moral and ethical values as well. HITEC University provides a platform to students to acquire knowledge of pertinent fields and get hands on experience by extensive laboratory work.

## **Main Elements of Strategic Plan**

### **Curriculum Design**

Curriculum of BS Electrical Engineering comprises of 42 courses including core and electives. The curriculum is designed to build the basic concepts of the students. The goal is to help students in attaining deep insight of the relevant fields using different courses and practical work.

Core subjects include computer fundamentals, network analysis, linear circuit analysis, electrical machines, digital logic design, communication systems, engineering management, communication skills, power generation, power system analysis, power system operation & control and electronic circuits to name a few. Elective courses can be selected from a wide range of available courses. See criterion 2, for detailed description of curriculum.

### **Practical Work**

Students are required to go through extensive practical work in laboratories to implement the knowledge gained in theory class. Use of state of the art equipment helps students in grasping the concepts and observes the outcome of their experiments. The practical work in laboratories is segmented as follows:

- a. Electronics and Digital Laboratory Work
- b. Electrical Machines and Power Generation Laboratory Work
- c. Power Protection and Power Transmission & Distribution Laboratory Work
- d. High Voltage Laboratory Work
- e. Engineering Workshop Laboratory Work
- f. Computer Laboratory Work

### **Projects**

During the program execution, every student is required to participate in multiple subject related projects during each semester. Every graduating student has to present final year project before evaluation committee. That is student's last year's work, based on design, analysis and implementation of a solution pertaining to engineering problems.

## Internships/Industrial Experience

University arranges the internships for students at different stages during the execution of the program. The university keeps in touch with the potential industrial units for student's internship possibilities through a very well-defined system. Office of Director Student Affairs approaches industries of repute every year and requests them to create internships vacancies for students of HITEC University. Students are informed to choose internships according to their major and location of the industry. Heavy Industries Taxila (HIT) gave approval for internships for up to 120 students of HITEC University.

## Program Objectives Assessment

Objective	How Measured	When measured	Improvement Identified	Improvement Made
1	Alumni Survey	October 2022	Need to include a case study related to objective 1	Under Review
2	Alumni Survey	October 2022	Lack of career counseling	Career counseling center has been developed within electrical engineering department, comprising of senior faculty with exposure of higher education from abroad or industry.
3	Alumni Survey	October 2022	Emphasis on laboratory work/ Link theory to practice	We are in process of reviewing existing lab manuals to make those compatible with theoretical knowledge. Also, collaboration between instructor and lab engineer is encouraged.
4	Alumni Survey	October 2022	Need to have more advanced courses near final year	PhD qualified faculty being preferred to impart advanced knowledge in final year of study.
5	Alumni Survey	October 2022	Need to impart more mentoring	Class Advisors are assigned to each session
6	Alumni Survey	October 2022	Focus on communication skills required	Bi-semester seminars are to be organized comprising of leadership talks as well a forum for students to present their ideas, projects or research findings.

**Table 1: Program Objectives Assessment**

Alumni Surveys were conducted to get their feedback. See Annexure A for cumulative results of Alumni Survey. Employer surveys were conducted to get their feedback. See Annexure A for cumulative results of Employer Survey.

## Standard 1-2

The program must have documented outcomes for graduating students. It must be demonstrated that the outcomes support the program objectives and that graduating students are capable of performing these outcomes.

### 3.2.1 Program Outcomes

1. Students shall be able to go for higher education (MSc, MS, Ph. D) in Electrical Engineering field.
2. Students shall be able to use software related to Electrical Engineering.
3. Students shall have interpersonal skills.
4. Students shall be able to perform technical and non-technical jobs in electrical engineering field.
5. Students shall be able to perform analysis of the systems.
6. Students shall be able to design, develop and implement the solutions.
7. Students shall be able to run existing communication systems.
8. Students shall be able to perform research in related fields.
9. Students shall be able to execute tasks in positive and constructive manner.

Program Objectives	Program Outcomes								
	1	2	3	4	5	6	7	8	9
1	x								
2		x	x		x				
3		x		x			x		
4					x	x	x	X	
5									x
6			x				x		

**Table: Outcomes versus Objectives**

### 3.2.2 Standard 1-3

The results of Program assessment and the extent to which they are used to improve the program must be documented.

The program assessment has been done by launching HEC Performa number 1 and 10. The students of the program evaluated the courses and teachers in the program.

#### Course Evaluation

Courses evaluation is shown in the following graphical chart:

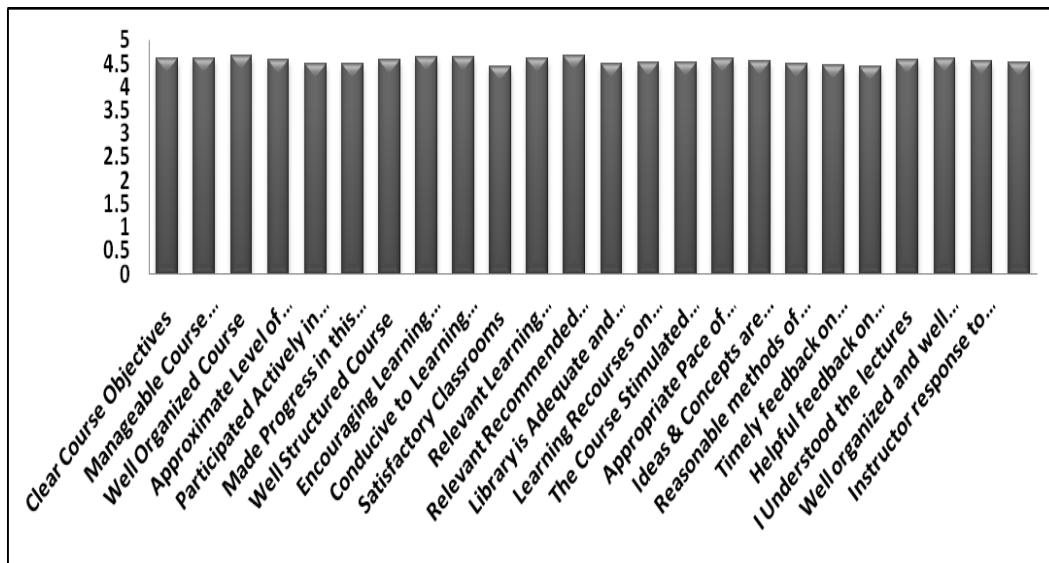


Figure 1: Course Evaluation Bar Chart

Through this evaluation, students have graded the courses against the structure, method of teaching, learning outcomes, objectives, and practical implementation of theory. The total graded marks are 5.

See Annexure B (Course Evaluation Survey) for sample course evaluation results. The sample shows the results for one course only while the same has been done for all courses listed below. The results of all other courses have been kept in a separate file for record purposes. Following is the list of courses that are being evaluated by the students along with their course code and graded scores.



<b>S. No.</b>	<b>Subject</b>	<b>Evaluation</b>
1	English	4.76
2	Network Analysis	4.75
3	Electrical Machines-I	4.71
4	Network Analysis Lab	4.70
5	Electronic Devices & Circuits Lab	4.69
6	Electrical Machines-I Lab	4.68
7	Analog & Digital Systems	4.67
8	Power Generation	4.61
9	Analog & Digital Sys. Lab	4.60
10	Electronic Devices & Circuits	4.58
11	Analog & Digital Systems	4.58
12	Communication Systems Lab	4.56
13	Communication Skills (CS)	4.53
14	Computer Communication Network Lab	4.52
15	Microprocessor & Interfacing Techniques Lab	4.51
16	Computer Communication Network	4.49
17	Health Safety and Environment	4.48
18	High Voltage Engineering	4.48
19	Fundamentals of Electrical Engineering Lab	4.46
20	Analog & Digital Sys. Lab	4.46
21	Analog & Digital Systems	4.45
22	Professional Values & Ethics	4.44
23	Management and Entrepreneurship	4.43

24	High Voltage Engineering Lab	4.43
25	Power Generation Lab	4.42
26	Technical Report Writing	4.41
27	Communication Systems Lab	4.41
28	Analog & Digital Systems Lab	4.41
29	Microprocessor & Interfacing Techniques	4.37
30	Numerical Methods Lab	4.37
31	Electronic Systems Design Lab	4.37
32	Power Electronics Lab	4.36
33	Communication Skills	4.34
34	Fundamentals of Electrical Engineering	4.32
35	Electronic Systems Design	4.28
36	Electronic Systems Design Lab	4.26
37	Telecom Transmission and Switching Systems	4.24
38	Power Systems Operations and Control	4.19
39	Fundamentals of Electrical Engineering Lab	4.18
40	Electrical Machines-I Lab	4.07
41	Electronics Devices and Circuits Lab	4.04
42	Electronics Devices and Circuits	4.03
43	Analog & Digital Systems	4.01
44	Wireless & Mobile Communications Lab	3.98
45	Wireless & Mobile Communications	3.93
46	Communication Systems	3.90
47	Power Electronics	3.80

## Teachers Evaluation

Teacher's evaluation for semester Spring 2022 and fall 2022 are shown in the following graphical charts:

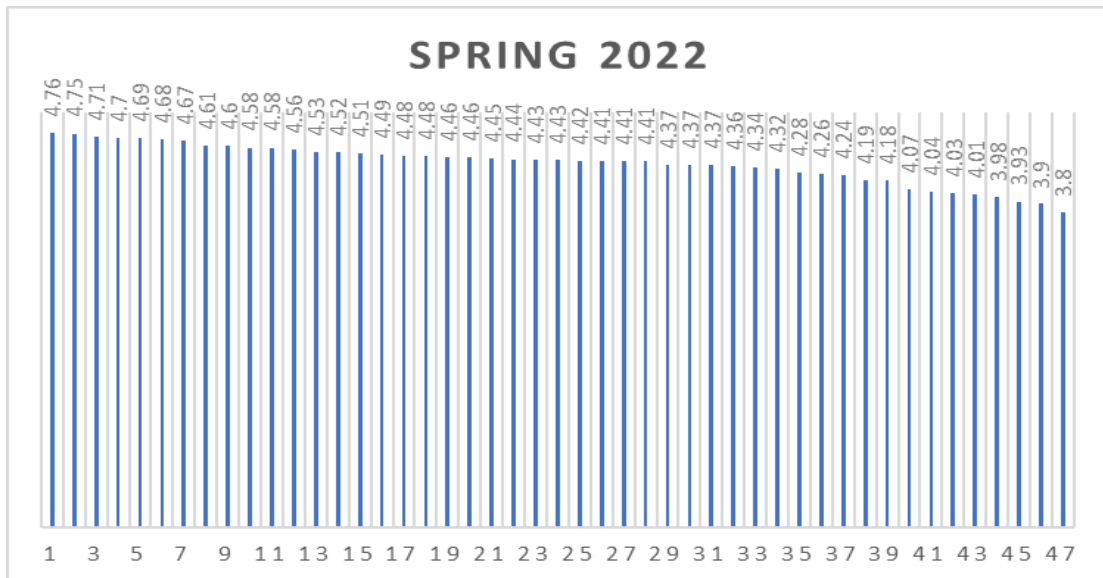


Figure 2a: Teachers Evaluation Graph

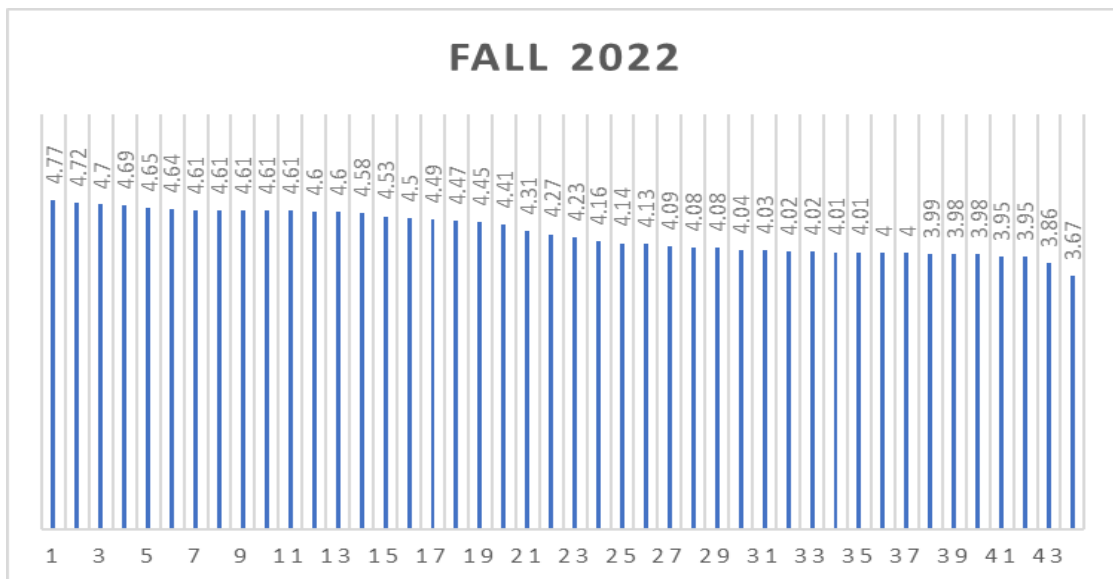


Figure 2b: Teachers Evaluation Graph

Through this evaluation, students have graded the teachers against lecture preparation, punctuality, general behavior, subject knowledge, and teaching method. The total graded marks are 5. See Annexure C (Teachers Evaluation Survey) for sample teacher evaluation results. The sample shows the results for one teacher only while same has been

done for all teachers listed below. The results of all other teachers have been kept in a separate file for record purposes.

Following is the list of teachers that are being evaluated (in spring 2022) by the students along with the serial number and graded scores.

<b>S. No.</b>	<b>Name</b>	<b>Subject</b>	<b>Evaluation</b>
1	Teacher 1	English	4.76
2	Teacher 2	Network Analysis	4.75
3	Teacher 3	Electrical Machines-I	4.71
4	Teacher 4	Network Analysis Lab	4.70
5	Teacher 5	Electronic Devices & Circuits Lab	4.69
6	Teacher 6	Electrical Machines-I Lab	4.68
7	Teacher 7	Analog & Digital Systems	4.67
8	Teacher 8	Power Generation	4.61
9	Teacher 9	Analog & Digital Sys. Lab	4.60
10	Teacher 10	Electronic Devices & Circuits	4.58
11	Teacher 11	Analog & Digital Systems	4.58
12	Teacher 12	Communication Systems Lab	4.56
13	Teacher 13	Communication Skills (CS)	4.53
14	Teacher 14	Computer Communication Network Lab	4.52
15	Teacher 15	Microprocessor & Interfacing Techniques Lab	4.51
16	Teacher 16	Computer Communication Network	4.49
17	Teacher 17	Health Safety and Environment	4.48
18	Teacher 18	High Voltage Engineering	4.48
19	Teacher 19	Fundamentals of Electrical Engineering Lab	4.46
20	Teacher 20	Analog & Digital Sys. Lab	4.46

21	Teacher 21	Analog & Digital Systems	4.45
22	Teacher 22	Professional Values & Ethics	4.44
23	Teacher 23	Management and Entrepreneurship	4.43
24	Teacher 24	High Voltage Engineering Lab	4.43
25	Teacher 25	Power Generation Lab	4.42
26	Teacher 26	Technical Report Writing	4.41
27	Teacher 27	Communication Systems Lab	4.41
28	Teacher 28	Analog & Digital Systems Lab	4.41
29	Teacher 29	Microprocessor & Interfacing Techniques	4.37
30	Teacher 30	Numerical Methods Lab	4.37
31	Teacher 31	Electronic Systems Design Lab	4.37
32	Teacher 32	Power Electronics Lab	4.36
33	Teacher 33	Communication Skills	4.34
34	Teacher 34	Fundamentals of Electrical Engineering	4.32
35	Teacher 35	Electronic Systems Design	4.28
36	Teacher 36	Electronic Systems Design Lab	4.26
37	Teacher 37	Telecom Transmission and Switching Systems	4.24
38	Teacher 38	Power Systems Operations and Control	4.19
39	Teacher 39	Fundamentals of Electrical Engineering Lab	4.18
40	Teacher 40	Electrical Machines-I Lab	4.07
41	Teacher 41	Electronics Devices and Circuits Lab	4.04
42	Teacher 42	Electronics Devices and Circuits	4.03
43	Teacher 43	Analog & Digital Systems	4.01
44	Teacher 44	Wireless & Mobile Communications Lab	3.98
45	Teacher 45	Wireless & Mobile Communications	3.93

46	Teacher 46	Communication Systems	3.90
47	Teacher 47	Power Electronics	3.80

Following is the list of teachers that are being evaluated (in fall 2022) by the students along with the serial number and graded scores.

<b>S. No.</b>	<b>Name</b>	<b>Subject</b>	<b>Evaluation</b>
1	Teacher 1	Applied Physics	4.77
2	Teacher 2	Wave Propagation and Antennas Lab	4.72
3	Teacher 3	Wave Propagation and Antennas	4.70
4	Teacher 4	Applied Physics Lab	4.69
5	Teacher 5	Economics	4.65
6	Teacher 6	Power System Analysis Lab	4.64
7	Teacher 7	English	4.61
8	Teacher 8	Applied Physics	4.61
9	Teacher 9	Power System Analysis	4.61
10	Teacher 10	Power Transmission and Distribution Lab	4.61
11	Teacher 11	English	4.61
12	Teacher 12	Power Transmission and Distribution	4.60
13	Teacher 13	Basic Electro-Mechanical Lab	4.60
14	Teacher 14	Basic Electro-Mechanical Engineering	4.58
15	Teacher 15	Linear Circuit Analysis	4.53
16	Teacher 16	Oral Communication	4.50
17	Teacher 17	Renewable Energy Resources	4.49
18	Teacher 18	Renewable Energy Resources	4.47
19	Teacher 19	English	4.45

20	Teacher 20	English	4.41
21	Teacher 21	Linear Circuit Analysis Lab	4.31
22	Teacher 22	Digital Signal Processing Lab	4.27
23	Teacher 23	Computing Fundamentals	4.23
24	Teacher 24	Linear Control Systems Lab	4.16
25	Teacher 25	Electrical Machine-II Lab	4.14
26	Teacher 26	Signals and Systems	4.13
27	Teacher 27	Applied Physics Lab	4.09
28	Teacher 28	Linear Control Systems	4.08
29	Teacher 29	Electromagnetic Theory	4.08
30	Teacher 30	Workshop Practice	4.04
31	Teacher 31	Instrumentation & Measurement Lab	4.03
32	Teacher 32	Digital Logic Design	4.02
33	Teacher 33	Communication Skills	4.02
34	Teacher 34	Data Structure & Algorithms Lab	4.01
35	Teacher 35	Industrial Electronics Lab	4.01
36	Teacher 36	Communication Skills	4.00
37	Teacher 37	Digital Logic Design Lab	4.00
38	Teacher 38	Electrical Machine-II	3.99
39	Teacher 39	Probability and Statistics	3.98
40	Teacher 40	Instrumentation & Measurement	3.98
41	Teacher 41	Computing Fundamentals Lab	3.95
42	Teacher 42	Data Structure & Algorithms	3.95
43	Teacher 43	Industrial Electronics	3.86
44	Teacher 44	Digital Signal Processing	3.67

Note: The detailed list of evaluation is with Quality Enhancement Cell and can be provided on request.

The Dean and the Chairman of Program discussed the teacher evaluation results and decided to carry out counseling of teachers who are below par. It was also decided to conduct training sessions for teachers who are not performing at expected level.

The strengths and weaknesses of the program are:

### **Strengths**

- a. Coherent, on time and uninterrupted semester system
- b. Efficient and capable senior faculty
- c. Market oriented course contents

### **Weaknesses**

- a. Low percentage of design contents in syllabi
- b. Low number of case studies
- c. Training of junior faculty members

Significant future development plans for the program include improvement in sound systems and up gradation of lab equipment. On the academic side, the future development plans for the programs include training programs for junior faculty members to enhance their teaching capabilities and revision of course syllabi. In addition to this, overall enhancement of knowledge and skills of all faculty members in relation to the latest global advancements in electrical engineering through short trainings and collaborative research projects within and outside Pakistan are also under consideration.



## Standard 1-4

The department must assess its overall performance periodically using quantifiable measures.

### 3.1.1 Graduates/Undergraduates enrolled in last three years

A total of 116 students enrolled during the last three years. The yearly breakdown is as follows:

- Year 2020            67
- Year 2021            25
- Year 2022            24

Students, who enrolled during the last three years, have not yet graduated.

However, data of students who enrolled in years 2016, 2017 and 2018 and graduated in years 2020, 2021 and 2022 is as under:

Year	Enrolled	Year Passed	Graduated	% Honors
2016	160	2020	153	
2017	160	2021	152	
2018	160	2022	142	

### 3.1.2 Student Faculty Ratio:

19.62-1

### 3.1.3 Average GPA per semester:

Average GPA per semester for the batch enrolled in year 2019 is as under:

Semester 1	2.50
Semester 2	2.43
Semester 3	2.40
Semester 4	2.85
Semester 5	2.62
Semester 6	2.71
Semester 7	2.78

Currently session 2019 is in semester 8.

### **3.1.4 Average Completion time**

Average completion time for undergraduate program is 4 years. The attrition rate is 7.0 % for the period 2020-22.

### **3.1.5 Employer Satisfaction**

Employer surveys were conducted to get their feedback. See Annexure A for cumulative results of Employer Survey.

### **3.1.6 Students Course Evaluation Rate**

Average student evaluation for all courses is 4.01 out of 5.

### **3.1.7 Students Faculty Evaluation**

Students were asked to evaluate their faculty. The feedback was taken by QA&C staff in the absence of faculty members. 70% teachers (27 out of 39) were awarded more than 80% evaluation grade by students. Whereas 30% teachers (12 out of 39) were awarded from 60% to 80%.

### **3.1.8 Research**

The program faculty published 16 research papers in different impact factor journals in 2022. List attached in Annexure D.

### **3.1.9 Community Service**

HITEC University provides financial assistance for deserving students. It also takes part in disaster relief programs to help victims of flood, earthquake etc. University has its association with different blood donor clubs, and it arranges blood camps on regular periods. University also actively takes part in environmental awareness activities and celebrates events like green day etc.

### **3.1.10 Students/Teachers Satisfaction**

The department maintains a ratio of 4:1 for the academic (technical) and administrative non-technical staff which fulfills the standard set by the HEC.

Students indicated mix reactions to QA&C staff while taking feedback. A reasonably good percentage was happy with university environment and administrative support services of the department. While a few

gave suggestion for improvements in administrative facilities like canteen and games.

The feedback from faculty also showed mix reactions regarding prevailing environment.

## 4.0 Criterion 2: Curriculum Design and Organization

### Title of Degree Program

BS Electrical Engineering

### Definition of Credit Hour

One credit hour is 1 hour of theory lecture or 3 hours of laboratory work in a week.

### Degree Plan

Following is the list of courses taught in the selected program. (Source Curriculum 2018)

#### Semester-I

Course Code	Course Title	Credit Hours
EE-101	Engineering Workshop	0+1
EE-102	Electric Circuit Analysis	3+0
MT-101	Calculus and Analytic Geometry	3+0
EC-110	Computing Fundamentals	2+1
HS-101	English	3+0
BS-104	Engineering Physics	3+0
EE-102L	Electric Circuit Analysis Lab	0+1
BS-104L	Engineering Physics Lab	0+1
	<b>Credit Hours</b>	<b>18</b>

#### Semester-II

Course Code	Course Title	Credit Hours
EE-103	Network Analysis	3+0
MT-303	Applied Linear Algebra	2+0
ME-210	Engineering Mechanics	3+0
ME-211	Computer-Aided Engineering Drawing	0+1
EC-112	Object Oriented Programming	2+1
EE-205	Electronic Devices and Circuits	3+0
EE-103L	Network Analysis Lab	0+1
EE-205L	Electronic Devices and Circuits Lab	0+1
	<b>Credit Hours</b>	<b>17</b>

### **Semester-III**

Course Code	Course Title	Credit Hours
EE-302	Signals and Systems	3+0
EE-203	Digital Logic Design	3+0
MT-201	Complex Variables & Transforms	3+0
IS-211	Islamic Studies	2+0
EC-222	Data Structure & Algorithms	2+1
HS-103	Communication Skills	3+0
EE-203L	Digital Logic Design Lab	0+1
HS-203	Community Service	0+1 (NC)
	<b>Credit Hours</b>	<b>18</b>

### **Semester-IV**

Course Code	Course Title	Credit Hours
EE-204	Electrical Machines-I	3+0
EE-303	Microprocessor and Interfacing Techniques	3+0
MT-103	Differential Equations	3+0
EE-304	Communication Systems	3+0
HS-201	Technical Report Writing	3+0
EE-204L	Electrical Machines-I Lab	0+1
EE-303L	Microprocessor and Interfacing Techniques Lab	0+1
EE-304L	Communication Systems Lab	0+1
	<b>Credit Hours</b>	<b>18</b>

### **Semester-V**

Course Code	Course Title	Credit Hours
EE-305	Linear Control Systems	3+0
EE-301	Electromagnetic Theory	3+0
MT-302	Probability and Statistics	3+0
EE-307	Instrumentation & Measurement	3+0
EE-3XX	Depth Elective-I	3+0
EE-305L	Linear Control Systems Lab	0+1
EE-307L	Instrumentation & Measurement Lab	0+1
EE-3XXL	Depth Elective-I Lab	0+1
	<b>Credit Hours</b>	<b>18</b>

### **Semester-VI**

Course Code	Course Title	Credit Hours
MT-202	Numerical Methods	2+1
EE-308	Electronic Systems Design	3+0
EE-405	Power Electronics	3+0
EE-3XX	Depth Elective-II	3+0
EE-308L	Electronic Systems Design Lab	0+1

EE-405L	Power Electronics Lab	0+1
EE-3XXL	Depth Elective-II Lab	0+1
HS-102	Pakistan Studies	2+0
	<b>Credit Hours</b>	<b>17</b>

### **Semester-VII**

Course Code	Course Title	Credit Hours
EE- 401	Project Part-I	0+3
HS-404	Foreign Language	1+1
EE-4XX	Depth Elective-III	3+0
HS-402	Economics	2+0
EE-4XX	Depth Elective-IV	3+0
ME-416	Renewable Energy Resources	3+0
EE-4XXL	Depth Elective-III Lab	0+1
EE-4XXL	Depth Elective-IV Lab	0+1
	<b>Credit Hours</b>	<b>18</b>

### **Semester-VIII**

Course Code	Course Title	Credit Hours
EE-401	Project Part-II	0+3
EE-4XX	Depth Elective-V	3+0
HS-401	Professional Values & Ethics	2+0
HS-403	Management and Entrepreneurship	3+0
ME-407	Health Safety and Environment	1+0
	<b>Credit Hours</b>	<b>12</b>
<b>Total Credit Hours: 136</b>		

### **List of Elective Courses**

#### List of Electives (Power):

Course Code	Course Title	Credit Hours
EE-309	Electrical Machine-II	3+1
EE-310	Power Generation	3+1
EE-404	Power Transmission and Distribution	3+1
EE-423	High Voltage Engineering	3+1
EE-426	Renewable Energy Systems	3+0
EE-428	Electrical Machine Design	3+1
EE-429	Power System Analysis	3+1
EE-431	Power System Protection	3+1
EE-432	Power System Operation and Control	3+0

#### List of Elective (E&T):

Course Code	Course Title	Credit Hours
EE-306	Digital Signal Processing	3+1

EE-311	Digital Communications	3+1
EE-402	Wave Propagation and Antennas	3+1
EE-403	Computer Communication Networks	3+1
EE-409	Optical Communication	3+1
EE-410	Industrial Electronics	3+1
EE-417	Embedded Systems	3+1
EE-427	Wireless and Mobile Communications	3+1
EE-430	Telecom Transmission and Switching Systems	3+0
EE-433	AI Tools	3+1
EE-434	Principles and Design of IoT systems	3+1
EE-435	Electric Vehicles	3+0

### Curriculum Breakdown

Knowledge Area	Course Code	Name of Course	Theory	Lab Contact Hours	Credit Hours	Total Cr. Hrs
Computing	EC-110	Computing Fundamentals	2	3	3	9
	EC-222	Data Structure & Algorithms	2	3	3	
	EC-112	Object Oriented Programming	2	3	3	
Electrical Engineering Foundation	EE-101	Engineering Workshop	0	3	1	31
	EE-102 EE-102L	Electric Circuit Analysis Electric Circuit Analysis Lab	3	3	4	
	EE-103 EE-103L	Network Analysis Network Analysis Lab	3	3	4	
	ME-211	Computer-Aided Engineering Drawing	0	3	1	
	MT-302	Probability and Statistics	3	0	3	
	EE-203 EE-203L	Digital Logic Design Digital Logic Design Lab	3	3	4	
	EE-204 EE-204L	Electrical Machines-I Electrical	3	3	4	

		Machines-I Lab				
	EE-205 EE-205L	Electronic Devices and Circuits Electronic Devices and Circuits Lab	3	3	4	
	EE-302	Signals and Systems	3	0	3	
	EE-301	Electromagnetic Theory	3	0	3	
Electrical Engineering Core (Breadth)	EE-304 EE-304L	Communication Systems Communication Systems Lab	3	3	4	24
	EE-305 EE-305L	Linear Control Systems Linear Control Systems Lab	3	3	4	
	EE-303 EE-303L	Microprocessor & Interfacing Techniques Microprocessor & Interfacing Techniques Lab	3	3	4	
	EE-307 EE-307L	Instrumentation & Measurement Instrumentation & Measurement Lab	3	3	4	
	EE-308 EE-308L	Electronic Systems Design Electronic Systems Design Lab	3	3	4	
	EE-405 EE-405L	Power Electronics Power Electronics Lab	3	3	4	
Electrical Engineering Specialization Based Electives	EE-306 EE-306L	Digital Signal Processing Digital Signal Processing Lab	3	3	4	19/20
	EE-309 EE-309L	Electrical Machines-II Electrical Machines-II Lab	3	3	4	
	EE-403	Computer	3	3	4	



	EE-403L	Communication Networks Computer Communication Networks Lab				
	EE-310 EE-310L	Power Generation Power Generation Lab	3	3	4	
	EE-402 EE-402L	Wave Propagation & Antennas Wave Propagation & Antennas Lab	3	3	4	
	EE-404 EE-404L	Power Transmission & Distribution Power Transmission & Distribution Lab	3	3	4	
	EE-311 EE-311L	Digital Communications Digital Communications Lab	3	3	4	
	EE-431 EE-431L	Power System Protection Power System Protection Lab	3	3	4	
	EE-427 EE-427L	Wireless and Mobile Communications Wireless and Mobile Communications Lab	3	3	4	
	EE-429 EE-429L	Power Systems Analysis Power Systems Analysis Lab	3	3	4	
	EE-430	Telecom Transmission and Switching Systems	3	0	3	
	EE-432	Power Systems Operation and Control	3	0	3	
	EE-423 EE-423L	High Voltage Engineering	3	3	4	

		High Voltage Engineering Lab				
	EE-426	Renewable Energy Systems	3	0	3	
	EE-428 EE-428L	Electrical Machine Design Electrical Machine Design Lab	3	3	4	
	EE-409 EE-409L	Optical Communication Optical Communication Lab	3	3	4	
	EE-410 EE-410L	Industrial Electronics Industrial Electronics Lab	3	3	4	
	EE-417 EE-417L	Embedded Systems Embedded Systems Lab	3	3	4	
	EE-433 EE-433L	AI Tools AI Tools Lab	3	3	4	
	EE-434 EE-434L	Principles and Design of IoT Systems	3	3	4	
	EE-435	Electric Vehicles	3	0	3	
Interdisciplinary Course	ME-210	Engineering Mechanics	3	0	3	6
	ME-416	Renewable Energy Resources	3	0	3	
Final Year Project	EE-401	Project Part-I	0	9	3	6
	EE-401	Project Part-II	0	9	3	
Total Credits	95/96					

Knowledge Area	Subject Area	Course Code	Name of Course	Theory	Lab Contact Hours	Credit Hours	Total Cr. Hrs
Humanities	English	HS-101	English	3	0	3	18
		HS-103	Communication Skills	3	0	3	
		HS-	Technical Report	3	0	3	

		201	Writing				
	Other	HS-404	Foreign Language	1	1	2	
		HS-405	Health Safety and Environment	1	0	1	
		HS-203	Community Service	0	1	NC	
	Culture	HS-102	Pakistan Studies	2	0	2	
		IS-211	Islamic Studies	2	0	2	
		HS-401	Professional Values & Ethics	2	0	2	
Management Sciences		HS-402	Economics	2	0	2	5
		HS-403	Management and Entrepreneurship	3	0	3	
Natural Sciences	Math	MT-101	Calculus & Analytical Geometry	3	0	3	18
		MT-303	Applied Linear Algebra	2	0	2	
		MT-103	Differential Equations	3	0	3	
		MT-201	Complex Variables & Transforms	3	0	3	
		MT-202	Numerical Methods	2	3	3	
	Physics	BS-104 BS-104L	Engineering Physics Engineering Physics Lab	3	3	4	
Total Credits							41

## **COURSE CONTENTS**

### **Semester-1**

#### **4.1.1. Course Name: English**

**Course Code: HS-101**

**Credit Hours: 3+0**

#### **Objectives:**

To equip the students with the knowledge of Vocabulary, sentences, comprehension (extensive reading, intensive reading, skimming and scanning); composition; and summarization (descriptive, argumentative and persuasive skills in composition, comprehension, and précis writing)

#### **Course Contents:**

Vocabulary (frequently confused/misused words, phrases, synonyms, antonyms, idioms and general vocabulary); practical use of business grammar (nouns, pronouns, verbs, adjectives, adverbs, prepositions, conjunctions, articles, interjections and tenses); sentences (types of sentences, parts of sentences, direct and indirect speech, active and passive voice and conditional sentences); reading, comprehension (extensive reading, intensive reading, skimming and scanning); composition; and summarization (descriptive, argumentative and persuasive skills in composition, comprehension, and précis writing)

#### **Recommended Books:**

1. Practical English Grammar by A. J. Thomson and A. V. Martinet. Fourth edition. Oxford University Press. ISBN 978-0-19-431342-1.
2. Practical English Grammar Exercises 1 by A. J. Thomson and A. V. Martinet. Third edition. Oxford University Press. ISBN 978-0-19-431349-0.
3. Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2

#### **4.1.2 Course Name: Calculus and Analytical Geometry**

**Course Code: MT-101**

**Credit Hours: 3+0**

#### **Course outline:**

##### **Limits and Continuity**

- Introduction to Limits
- Rates of Change and Limits
- One-Sided Limits, Infinite Limits
- Continuity, Continuity at a Point, Continuity on an interval

##### **Differentiation**

- Definition and Examples
- Relation Between Differentiability and Continuity

- Derivative as slope, as rate of change (graphical representation).
- The Chain Rule
- Applications of Ordinary Derivatives

### **Integration**

- Indefinite Integrals
- Different Techniques for Integration
- Definite Integrals
- Riemann Sum, Fundamental Theorem of Calculus
- Area Under the Graph of a Nonnegative Function
- Improper Integrals

### **Transcendental Functions**

- Inverse functions
- Logarithmic and Exponential Functions
- Inverse Trigonometric Functions
- Hyperbolic Functions and Inverse Hyperbolic Functions
- More Techniques of Integration

### **Analytical Geometry**

- Three-Dimensional Geometry
- Vectors in Spaces
- Vector Calculus
- Directional Derivatives
- Divergence, Curl of a Vector Field
- Multivariable Functions
- Partial Derivatives
- Conic Sections
- Parameterizations of Plane Curves
- Vectors in Plane, Vectors in space
- Dot Products, Cross Products
- Lines and Planes in Space
- Spherical, Polar and Cylindrical Coordinates.
- Vector-Valued Functions and Space Curves
- Arc-Length and Tangent Vector
- Curvature, Torsion and TNB Frame
- Fubini's Theorem for Calculating Double Integrals
- Areas Moments and Centers of Mass
- Triple Integrals and volume of a region in space

### **Recommended Books**

1. Thomas' Calculus by J. R. Hass, C. D. Heil and M. D. Wier, 14<sup>th</sup> edition, Pearson, ISBN 978 0134438986
2. Essential Calculus by James Stewart, 2<sup>nd</sup> Edition, ISBN 978-1133112297
3. Advanced Engineering Mathematics by Erwin Kreyszig, 10<sup>th</sup> Ed. Willey 2014. ISBN 978-0-470-91361-1

### **4.1.3 Course Name: Linear Circuit Analysis**

**Course Code: EE-102**

**Credit Hours: 3+0**

#### **Objectives:**

To equip the students with the knowledge and techniques of electric circuit analysis.

#### **Course Contents:**

Electric quantities, electric signals, electric circuits, Kirchhoff's laws, circuit elements. Resistance, series parallel combination, voltage and current dividers, resistive bridges, Nodal analysis, loop analysis, linearity and superposition, source transformation, one ports, circuit theorems, power calculations. dependent sources, circuit analysis with dependent sources, the operational amplifier, basic op-amp configurations, ideal op-amp circuit analysis, summing and difference amplifiers, amplifier types, Capacitance, inductance (including mutual inductance), natural response of RC and RL circuits. Response to DC forcing function, AC fundamentals; RMS or effective, average and maximum values of current & voltage for sinusoidal signal wave forms.

#### **Recommended books:**

1. S. Franco, "Electric Circuits Fundamentals", Oxford University Press, (Latest Edition).
2. R E Thomas, A J Rosa and G J Toussaint, "The Analysis and Design of Linear Circuits" John Wiley, 6th Edition, 2009
3. C Alexander and M Sadiku, "Fundamentals of Electric Circuits", McGraw-Hill, 4th Edition, 2008

### **4.1.4 Course Name: Linear Circuit Analysis Lab**

**Course Code: EE-102L**

**Credit Hours: 0+1**

#### **Lab Work Outline:**

Design and implement RLC circuits and observe resonance and impedance characteristics. Verify the node voltages and loop currents in RLC circuits using instruments. Verify Circuit-theorems using lab instruments. Verify circuit transformations using lab instruments. Learn the use of Circuit Simulation computer package such as, SPICE, observe transient and steady state response in RL, RC and RLC circuits using SPICE, MATLAB/SIMULINK.

#### **Assessment (Lab)**

**Weekly lab reports**

**Viva voce**

**Project work**

#### **Recommended Books:**

1. S. Franco, "Electric Circuits Fundamentals", Oxford University Press, (Latest Edition).
2. V.V. Burg, "Network Analysis", (Latest Edition)

3. R E Thomas, A. J. Rosa and G. J. Toussaint, "The Analysis and Design of Linear Circuits" John Wiley, 6<sup>th</sup> Edition, 2009
4. C. Alexander and M. Sadiku, "Fundamentals of Electric Circuits", McGraw- Hill, 4<sup>th</sup> Edition, 2008
5. J. D. Irwin and R. M. Nelms, "Basic Engineering Circuit Analysis", Wiley, 9<sup>th</sup> Edition, 2008
6. W. Hayt, J. Kemmerly and S. Durbin, "Engineering Circuit Analysis", McGraw-Hill, 7<sup>th</sup> Edition, 2007.

#### **4.1.5 Course Name: Computing Fundamentals**

**Course Code: EC-110**

**Credit Hours: 2+1**

##### **Course outline:**

Introduction to basic computer hardware, Input/output (mouse, keyboard, optical input devices, audiovisual input devices, monitors, projectors, sound systems and printers), processing data, modern CPU's, storing data, operating system, networks, internet, basic higher level programming language concepts in C++ (program structure, constants, variables, data types, operators and expressions, conditional statements, loop statements, arrays and functions).

##### **Recommended Books:**

1. "Introduction to Computers" by Peter Norton, 7th Edition, McGraw-Hill SiE, ISBN 0-07-059374-4.
2. "Programming with C++ Object Oriented Programming" By Aikman Series.

#### **4.1.6 Course Name: Workshop Practice**

**Course Code: EE-101**

**Credit Hours: 0+1**

##### **Objectives:**

To equip the students with the knowledge and techniques of various technical facilities in the workshop including mechanical and electrical equipment. Concepts in electrical safety, safety regulations, earthing concepts, electric shocks and treatment.

##### **Course Contents:**

Introduction to various technical facilities in the workshop including mechanical and electrical equipment. Concepts in electrical safety, safety regulations, earthing concepts, electric shocks and treatment. Use of tools used by electricians, wiring regulations, types of cables and electric accessories including switches, plugs, circuit breakers, fuses etc., symbols for electrical wiring schematics e.g., switches, lamps, sockets etc., drawing 80 and practice in simple house wiring and testing methods, wiring schemes of two-way and three-way circuits and ringing circuits, voltage and current measurements. Electric soldering and soldering tools; soldering methods and skills, PCB designing, transferring a circuit to PCB, etching, drilling and soldering component on PCB testing.

##### **Recommended Books:**

1. Choudhury, "Elements of Workshop Technology", Vol. 1, MPP.
2. Chapman, "Workshop Technology", Part-I, II, III, CBS.

#### **4.1.7 Course Name: Applied Physics**

**Course Code: BS-104**

**Credit Hours: 3+0**

#### **Objectives:**

To equip the students with the knowledge of semiconductor, conductor, insulator, pn junction diode and different types of diode and its applications.

#### **Course outline:**

##### **1. Force and Motion**

- Motion along a straight line.
- Vectors.
- Motion in 2 and 3 dimensions.
- Force
- Friction

##### **2. Waves**

- Vibrations and Oscillations
- Simple Harmonic Motion
- Wave Motion and Sound

##### **3. Mechanics**

- Work and Energy
- Kinetic and Potential energy
- Conservation of energy.
- Center of mass and rotation
- Linear momentum.
- Torque and angular momentum.
- Equilibrium and elasticity.
- Gravitation.

##### **4. Thermodynamics**

- a. Thermal Equilibrium and zeroth law
- b. First and second law of thermodynamics

##### **5. Electric Charge**

- Introduction to electric charge
- Conductors and Insulators
- Coulomb's Law
- Quantization and Conservation of Charge.

##### **6. Electric Fields**

- Introduction to Electric Field
- A point charge in electric field
- A dipole in electric field

##### **7. Gauss' Law**

- Electric Flux
- Gauss' Law and its Applications

##### **8. Electric Potential**

- Electric potential and Electric potential energy



- Potential due to a point charge
- Potential due to group of charges
- Potential due to an electric dipole
- Potential due to continuous charge distribution

### **9. Capacitance**

- Introduction to capacitance
- Capacitors in parallel and series
- Energy stored in an electric field
- Dielectric

### **10. Current and Resistance**

- Introduction to electric current
- Effects of Electric Current
- Sources of Electricity
- Current density
- Resistance and Resistivity
- Ohm's Law
- Power in electric circuits
- Semiconductors and super conductors

### **11. Circuits**

- Introduction to electric circuits
- Pumping charges
- Work, energy and EMF
- Single and Multi-loop circuits
- The ammeter and voltmeter

### **12. Electromagnetism**

- Introduction to magnetic fields
- The Hall effect
- Magnetic field on a current carrying wire
- Torque on a current loop
- Electromagnetic Induction

#### **Recommended Books:**

1. University Physics by Hugh D. Young and Roger A. Freedman, 14th Edition.
2. Fundamentals of Physics Extended by D. Halliday, R. Resnick, J. Walker. 10th edition.
3. Fundamentals of Electromagnetic Phenomenon by D. Corson & Lorrain.

**4.1.8 Course Name: Applied Physics Lab**

**Course Code: BS-104L**

**Credit Hours: 0+1**

#### 4.1.9 Course Name: Translation of the Quran: Beliefs

Course Code: QT-101

Credit Hours: 1+0 (NC)

کورس کے مقاصد:

1. قرآنی سورتوں کے اہم ایمانی موضوعات کا تعارف کروانا
2. اہم ایمانی مضامین قرآن سے متعلق آیات کا تعارف کروانا
3. طالب علم کو اہم قرآنی موضوعات ایمانیات کا احاطہ کروانا۔
4. طالب علم کو اہم قرآنی موضوعات (ایمانیات، عبادات، اخلاقیات، معاملات، احکامات) کا اس طرح احاطہ کروانا کہ وہ ان پر گفتگو کر سکے۔

### Weekly Course Plan

قرآنی آیات	بنیادی عنوان	S. No.
تدریسی کورس کی اہمیت ، مقاصد، اہداف اور منتخب موضوعات ایمانیات کا تعارف	لازمی قرآنی تعلیم ترجمہ کے ساتھ: کورس کا تعارف	1.
Surah Al- Baqarah, No.6-8,13,41	کافر ، منافق کے ایمان کا فرق	2.
Surah Al- e -Imran No.7, 16, 49, 52,53.	عالم راسخ، عیسیٰ علیہ السلام و حواریوں کا ایمان	3.
Surah Al-Nisa No.38, 39, 46, 47,55.	منافق کا خرچ دکھاوا ہے ایمان نہیں، کتاب پر ایمان لانا	4.
Surah Al-Maidah No.5, 9, 14, 23,35.	عدم ایمان پر اعمال کا ضیاع، اللہ سے ڈرو، جہاد کرو	5.
Surah Al- Anaam No.12,20, 25, 48,54.	ایمان لانے والوں پر سلامتی بھیجنا	6.
Surah Al-Aaraaf No.27, 35, 42,72,86.	شیطان ہے ایمان کا ساتھی، ایمان کا صلہ بہشت	7.
Surah Al-Anfaal No.1,41,46,55,72.	ایمان والو اللہ و رسول کا حکم مانو، غنیمت کے احکام	8.
Surah Al-Tobah No.12,13,18,19,20,21.	بد عہد ہے ایمان ہے، مسجد کو آباد کرنا ایمان ہے۔	9.
Surah Yunus No.9,10,13,33,40.	عدم ایمان پہلونکی ہلاکت کا سبب	10.
Surah Hood No.17,23,29,36,53.	ہے ایمان کیلئے آگ، قوم نوح علیہ السلام کا ذکر	11.
Surah Yusuf No.37,57,87,103,105.	مومن کا اجر، مایوسی ہے ایمانی ہے	12.
Surah Al-Raad No.1,11,28,29	قوموں کی تبدیلی کیسے؟	13.
Surah Ibrahim no.23,31,44,	جنتی کو سلام، نماز و صدقہ کا حکم	14.
Surah Al-Hajar No.12,13,14.	ایمان کی تکذیب کے اثرات	15.
Surah Al-Nahl No.22,60,106,107	آخرت پر عدم ایمان سرکشی ہے	16.

#### Books Recommended:

1. The translation of Holy Quran by Mufti Muhammad Taqi Usmsni, Titled, "The meanings of the NOBAL QURAN with explanatory notes".
2. Irfan ul Quran, Dr.Muhammad Tahirul Qadiri

3. فتح محمد جالندهرى، ترجمه قرآن
4. مولانا موددى، ترجمه و تفسير تفهيم القرآن
5. پير محمد كرمشاه بالازبرى: ترجمه جمال القرآن و تفسير ضياء القرآن
6. مفتى شفيع عثمانى، ترجمه و تفسير معارف القرآن
7. پيرسٹر فاروق بهاء الحق شاه، خلاصه القرآن
8. ڈاكٽر اطهر محمد اشرف، جامع اشاريه مضامين قرآن
9. زاہد ملك، مضامين قرآن حكيم

## Semester-2

### 4.1.10 Course Name: Differential Equations

**Course Code: MT-103**

**Credit Hours: 3+0**

#### **Objectives:**

To equip the students with the knowledge the fundamental concepts of differential equations. Solve first and second order differential equations and partial differential equations using the concepts developed in the course.

#### **Course Contents:**

Understand the basic notions of differential equation, linearity, superposition, and existence and uniqueness of solutions to DE's, and use these concepts in solving linear DE's. Use known DE types to model and understand situations involving exponential growth or decay and second order physical systems such as driven spring-mass systems or LRC circuits. Solution of First-order ODE's by Analytical method, Linear ODE's, Especially Second Order with Constant Coefficients, Undetermined Coefficients and Variation of Parameters, Laplace transformation and PD,s.

#### **Text Book And Materials:**

1. Advanced Engineering Mathematics by Erwin Kreyszig (10thEd)
2. Partial Differential Equations and Solitary Waves Theory by Abdul-MajidWazwaz

#### **Reference Material:**

Introduction to Ordinary differential equations by Danis GZill

### 4.1.11 Course Name: Technical Report Writing

**Course Code: HS-201**

**Credit Hours: 3+0**

#### **Objectives:**

To equip the students with the knowledge and techniques of technical writing.

#### **Course Contents:**

Introduction to technical writing; top-down method; use of headings and chunks; visual aids; use of plain and objective language; format; codes of ethical conduct; pre-writing, writing and post-writing stages; editing; plagiarism; use of correct tone; echo techniques; extended definitions; comparing and contrasting; explaining cause and effect; description; *and* memos, proposals, applications, project reports, user manuals, and letters

#### **Recommended Books**

1. Technical Report Writing Today by Daniel G. Riordan, Wadsworth Publishing, 10th Edition, ISBN 9781133607380
2. Scenarios for Technical Communication by Teresa C. Kynell and Wendy Krieg Stone. ISBN 978- 0205275243
3. Communication for Engineering Students by J. W. Davies, ISBN 978-0582256484

#### 4.1.12 Course Name: Islamic Studies

Course Code: IS-211

Credit Hours: 2+0

#### Objectives:

1. طلبہ میں قرآن و سنت کی روشنی میں اسلامی عقائد اور عبادات کی سمجھ اور ان کا عملی زندگی میں اطلاق پیدا کرنا۔
2. طلبہ کو اخلاقیات اور باہمی معاملات کے بارے میں اسلامی احکام سمجھانا اور روزمرہ زندگی میں ان پر عمل کے لیے تیار کرنا۔
3. طلبہ کو معاشرے میں اپنی ذمہ داریوں کو احسن طریقے سے نبھانے کے قابل بنانا۔

Books and Chapters	Course Contents	Week
اسلامی نظریہ حیات باب نمبر 10،11،13	اسلامیات کی اہمیت و ضرورت بنیادی اسلامی عقائد: توحید، رسالت، آخرت (حدیث جبرئیل کی روشنی میں) توحید کا مفہوم، آخرت کا تصور، انسانی زندگی پر اس کے اثرات، نبوت و رسالت کا مفہوم، اس کی ضرورت اور ختم نبوت	1.
اسلامی نظریہ حیات باب نمبر 14	اسلامی عبادات: عبادات کا مفہوم، اسلامی تصور عبادت نماز، روزہ (فضائل، احکام و مسائل)	2.
معارف الحدیث	اسلامی عبادات: زکوٰۃ، حج، (فضائل، احکام و مسائل) انسانی زندگی پر عبادات کے اثرات	3.
اسلامی نظریہ حیات از خورشید احمد باب نمبر 15	تعارف قرآن وحی کی ضرورت، وحی کا مفہوم، نزول قرآن، جمع و تدوین قرآن، قرآن کے حقوق، دیگر کتب سماویہ کا بیان	4.
آسان ترجمہ قرآن مفتی تقی عثمانی	منتخب آیات قرآنی: سورة المؤمنون آیت 1 تا 11، سورة الفرقان آیت 63 تا 77	5.
آسان ترجمہ قرآن مفتی تقی عثمانی	منتخب آیات قرآنی: سورة الحجرات (آیت 1 تا 18)	6.
	1 <sup>st</sup> Sessional	
اسلامی نظریہ حیات باب نمبر 15	مطالعہ حدیث: حدیث و سنت کی تعریف، ضرورت و اہمیت، جمع و تدوین حدیث، اقسام حدیث، معروف کتب حدیث (صحاح ستہ وغیرہ) کا تعارف	7.
منسلک	10 منتخب احادیث	8.
معیاری اسلامیات لازمی از ڈاکٹر حافظ محمود اختر صفحہ 260	مطالعہ سیرت نبوی ﷺ کی ضرورت و اہمیت اور اہم کتب سیرت	9.
"الرحیق المختوم" صفی الرحمن مبارکپوری	سیرت نبوی ﷺ مکی دور: دعوت دین، ہجرت حبشہ اور ہجرت مدینہ	10.

سیرت رحمت عالم صفحہ 76، 110	سیرت نبوی ﷺ مدنی دور : میثاق مدینہ، صلح حدیبیہ، خطبہ حجۃ الوداع	11.
	2 <sup>nd</sup> Sessional	
	اسلامی تہذیب و ثقافت کی خصوصیات: انسانی عظمت، مساوات، عالمگیر اخوت	12.
اسلامی نظریہ حیات: از خورشید احمد، باب نمبر 19	معاشرتی اخلاقی اقدار: صداقت، امانت، عدل، کسب حلال اور محنت کی عظمت	13.
اسلام میں اختلاف کے اصول و آداب ڈاکٹر طہ جابر علوی باب نمبر 1	فرقہ وارانہ ہم آہنگی اور اسلامی تعلیمات اسلام میں فرقہ بندی کی ممانعت اختلافات باعث رحمت اور فکری ارتقا مسئلہ کی اہم آہنگی کیسے پیدا کی جائے	14.
اسلامی معاشرے میں غیر مسلموں کے حقوق فرائض از ڈاکٹر یوسف قرضاوی، باب نمبر 1 اسلام کا قانون بین الممالک ڈاکٹر محمود احمد غازی خطبہ نمبر 12	انسانی حقوق اور رواداری: غیر مسلموں کے حقوق اور ان سے رواداری مسلمان – غیر اسلامی ریاستوں کے شہری بطور شہری حقوق و فرائض، مکالمہ بین ال مذاہب	15.
	اسلام اور سائنس سائنسی تحقیقات میں مسلمان سائنسدانوں کے کارنامے سائنس اور قرآن	16.
	Final Exam	

### عملی کام:

الف: قرآن پاک کی آخری دس سورتیں زبانی یاد کرنا  
ب: نماز مع ترجمہ زبانی یاد کرنا

### Recommended books :

1. Hamidullah, Dr. (2000), *Introduction to Islam*, Dawah Academy, Islamabad
2. Khan, Rafique Ali (2001), *Freedom of Thought in Islam*, Royal Book Company, Karachi
3. Ali, Syed Amir *The Spirit of Islam*, Islamic Book Service, Lahore
4. Hamidullah, Dr. (2005), *Muhammad Rasulullah: A concise survey of the life and work of the founder of Islam*, Dawah Academy, Islamabad
5. Hamidullah, Dr. (2000), *Islamic Notion of conflict of Laws*, Dawah Academy, Islamabad
6. UNO Charter of International Human Rights of 1948
7. مودودی، سید ابو الاعلیٰ (2002)، انسان کے بنیادی حقوق، اسلامک پبلی کیشنز، لاہور
8. قطب، سید محمد (2010)، اسلام اور جدید ذہن کے شبہات، ہولی قرآن پبلی کیشنز ہاؤس، کراچی
9. اسلامی نظریہ حیات، پروفیسر خورشید احمد (2014)، ادارہ ترجمان القرآن، لاہور
10. غیر مسلموں کے حقوق، ڈاکٹر یوسف القرضاوی، اسلامک پبلی کیشنز، لاہور
11. زیدان، عبدالکریم (2002)، اسلام میں ریاست اور فرد کا مقام، ادارہ ترجمان القرآن، لاہور
12. پاکستان کمیشن برائے انسانی حقوق (2012)، پاکستان میں انسانی حقوق کی صورت حال، میڈیا سیل
13. نعمانی، محمد شبلی (2003)، سیرت النبی، مکتبہ رحمانیہ اردو بازار، لاہور

#### **4.1.13 Course Name: Pakistan Studies**

**Course Code: HS-102**

**Credit Hours: 2+0**

##### **Objectives**

:Develop vision of historical perspective, government, politics, contemporary Pakistan, ideological background of Pakistan. Study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan.

##### **Course Contents:**

Historical Perspective: Ideological rationale with special reference to Sir Syed Ahmed

Khan, Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah. Factors leading to Muslim separatism ,People and Land. Government and Politics in Pakistan, Contemporary Pakistan Economic institutions and issues. Society and social structure. Ethnicity. Foreign policy of Pakistan and challenges. Futuristic outlook of Pakistan

##### **Recommended Books:**

1. Burki, Shahid Javed. *State & Society in Pakistan*, The MacMillan Press Ltd 1980.
2. Akbar, S. Zaidi. *Issue in Pakistan's Economy*. Karachi: Oxford University Press, 2000.
3. S. M. Burke and Lawrence Ziring. *Pakistan's Foreign policy: An Historical analysis*. Karachi: Oxford University Press, 1993.
4. Mehmood, Safdar. *Pakistan Political Roots & Development*. Lahore, 1994.
5. Wilcox, Wayne. *The Emergence of Bangladesh*, Washington American Enterprise, Institute of Public Policy Research, 1972.
6. Mehmood, Safdar. *Pakistan Kayyun Toota*, Lahore: Idara-e-Saqafat-e-Islamia, Club Road, nd.
7. Amin, Tahir. *Ethno - National Movement in Pakistan*, Islamabad: Institute of Policy Studies, Islamabad.
8. Ziring, Lawrence. *Enigma of Political Development*. Kent England: Wm Dawson & sons Ltd, 1980.
9. Zahid, Ansar. *History & Culture of Sindh*. Karachi: Royal Book Company, 1980.
10. Afzal, M. Rafique. *Political Parties in Pakistan*, Vol. I, II & III
11. Islamabad: National Institute of Historical and cultural Research, 1998.

#### **4.1.14 Course Name: Object Oriented Programming**

**Course Code: EC-112**

**Credit Hours: 2+1**

##### **Objectives:**

Build logic of a program, design an algorithm and make a flow chart to represent the solution of problem. Design and Implement the solution of problem using loops, arrays, functions, structures

##### **Course Contents:**

Fundamental data types. Basic programming structs. Functions and Arrays. Pointers and Structures. File I/Os...Concepts of object oriented programming: encapsulation, inheritance, polymorphism, abstract classes and interfaces, overloading and overriding, object-oriented design, event-driven programming, Event propagation, exception handling, threading, multi- threading, packages, recursion, use of stacks, queues

**Recommended Books:**

1. Kernighan and Riechie, “ The C programming language”, Latest Edition.  
Deitel and Deitel, *C++*, *How to Program* , Prentice Hall. ISBN 9780134448848

**4.1.15 Course Name: Electrical Network Analysis**

Pre-Requisite: Electric Circuit Analysis

**Course Code: EE-103**

**Credit Hours: 3+0**

**Objective:**

To equip the students with the knowledge and techniques of analyzing electrical networks.

**Course Outline:**

Current and voltage transients, RLC circuits with DC and AC excitation, Transient response and step response of second order circuits., resonant circuit: series and parallel resonance in AC circuit, Q-Factor, analog filters, mutual inductance and transformers, introduction to phasor representation of alternating voltage and current, single-phase circuit analysis, star-delta transformation for DC and AC circuits, three phase circuits, power in three phase circuits and different methods of its measurements. Two-port networks and their interconnections. Application of Laplace transform in circuit analysis.

**Recommended Books:**

1. S. Franco, "Electric Circuits Fundamentals", Oxford University Press, (Latest Edition).
2. V.V. Burg, "Network Analysis", (Latest Edition)
3. R E Thomas, A. J. Rosa and G. J. Toussaint, "The Analysis and Design of Linear Circuits" John Wiley, 6<sup>th</sup> Edition, 2009
4. C. Alexander and M. Sadiku, "Fundamentals of Electric Circuits", McGraw-Hill, 4<sup>th</sup> Edition, 2008
5. J. D. Irwin and R. M. Nelms, "Basic Engineering Circuit Analysis", Wiley, 9<sup>th</sup> Edition, 2008
6. W. Hayt, J. Kemmerly and S. Durbin, "Engineering Circuit Analysis", McGraw-Hill, 7<sup>th</sup> Edition, 2007.



**4.1.16 Course Name: Electrical Network Analysis Lab**

Pre-Requisite: Electric Circuit Analysis

**Course Code: EE-103L**

**Credit Hours: 0+1**

**Lab Work Outline:**

Design and implement RLC circuits and observe resonance and impedance characteristics. Verify the node voltages and loop currents in RLC circuits using instruments. Verify Circuit-theorems using lab instruments. Verify circuit transformations using lab instruments. Learn the use of Circuit Simulation computer package such as, SPICE, Observe transient and steady state response in RL, RC and RLC circuits using SPICE, MATLAB/SIMULINK.

**4.1.17 Course Name: Community Service**

**Course Code: HS-203**

**Credit Hours: 0+1 (NC)**

**Objective:**

To impart general awareness and knowledge along with social guidance to develop HITEC students into socially active citizens of the country and to exert a positive impact on society through active community service programs.

**Course Outline:**

Course comprises of 15 hours of seminars/workshops (4-5 seminars/workshops) and 30 hours of fieldwork (2 field projects). 15 hours of Seminars/workshops would be conducted on various community service/related topics of interest on the campus.

For 30 hours of field projects, 2 project involvements are proposed initially. However, since this is the first time implementation of community service program, involvement in one project can be deemed sufficient.

## Semester-3

### **4.1.18 Course Name: Complex Variables & Transforms**

**Course Code: MT-201**

**Credit Hours: 3+0**

#### **Objectives:**

To equip the students with the knowledge to Identify the complex number system, complex functions, and integrals of complex functions

#### **Course Contents:**

Introductory Concepts .Introduction to Complex Number System .Argand diagram .De Moivre's theorem and its Application Problem Solving Techniques .Analyticity of Functions .Complex and Analytical Functions, .Harmonic Function, Cauchy-Riemann Equations. .Cauchy's theorem and Cauchy's Line Integral. .Power series, Taylor series, Laurent series .Residual integration .Singularities .Singularities, Poles, Residues. .Contour Integration. .Laplace transform .Laplace transform definition, .Laplace transforms of elementary functions .Properties of Laplace transform, Periodic functions and their Laplace transforms, .Inverse Laplace transform and its properties, .Convolution theorem, .Inverse Laplace transform by integral and partial fraction methods, .Heaviside expansion formula, .Solutions of ordinary differential equations by Laplace transform, .Applications of Laplace transforms .Fourier series and Transform .Fourier theorem and coefficients in Fourier series, .Even and odd functions, .Complex form of Fourier series, .Fourier transform definition, .Fourier transforms of simple functions, .Magnitude and phase spectra, .Fourier transform theorems, .Inverse Fourier transform, .Solution of Differential Equations .Series solution of differential equations, .Validity of series solution, Ordinary point, .Singular point, Forbenius method, .Indicial equation, .Bessel's differential equation, its solution of first kind and recurrence formulae, .Legendre differential equation and its solution, .Rodrigues formula .

#### **Recommended books:**

1. Advanced Engineering Mathematics by Erwin Kreyszig, 10th Ed. Willey 2014. ISBN 978-0-470-91361-1.

### **4.1.19 Course Name: Communication Skills**

**Course Code: HS-103**

**Credit Hours: 3+0**

#### **Objectives:**

To equip the students with the knowledge of verbal and non-verbal communication; components of communication; problems of communication; intercultural communication in the global context.

#### **Course Contents:**

Principles of effective communication; concepts, benefits and characteristics of effective organizational communication; verbal and non-verbal communication; components of communication; problems of communication; intercultural communication in the global context; listening, speaking, reading and writing skills;

presentation skills; seven C's of effective communication; communication and the technology context; and formal letters, memorandum, curriculum vitae (résumé), and business e-mails

**Recommended books:**

1. Practical English Grammar by A. J. Thomson and A. V. Martinet. Fourth edition. Oxford University Press. ISBN 978-0-19-431342-1.
2. Practical English Grammar Exercises 1 by A. J. Thomson and A. V. Martinet. Third edition. Oxford University Press. ISBN 978-0-19-431349-0.
3. A Practical Guide to Business Writing: Writing in English for Non-Native Speakers by Khaled Mohamed Al Maskari. Wiley. ISBN 978 1 118 41079 0

**4.1.20 Course Name: Digital Logic Design**

**Course Code: EE-203**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of combinational and sequential circuits.

**Course Contents:**

Introduction to number systems; Boolean algebra; logic gates (AND, OR, NOT, etc.); Karnaugh maps; QM method; combinational circuits; half and full adder; subtractor, comparator, encoder, decoder, multiplexer, and de-multiplexer; sequential circuits; Flip Flop, (RS, JK, D, T, Master Slave); state transition diagram; counters, registers, memories; PLAs; Programmable Logic Devices (PLDs); hardware descriptive language (HDL Verilog); gate-level, data flow, and behavioral modeling; and use of simulation software

**Recommended Books**

1. M. Morris Mano and Micheal D. Ciletti, "Digital Design with an introduction to the Verilog HDL", Prentice Hall, 5th Edition.
2. Morris Mano and Charles R. Kime, "Logic and Computer Design Fundamentals", Prentice Hall. Latest Edition
3. Tocci and Widmer, "Digital Systems: Principles and Applications". Prentice Hall. Latest Edition

**4.1.21 Course Name: Digital Logic Design Lab**

**Course Code: EE-203L**

**Credit Hours: 0+1**

**Practical:**

Basic logic gates, hardware implementation of combinational logic circuits such as multiplexers and de-multiplexers, encoders/decoders, ALU; implementation of sequential circuits such as flip-flops, registers, shift registers, counters and other digital circuits. Complex engineering problem such as ALU Design in Verilog and its implementation in FPGA.

**4.1.22 Course Name: Engineering Drawing**  
**Course Code: ME-211**  
**Credit Hours: 0+1**

**Objective:**

To equip the students with the basic knowledge and skills of engineering drawing and its application in practical scenarios. The students will also be introduced to a CAD package.

**Course Outline:**

The students are introduced to engineering drawing, concepts of lines, orthographic projections, and how points, lines, and areas are projected. Emphasis would be on basic drawing concepts, classical techniques of drawing, dimensioning, introduction to CAD tools, and detailed CAD modeling in AutoCAD software.

**Practical:**

Contents as mentioned above

**Teaching Methodology**

Lab instructions/Lecturing  
Lab Assignments

**Assessment (Lab)**

Weekly lab reports  
Viva voce  
Project work

**Recommended Books:**

1. Shawna Lockhart, "Tutorial Guide to AutoCAD", Prentice Hall.
2. C. Parkinson, "First Year Engineering Drawing".
3. N.D. Bhatt, Engineering Drawing.

**4.1.23 Course Name: Data Structures & Algorithms**  
**Course Code: EC-221**  
**Credit Hours: 2+1**

**Objectives:**

Classify and analyze different categories of data structures and algorithms. Implement common searching and sorting algorithms.

**Course Contents:**

Data types, Arrays, Records, Set structure, Abstract Data Types, Sequential allocation, Linked allocation. Stacks (Sequential as well as Linked Implementation) Queues. (Sequential as well as Linked Implementation), Linked Lists, Recursive versus Iterative Algorithms, Applications, Towers of Hanoi, Linked Lists, Traversal, Insertion, Deletion, Doubly linked lists, Root Node, Terminal Node, Branch Node, Level of a Node, Degree of a node. Binary Tree, Tree traversal, (In-order/Pre-order/Post-order traversal), Shortest Path **Searching & Sorting Algorithms**, Insertion sort, Selections sort, Merge sort, Radix sort.

**Recommended Books:**

1. Horowitz Sahni, "Fundamentals of Data Structures in C++", 2014.
2. Lipshutz, "Data Structures", Schaum Outline Series, 2012.
3. Weiss, "Data structures and algorithm analysis in C++".
4. A. M. Tanenbaum, "Data structures using C and C++", 2001.

**4.1.24 Course Name: Electronic Devices & Circuits**

Pre-Requisite: College Physics/ Engineering Physics

**Course Code: EE-205**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of Bipolar junction transistor; DC biasing schemes; transistor AC equivalent models; AC analysis of common emitter and common collector amplifiers, JFET characteristics and DC biasing; MOSFET characteristics and DC biasing.

**Course Contents:**

Bipolar junction transistor; DC biasing schemes; transistor AC equivalent models; AC analysis of common emitter and common collector amplifiers; multistage amplifiers; differential amplifier; JFET characteristics and DC biasing; MOSFET characteristics and DC biasing; FET amplifiers and AC analysis; power amplifiers; amplifier frequency response; and operational amplifier-basics and characteristics

**Recommended Books**

1. Electronic Devices and Circuit Theory, H. Boylestad and L. Nashelsky, ISBN-10: 0135026490
2. Electronic Devices, Thomas L. Floyd, ISBN-10: 013235923586  
Electronics Principles, Alberto P Malvino ISBN: 978-0073373881

**4.1.25 Course Name: Electronic Devices & Circuits Lab**

**Course Code: EE-205L**

**Credit Hours: 0+1**

**4.1.26 Course Name: Translation of the Quran: Worships**  
**Course Code: QT-201**  
**Credit Hours: 1+0 (NC)**

**کورس کے اہداف:**

1. طلباء کو صحیح تلفظ سے قرآن کریم اور اس کا ترجمہ پڑھنے کے قابل بنانا
2. عبادات سے متعلق قرآنی موضوعات کا جمع و تعارف کروانا
3. عبادات کے موضوع پر قرآنی نقطہ نظر بیان کرنا
4. طالب علم کو عبادات کے اہم موضوعات (نماز، روزہ، زکوہ، حج) اہمیت، مفہوم، فوائد و احکامات کو قرآن حکیم کی روشنی اجاگر کرنا۔

**Week Wise Course Coverage Plan**

Week. No.	بنیادی عنوان	منتخب قرآنی آیات
1.	لازمی قرآنی ترجمہ کا نصاب (عبادات)	نصاب کا تعارف، اہمیت، مقاصد اور منتخب عبادات کا اجمالی تعارف
2.	عبادت وجہ تخلیق، معبود برحق، غیر اللہ کی عبادت، عبادت میں خلوص	الذاریات 56، الفاتحہ 4، آل عمران 51، النساء 36-87، المائدہ 76، الانعام 162، یونس 22، 28، 29، 104، الرعد 36، النحل 36، الزمر 11، المؤمن 65،
3.	اللہ کی عبادت صراط مستقیم اور ذریعہ فلاح، معبودان غیر سے سوال، تکبر عبادت سے محرومی کی وجہ اور انجام متکبرین	الکہف 110، مریم 25، الانبیاء 92، الفرقان 17، الشعراء 92، الصافات 35، المؤمن 60، 66،
4.	نماز کے شرائط قبلہ رخ ہونا، طہارت و صفائی	البقرہ 144، 149، 150، 238، 239، النساء 43، 101، 102، 103، 141، المائدہ 6، الاعراف 31، 29،
5.	نماز اور صبر نماز میں سستی، نماز چھوڑنے کے نقصانات اور وجوہات	البقرہ 45، 153، النساء 142، مریم 59، الماعون 4، 5،
6.	نماز کی اہمیت، پابندی، نماز مومن کی صفت،	البقرہ 43-177، التوبہ 18، النور 41، لقمان 17، الانعام 162، 163، طہ 132، المؤمنون 92، الفرقان 64، المائدہ 55-56، التوبہ 71، الحج 41.
7.	نماز کے اوقات، فوائد، نماز جمعہ	النساء 103، ہود 114، ابراہیم 37، بنی اسرائیل 79-78، طہ 130، 132، العنکبوت 45، الروم 18، 31، 17، ق 39، 40، الطور 48 و 49، الاعلیٰ 14، 15،
8.	نماز قصر، نماز جمعہ اور نماز عصر کی اہمیت، نماز جنازہ	النساء 102-102، الجمعہ 9، 10، البقرہ 238، التوبہ 84
9.	زکوٰۃ کی اہمیت، حکم، اجر و ثواب	البقرہ 43، 110، 177، 261، 265، 267، 277، 274، النساء 114، المائدہ 55، 12، 55، 56، بنی اسرائیل 26، مریم 55، الحج 78، النور 37، الدھر 8
10.	زکوٰۃ کے مصارف	البقرہ 83، 177، 273، النساء 8، 36، التوبہ 60، بنی اسرائیل 26، النور 22، المعارج 24، 25، الدھر 8، البلد 11 تا 16، بنی اسرائیل 26، مریم 55، الحج 78، النور 37، الدھر 8

11.	زکوٰۃ دینے اور نہ دینے والوں کی جزا و سزا	، الاعراف 156 التوبہ 34،35، 71، 103، العمران 180،92، الدهر 8،9، الليل 18 تا 21، الماعون 3
12.	نقلی صدقہ و خیرات	البقرہ 270 تا 273،276، 268، 254، 215، العمران 180،92،، بنی اسرائیل 100، التغابن 17، الدهر 8،9،
13.	روزہ، روزے کے اوقات و شرائط	البقرہ آیات 184،183، 196،187،185 التوبہ 112،مریم 26،
14.	روزے کا کفارہ، قضا، روزہ مؤمن مرد عورتوں کی صفت، روزہ بطور کفارہ	البقرہ ۱۸۴، الاحزاب 35،المجادلہ 4، التحريم 5، ، النساء 92، المائدہ 89
15.	حج اور عمرہ، طواف، کفارات حج، فرضیت حج، صفا مروہ	البقرہ،196،192،125،127،158،189، آل عمران 96،97، الفتح 27
16.	حج اور عمرہ کے احکام و ممنوعات	المائدہ 1،2،94،96،97،التوبہ 3،الحج 26،27،28،29،33،34

### Books Recommended:

1. The Translation of Holy Quran by Mufti Muhammad Taqi Usmani titled: "The Noble Quran Meaning with Explanatory Notes"
2. Mazameen e Quran Hakeem, By Zahid Malik

3. فتح محمد جالندھری، ترجمہ قرآن
4. مولانا مودودی، ترجمہ و تفسیر تفہیم القرآن
5. پیر محمد کر مشابہ الازہری: ترجمہ جمالی القرآن و تفسیر ضیاء القرآن
6. مفتی محمد شفیع عثمانی، ترجمہ و تفسیر معارف القرآن
7. فاروق بہاء الحق شاہ، خلاصۃ القرآن
8. ڈاکٹر اطہر محمد اشرف، جامع اشاریہ مضامین قرآن
9. زاہد ملک، مضامین قرآن حکیم

## Semester-4

### 4.1.27 Course Name: Professional Values & Ethics

**Course Code: HS-401**

**Credit Hours: 2+0**

#### **Objectives:**

To equip the students with the meaning of ethics and professional ethics; historical background of professional ethics and its need in engineering practice; essentials of professional ethics.

#### **Course Contents:**

Introduction and meaning of ethics and professional ethics; historical background of professional ethics and its need in engineering practice; essentials of professional ethics; ethical issues in engineering practice; resolving ethical problems; engineers and environment; societal concerns in engineering practice; plagiarism; Pakistan Engineering Council's Code of Ethics; and case studies.

#### **Recommended Books**

1. Engineering Ethics Concepts & Cases by Charles E Harris, 5th Edition, Cengage 2014, ISBN 9781285671130.
2. Kenneth Blanchard, Professional Ethics, 4th Edition

### 4.1.28 Course Name: Applied Linear Algebra

**Course Code: MT-303**

**Credit Hours: 2+0**

#### **Objectives:**

Interpret the vector equations and linear transformations. Illustrate how to solve a system of linear equations that appears in different engineering applications. Apply the basic knowledge of vector spaces, eigen value and eigen vectors.

#### **Course Contents:**

System of Linear Equations and Matrices, Introduction to system of linear equations, Matrix form of system of Linear Equations, Gaussian Elimination method, Gauss-Jordan Method , Consistent and inconsistent systems, Homogeneous system of equations , Vector Equations , Introduction to vector in plane , Vector in  $R^n$  , Vector form of straight line , Linear Combinations , Geometrical interpretation of solution of Homogeneous and Non-homogeneous equations, Applications of Linear Systems , Traffic Flow Problem , Electric circuit Problem , Economic Model , Linear transformations , Introduction to linear transformations , Matrix transformations , Domain and range of linear transformations , Geometric interpretation of linear transformations , Matrix of linear transformations , Inverse of a matrix , Definition of inverse of a matrix , Algorithm to find the inverse of matrices , LU factorization , Determinants , Introduction to determinants , Geometric meaning of determinants , Properties of determinants , Cramer Rule , Cofactor method for finding the inverse of a matrix , Vector Spaces , Definition of vector spaces , Subspaces , Spanning set , Null Spaces and column spaces of linear transformation , Linearly Independent sets



and basis , Bases for Null space and Kernal space , Dimension of a vector space, Eigen Values and Eigen vectors ,Introduction to Eigen value and Eigen vectors , Computing the Eigen values , Properties of Eigen values , Diagonalization , Applications of Eigen values.

**Recommended Books:**

1. Linear Algebra and its applications by David C. Lay. 4th Edition, Addison Wesley, ISBN 978 0 321 38517 8
2. Linear Algebra and its Applications by Gilbert Strang, 4th Edition, ISBN 978-0030105678

**4.1.29 Course Name: Introduction to Embedded Systems**

Pre-Requisite: Digital Logic Design

**Course Code: EE-204**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of embedded systems, microprocessor, microcontroller, simulation design and debugging.

**Course Contents:**

Scope and ubiquitous presence of embedded systems. Microprocessor and Microcontroller (AVR) Architecture. Internal Registers, Machine code, addressing modes and Instruction Set, C and the Compiler, Debugging Software and Hardware, Threads, Tasks and Simple Scheduling, Branching, Interrupt handling, I/O and Communication Ports programming, Digital and Analog I/O Peripherals, A/D and D/A interfacing, Simulation design and debugging. Application using PWM.

**Recommended books:**

1. Muhammad Ali Mazidi, Rolin D. McKinlay, and Danny Causey, “PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18”, Pearson.
2. Frank Vahid and Tony D. Givargis, “Embedded System Design: A Unified Hardware/Software Introduction”, John Wiley & Sons.
3. Muhammad Ali Mazidi, Sarmad Naimi, and Sepehr Naimi, “The AVR Microcontroller and Embedded Systems: Using Assembly and C” published by Pearson Custom Electronics Technology

**4.1.30 Course Name: Introduction to Embedded Systems Lab**

**Course Code: EE-204L**

**Credit Hours: 0+1**

**Practical:**

Learn to read datasheets/manuals in order to develop practical applications. Assembly and C language based microcontroller (PIC or Rasberry Pi) interfacing for interrupt and data based applications involving LED/ LCD, GPIO ports, communication ports, A/D, and D/A interfacing. Example project can be input voltage based speed control of DC Motor / stepper motor using PWM.

#### **4.1.31 Course Name: Probability and Statistics**

**Course Code: MT-302**

**Credit Hours: 3+0**

**Objectives:**

Apply basic probability concepts and their use in different problems. Apply basic statistical techniques such as regression, curve fitting to engineering data

**Course Contents:**

Basic probability concepts, conditional probability, Bayes' theorem Random variable, probability density function, cumulative distribution function Specific random variable discrete as well as continuous Moments and moment generating function Law of large numbers Basic statistical concepts, samples and sampling distributions Parameter estimation, hypothesis testing and curve fitting

**Recommended books:**

1. Alberto Leon-Garcia: Probability and Random Processes for Electrical Engineering. Prentice Hall, Inc. New Jersey, 3rd ed. 2008.
2. Peyton Z. Peeble Jr.: Probability and Random Variables and Random Signal Principles. McGraw Hill, 4th ed. 2001.
3. Richard L. Scheaffer and James T. McClave: Probability and Statistics for Engineers. Brooks/Cole, 5th ed. 2011.

#### **4.1.32 Course Name: Signal and Systems**

Pre-Requisite: Network Analysis

**Course Code: EE-206**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of Signals and Systems classification, models, and operations; time domain analysis of continuous-time and discrete-time systems

**Course Contents:**

Signals and Systems classification, models, and operations; time domain analysis of continuous-time and discrete-time systems; analysis of continuous-time systems using the Laplace Transform; discrete-time system analysis using the Z-Transform; and analysis of continuous-time signals using the Fourier Series and the Fourier Transform sampling theory.

**Recommended books:**

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and Systems", 2nd Edition, Prentice Hall, 1996
2. M. J. Roberts, "Fundamentals of Signals and Systems", McGraw-Hill, 2007
3. B. P. Lathi, "Linear Systems and Signals", 2nd Edition, Oxford, 2004

**4.1.33 Course Name: Signal and Systems Lab**  
**Course Code: EE-206L**  
**Credit Hours: 0+1**

**4.1.34 Course Name: Foreign Language**  
**Course Code: HS-404**  
**Credit Hours: 1+1**

#### **COURSE DESCRIPTION**

The course has been designed to enable the students to learn the basic rules and regulations of the Arabic language as well as to learn the basic level of speaking, writing, and reading of Arabic. Since the Arabic language is the language of the Qur'an and Sunnah as well as the Islamic basic sources, it is very important for students to equip themselves with the language of the Qur'an and the Sunnah along with the professional education they have chosen so that they can use the Qur'anic guidance in practical life. One of the objectives of teaching this course is that the graduates of HITEC University should not face any problem if they travel or get a job in any Arab country and can easily solve their problem through spoken Arabic

#### **Text Books:**

1. AL ARABIYYATU BAINA YADAIIKA العربية بين يديك  
By a group
2. ATT TARIQATUL ASRIYYA الطريقة العصرية  
By Dr. Abdur Razzaq Sikandar

#### **Reference books:**

1. AL ARABIYYATU BAINA YADAIIKA العربية بين يديك By a group
2. ATT TARIQATUL ASRIYYA الطريقة العصرية By Dr. Abdur Razzaq Sikandar
3. ELMUSSARF علم الصرف BY Mushtaq Ahmad Chirhawli
4. ELMUNNAHW علم النحو By Mushtaq Ahmad Chirhawli

## **Semester-5**

### **4.1.35 Course Name: Electrical Machines**

**Course Code: EE-309**

**Credit Hours: 3+0**

#### **Objectives:**

To equip the students with the knowledge of Basic principles of electromagnetism and simple linear machines; active, reactive, apparent, and complex powers; power factor measurement and improvement.

#### **Course Contents:**

Introduction to electrical machinery principles, single phase transformer, DC generators & motors, Basic principles of electromagnetism and simple linear machines; active, reactive, apparent, and complex powers; power factor measurement and improvement; need, construction, types and operation of power transformer; DC machinery fundamentals; DC motors; DC generators; and types of DC motors, Induction and Synchronous machines, Special Purpose Motors: Introduction to Single phase Induction Motors, Switched Reluctance motors, Hysteresis motors, Stepper, brushless DC motors.

#### **Recommended Books**

1. Stephen J. Chapman, "Electric Machinery Fundamentals", McGraw-Hill. (Latest Edition)
2. Fitzgerald, Kingsley and Umans, "Electric Machinery", McGraw-Hill. (Latest Edition)
3. Hindmarsh, "Electrical Machines", McGraw-Hill. (Latest Edition)
4. Theodore Wildi "Electrical Machines, Drives, and Power Systems"

### **4.1.36 Course Name: Electrical Machines Lab**

**Course Code: EE-309L**

**Credit Hours: 0+1**

**4.1.37 Course Name: Electromagnetic Theory**

Pre-Requisite: Engineering Physics

**Course Code: EE- 301**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of Vector analysis Cartesian; cylindrical and spherical coordinate systems; transformations and inter-conversions between coordinate systems and maxwell equations.

**Course Contents:**

Vector analysis Cartesian; cylindrical and spherical coordinate systems; transformations and inter-conversions between coordinate systems; differential length, area and volume; path, area and volume integrals in different coordinate systems; Del Operator, gradient, divergence and curl operations; classification of vector fields and divergence; Stokes's theorem, Coulomb's law, and Gauss's law; electric field; energy and potential; conductors and dielectrics; convection and conduction currents; polarization in dielectrics; equation of continuity and relaxation time; boundary conditions; Poisson's and Laplace's equations; uniqueness theorem; method of images; magnetic field and forces; magnetization in materials; time-varying fields and inductances; Faraday's law; transformer and motional EMFs; displacement current and current densities; and Maxwell's equations in point, integral, and differential form

**Recommended books:**

1. William Hayt and John A. Buck, "Engineering Electromagnetics", McGrawHill, ISBN: 0073104639, Latest Edition.
2. Sadiku, Matthew N, "Elements of Electromagnetics", Oxford University Press, ISBN: 0195103688, Latest Edition. 3
3. J. D. Kraus, "Electromagnetics", John Wiley & Sons, Latest edition.

**4.1.38 Course Name: Communication Systems**

**Course Code: EE-304**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of Amplitude modulation; baseband and carrier communications; Double Side Band (DSB); Single Side Band (SSB); Vestigial Side Band

**Course Contents:**

Amplitude modulation; baseband and carrier communications; Double Side Band (DSB); Single Side Band (SSB); Vestigial Side Band (VSB); super heterodyne AM receiver; carrier acquisition, television, angle modulation, instantaneous frequency, bandwidth, generation, and demodulation of FM/PM; noise; mathematical representation; signal to noise ratio; noise in AM, FM, and PM systems; pulse modulation; sampling and quantization; pulse amplitude modulation; pulse position and pulse width modulation; quantization noise; signal to quantization noise ratio; pulse code and delta modulation; and frequency and phase shift keying.

**Recommended books:**

1. Simon Haykin, "Communication Systems", John Wiley, Latest Edition.
2. B. P. Lathi and Zhi Ding, "Modern Digital and Analog Communication Systems", Oxford University Press, Latest Edition.

**4.1.39 Course Name: Communication Systems Lab****Course Code: EE-304L****Credit Hours: 0+1****4.1.40 Course Name: Linear Control Systems**

Pre-Requisite: Signal &amp; Systems

**Course Code: EE-305****Credit Hours: 3+0****Objectives:**

To equip the students with the knowledge of linear control systems.

**Course Contents:**

Concept of feedback in control systems; modeling of electrical and mechanical systems; transfer function of systems; stability; evaluation of output of a system for various inputs; Root Locus; PID controller; Bode plots; *and* introduction to state space concepts

**Recommended books:**

1. Steffani, Savant, Shahian and Hostetter, "Design of Feedback Control Systems" 4th Edition, Saunders College Publications.
2. Katsushiko, Ogata, "Modern Control Engineering," McGraw-Hill, `5th Edition
3. R. C. Dorf and R. H. Bishop, "Modern Control Systems," 12th Edition

**4.1.41 Course Name: Linear Control Systems Lab**

Pre-Requisite: Signal &amp; Systems

**Course Code: EE-305L****Credit Hours: 0+1****4.1.42 Course Name: Engineering Mechanics****Course Code: ME-210****Credit Hours: 2+0****Course Objective:**

The course will cover the fundamental concepts and principles of mechanics, force factors, resultants, equilibrium of rigid body, kinetics and kinematics of particles, relative motion, curvilinear motion, basic thermodynamics laws and cycles, processes and PV diagrams, heat transfer modes and heat transfer through walls and pipes

## **ME201: Engineering Mechanics (3-0)**

Fundamental concepts and principles of Mechanics, Force factors, Resultant of forces and vectors, Equilibrium of Rigid body, Trusses, Method of Joints, Kinetics of particles (1-D, 2-D Analysis), Kinematics of particles (1-D, 2-D Analysis), Relative Motion (1-D Analysis), Relative Motion (2-D Analysis), Curvilinear Motion, Basic Thermodynamics Laws, Basic Thermodynamics Cycles, Processes and thermodynamic diagrams, Heat transfer modes, Heat transfer through walls and pipes.

### **Recommended Books:**

#### **1. Engineering Statics**

a. R. C. Hibbler, 12<sup>TH</sup> Edition

#### **2. Engineering Dynamics**

a. R. C. Hibbler, 11<sup>TH</sup> Edition

#### **3. Thermodynamics**

a. Y. A. Cengel, 6<sup>TH</sup> Edition

#### **4. Heat & Mass transfer**

a. Y. A. Cengel, 6<sup>TH</sup> Edition

### **4.1.43 Course Name: Translation of the Quran: Moral Values**

**Course Code: QT-301**

**Credit Hours: 1+0 (NC)**

#### **کورس کے اہداف :**

1. طلباء کو صحیح تلفظ سے قرآن کریم اور اسکا ترجمہ پڑھنے کے قابل بنانا
2. قرآنی سورتوں کے اہم موضوعات کا تعارف کروانا
3. اہم مضامین قرآن سے متعلق آیات کا تعارف کروانا
4. طالب علم کو اہم قرآنی موضوعات (ایمانیات، عبادات، اخلاقیات، معاملات، احکامات) کا اس طرح احاطہ کروانا کہ وہ ان پر گفتگو کر سکے۔

### **Week Wise Course Coverage Plan**

قرآنی آیات	بنیادی عنوان	S. No.
تدریسی کورس کی اہمیت ، مقاصد، اہداف اور ترتیب منتخب موضوع "اخلاقیات" کا تعارف	لازمی قرآنی تعلیم ترجمہ کے ساتھ: کورس کا تعارف	1.
سورة البقرة 83، سورة الممتحنة 4، سورة الانبياء: 107، سورة القلم: 4.	علم الاخلاق اور فلسفہ اخلاق	2.
سورة ال عمران 159، سورة التوبة 128، 129، سورة انبياء 107، سورة الشعراء 215، سورة القلم 1 تا 4،	اخلاق نبوی ﷺ	3.
سورة المائدة 119، سورة التوبة 119، سورة الاحزاب 23، 24 اور 35، سورة الزمر 33 تا 35	اخلاق حسنة: صدق (سچائی)	4.
سورة البقرة 283، سورة ال عمران 75، سورة النساء 58	امانت و دیانت	5.
سورة البقرة 153، 155، 152، سورة ال عمران 200، النحل 126، 127 اور 40، الحج 34، 35، سورة لقمان 17، سورة حم السجدة 34، 35، ابراهيم 07،	صبر و شکر	6.
سورة البقرة 27، سورة الرعد 21، 22، اور 25 سورة النساء 01،	صلح رحمی	7.

8.	شفقت ورحمت	سورة البقرة 105، 155 تا 157، سورة ال عمران 8، سورة الانعام 54، 148، سورة الاعراف 56، 57، 56، بنى اسرائيل 100، الكهف 10، الانبياء 107
9.	عفو ودرگزر اور احسان	سورة البقرة 195، الاعراف 56، التوبه 120، سوره يونس 26، النحل 90، بنى اسرائيل 7، سورة النجم 31، سورة الرحمن 60
10.	آداب گفتگو و مجلس	سورة البقره 83، سورة لقمان 19، سورة المجادله 9، سورة النور 27، سورة المجادله 11،
11.	رزق حلال	سورة البقرة 168، 169، سورة المانده 1 تا 5، 96، سورة الاعراف 31، 32، سورة الانفال 69، سورة النحل 114، 116، سورة الحج 26، 30، سورة النور 61،
12.	ردائل اخلاق: خيانت وعده خلافى	سورة البقرة 40، سورة النساء 105 تا 107، سورة المانده 1، سورة الانفال 27، 58، سورة بنى اسرائيل 34، سورة الحج 38، سورة المومن 19،
13.	تكبر	سورة النساء 36، 172، 173، سورة النحل 22، 23، 29، سورة القصص 83، سورة لقمان 18، 19، سورة المومن 27، 60
14.	حرص و حسد	سورة البقرة 96، 109، سورة النساء 54، 53، 128، سورة الحشر 9، سورة التغابن 16، سورة الفلق
15.	غيبت، طعنه ظنى، لژانى جهگژا	سورة الحجرات 11، 12، سورة الانعام 148، 116، سورة يونس 36،
16.	دهوكه، حرام خورى	سورة البقرة 173، سورة المانده 91، 90، 87، 3، سورة الانعام 145، 21، سورة المطففين 1 تا 3،

### Books Recommended:

1. The Translation of Holy Quran by Mufti Muhammad Taqi Usmani titled: "The Noble Quran Meaning with Explanatory Notes"
2. Mazameen e Quran Hakeem, By Zahid Malik
3. فتح محمد جالندهرى، ترجمه قرآن
4. مولانا مودودى، ترجمه و تفسير تفهيم القرآن
5. پير محمد كرمشاه بالازبرى: ترجمه جمالى القرآن و تفسير ضياء القرآن
6. مفتى محمد شفيع عثمانى، ترجمه و تفسير معارف القرآن
7. فاروق بهاء الحق شاه، خلاصه القرآن
8. ڈاكٽر اطهر محمد اشرف، جامع اشاريه مضامين قرآن
9. زابد ملك، مضامين قرآن حكيم



## Semester-6

### **4.1.44 Course Name: Numerical Methods**

**Course Code: MT-202**

**Credit Hours: 2+1**

#### **Objectives:**

To equip the students with the knowledge different numerical methods. Solve ordinary differential equations and compute optimum points in optimization problems using numerical techniques.

#### **Course Contents:**

Introduction to Numerical Analysis; Measuring Errors, Sources of Errors, Propagation of Errors Solution of Nonlinear Equations; Bisection Method, Newton Raphson Method, Secant Method, False Position Method. Regression and Interpolation; Linear Regression, Nonlinear Regression, Direct Method Interpolation, Newton's Method of Interpolation, Lagrange Interpolation, Spline Interpolation. Numerical Differentiation and Integration; Numerical Differentiation, Continuous Functions, Discrete Functions, Numerical Integration, Trapezoidal Rule, Simpson's Rule, Simpson's Rule, Gauss Quad Rule, Improper Integrals. Initial Value Problems for Ordinary Differential Equations; Elementary Theory of Initial Value Problems, Euler's Method, Finite Differential Method, Runge Kutta Methods, Shooting Method, Higher Order Differential Equations Numerical Optimization; Golden Section Search Method, Newton's Method, Direct Search Method, Gradient Search Method, Simplex Method, Adequacy of Regression

#### **Recommended books:**

1. Numerical Analysis by Richard L. Burden
2. Numerical Methods with Applications by Autar K. Kaw

### **4.1.45 Course Name: Health Safety and Environment**

**Course Code: ME-407**

**Credit Hours: 1+0**

#### **Objectives:**

To equip the students with the knowledge of Health and Safety, Risk Management, Practical Health and Safety Management, Occupational Health and Safety Hazards, Environmental Management

#### **Course Contents:**

Introduction of Health and Safety, need of health and safety in our industry, size of the problem and ILO, Reasons for managing health and safety, general responsibilities in occupational health and safety, Risk Management, Principles of accident prevention, Risk Assessment, Accident Causation models. Risk Management Techniques and Practices: Introduction: identification, assessment and control, Safe system of works, Permit-to-Work, Use of Statistics in health and safety, Fault tree Analysis, Cost Benefit Analysis. Practical Health and Safety Management: ISO Standards for Safety and Health, Health and safety management model, culture and

behavior, Inspections, Reporting and Investigation, Introduction to Audit. Occupational Health and Safety Hazards: Fire, Safe use of machinery, Electricity, Safety on construction site, Managing chemical Safety Environmental Management: ISO standards, importance of clean environment, Environmental pollution, Industrial waste, Noise pollution.

**Recommended books:**

1. Health and Safety, Environment and Quality Audits: A Risk-based Approach by Stephen Asbury
2. Health and Safety in Construction Revision Guide: For the NEBOSH National Certificate in Construction Health and Safety by Ed Ferrett

**4.1.46 Course Name: Power System Analysis**

Pre-Requisite: Power Transmission and Distribution

**Course Code: EE- 309**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of power system analysis; complex power flow, per unit system, single line diagram.

**Course Contents:**

Introduction to power system analysis; complex power flow; per unit system; single line diagram; impedance and reactance diagram; bus admittance and bus impedance matrix; power flow solution methods and comparison; symmetrical fault analysis; sequence components; unsymmetrical faults; and power system stability analysis.

**Recommended Books**

1. Hadi Saadat, "Power System Analysis", McGraw-Hill International Editions.
2. Glover and Sarma "Power System Analysis"
3. William D. Stevensons Jr, "Elements of Power System Analysis", McGraw Hill, Latest Ed.
4. B. M. Weedy, B. J. Cory, N. Jenkins, Janaka B. Ekanayake, Goran Strbac "Electric Power Systems", John Wiley.

**4.1.47 Course Name: Power System Analysis Lab**

Pre-Requisite: Power Transmission and Distribution

**Course Code: EE- 309L**

**Credit Hours: 0+1**

**4.1.48 Course Name: Computer Communication Networks****Course Code: EE- 307****Credit Hours: 3+0****Objectives:**

To equip the students with the knowledge of Computer communication concepts; layered network architectures and protocol reference models; systems and technologies

**Course Contents:**

Computer communication concepts; layered network architectures and protocol reference models; systems and technologies for physical layer; medium access control protocol; data link protocols; network layer functions and protocols; internetworking concepts; LAN, WAN, and MAN; telecom networks; IP based networks and services; and TCP/IP suit of protocols.

**Recommended Books**

1. James F. Kurose and K. W. Ross, "Computer Networking: A top-down approach".
2. Bruce S. Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann Publishers, Latest edition
3. S. Tanenbaum, "Computer Networks", Prentice Hall, Latest Edition

**4.1.49 Course Name: Computer Communication Networks Lab****Course Code: EE- 307L****Credit Hours: 0+1****Practical:**

Few suggested laboratory tasks

1. Cable construction
2. Building a switch based network
- 3.

**4.1.50 Course Name: Power Transmission and Distribution****Pre-Requisite: Power Generation****Course Code: EE-310****Credit Hours: 3+0****Objectives:**

To equip the students with the knowledge of Power Distribution and Utilization.

**Course Contents:**

Introduction to distribution systems, power cables, grounding and earthing, power factor, electrochemical process, heating and welding, fundamentals of illumination, modern trend in power distribution and utilization. Overview of power system in Pakistan; one-line diagram; choice of voltage and AC/DC systems; types of conductors; skin effect; Ferranti effect; short, medium and long transmission lines; surge impedance loading; line supports; mechanical design; sag and tension calculation; insulator material; types of insulators; string efficiency; corona effect;

corona loss; radio interference due to corona underground cables; classification of HVDC transmission; distribution system; urban, suburban and rural distribution systems; primary, secondary and tertiary voltages; radial and ring main systems; disadvantages and causes of low power factor; heating and welding; and fundamentals of illumination engineering.

#### **Recommended Books**

1. M. V. Deshpande, "Elements of Electrical Power Station Design", 2010, PHI Publishers
2. M. M. El Wakil, "Power Plant Technology", McGraw Hill International Editions, Electrical and Mechanical Engineering Series.
3. Arche W. Culp "Principles of Energy Conversion", Latest Edition. TuranGonen, "Electrical Power Distribution System", CRC Press.
4. Turan Gonen, "Electrical Power Transmission System Engineering --- Analysis & Design", John Wiley & Sons

#### **4.1.51 Course Name: Power Transmission and Distribution Lab**

Pre-Requisite: Power Generation

**Course Code: EE-310L**

**Credit Hours: 0+1**

#### **4.1.52 Course Name: Electronic Circuit Design**

Pre-Requisite: Electronic Device and Circuits

**Course Code: EE-308**

**Credit Hours: 3+0**

#### **Objectives:**

To equip the students with the knowledge of electronic system design.

#### **Course Contents:**

Basics of operational amplifier, classification of amplifier on the basis of biasing, practical amplifier consideration, differential amplifier, op-amp circuits and op-amp responses; active filters, oscillators, and timers; voltage regulators; *and* special purpose amplifiers (instrumentation amplifiers, operational trans-conductance amplifiers, log and anti-log amplifiers).

#### **Recommended Books**

1. Electronic Devices and Circuit Theory, H. Boylestad and L. Nashelsky, ISBN-10: 0135026490
2. Electronic Devices, Thomas L. Floyd, ISBN-10: 013235923586
3. Electronics Principles, Alberto P Malvino ISBN: 978-0073373881

#### **4.1.53 Course Name: Electronic Circuit Design Lab**

Pre-Requisite: Electronic Device and Circuits

**Course Code: EE-308L**

**Credit Hours: 0+1**

**Practical:**

Few suggested laboratory tasks

1. Characteristics and Analysis of different components (e.g. BJTs, FET and MOSFETs etc.)
2. Practical implementation of example circuits.
3. Design of Transmitters and Receivers

**4.1.54 Course Name: Economics**

**Course Code: HS-402**

**Credit Hours: 2+0**

**Objectives:**

To equip the students with Principles of engineering economy; scarcity and alternatives; opportunity cost of each choice; normative and positive economic analysis.

**Course Contents:**

Principles of engineering economy; scarcity and alternatives; opportunity cost of each choice; normative and positive economic analysis; consumer and producer goods; types of markets; demand law; supply law; price equilibrium; circular flow diagram; stakeholders; theory of firms' behavior; cost terminologies; cost curves; breakeven analysis; time value of money; methods of calculating interest; methods of depreciation; project cost control; numerical and graphical representation of breakeven; internal rate of return; payback period; discrete and continuous compounding; types of ownership; project feasibility analysis; macroeconomics; inflation; unemployment; and economic forces.

**Recommended Books**

1. Contemporary Engineering Economics by Chan S. Park, 6th edition, Pearson 2015, ISBN: 978- 0134105598
2. Engineering Economic Analysis by Donal G. Newnan, Jerome P. Lavelle, Ted G. Eschenbach, 12th edition, Oxford University Press, ISBN: 978-0199339273
3. Engineering Economy by Leland T. Blank and Anthony Tarquin

**4.1.55 Course Name: Digital Signal Processing**

Pre-Requisite: Signals and Systems

**Course Code: EE-306**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of digital signal processing; discrete signals and systems; time-domain analysis of discrete-time signals; frequency-domain analysis.

**Course Contents:**

Introduction to digital signal processing; discrete signals and systems; time-domain analysis of discrete-time signals; frequency-domain analysis; Fourier series and Fourier transform; system response and frequency response; Z-Transform and its properties; digital filter design; Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) filters and their applications in signal processing; and real time digital signal processing.

**Recommended books:**

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and Systems", 2nd Edition, Prentice Hall, 1996
2. M. J. Roberts, "Fundamentals of Signals and Systems", McGraw-Hill, 2007
3. B. P. Lathi, "Linear Systems and Signals", 2nd Edition, Oxford, 2004

**4.1.56 Course Name: Digital Signal Processing Lab**

Pre-Requisite: Signals and Systems

**Course Code: EE-306L**

**Credit Hours: 0+1**

## Semester-7

### **4.1.57 Course Name: Management & Entrepreneurship**

**Course Code: HS- 403**

**Credit Hours: 3+0**

#### **Objectives:**

To equip the students with the knowledge of Management & Entrepreneurship.

#### **Course Contents:**

Introduction to management; a manager; roles and responsibilities of a manager; organizational structure and cultures; project management; technology management; strategic planning; SWOT analysis; porter forces; design of goods and services; operations and production; workplace management; lean operations; Toyota production system; total quality management; 6 sigma quality; inventory management; process strategies; process of entrepreneurship; innovation concepts; and factors influencing entrepreneurship.

#### **Recommended Books**

1. Technology Ventures: From Idea to Enterprise by Thomas Byers, Richard Dorf, Andrew Nelson, 4th Edition, McGrawHill 2015, ISBN 9780073523422
2. The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company by Steve Blank, Bob Dorf, K & S Ranch 2012, ISBN 9780984999309
3. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses by Eric Ries, Penguin Books 2011, ISBN 9780307887894

### **4.1.58 Course Name: Robotics**

**Course Code: ME-427**

**Credit Hours: 3+0**

**Objectives:** To develop a working knowledge of the mathematical aspects of robot manipulator analysis and control

#### **Course Contents:**

This course is concerned with fundamentals of robotics, including kinematics, dynamics, motion planning, computer vision, and control. The goal is to provide a complete introduction to the most important concepts in these subjects as applied to industrial robot manipulators, mobile robots, and other mechanical systems.

Types of robots, Types of joints used in robots, Degree of freedom and constraints, Types of planar and spatial mechanisms, Transformations from one system to the other, Forward and Inverse kinematics, Jacobian, Velocity and Force Analysis, Dynamics of robots, Path planning and trajectory analysis, Mechanism design (serial and parallel) used in robots, Linear control of manipulators, Sensors and actuators used in robotics, current trends in robotics.

**Recommended books:**

1. Robot Modeling and Control (1<sup>st</sup> Edition) by Mark W. Spong Seth Hutchinson & M. Vidyasagar
2. Introduction to Robotics, by J. J. Craig, Addison-Wesley, Latest Edition
3. Introduction to Robotics, by O. Khatib and K. Kolarov, Latest edition
4. Robot dynamics and Control, by M. W. Spong and M. Vidyasagar, Wiley & Sons, Latest Edition
5. Robotics and Automation: An introduction to Cams, Mechanisms, and Robotics, by D. Tesar and S. Todunoglu., Latest edition
6. Robot Analysis: The Mechanics of Serial and Parallel Manipulators, by Lung-Wen Tsai, John Wiley & Sons, Latest edition
7. Introduction to Robotics Mechanics and Control (3<sup>rd</sup> Edition) by JOHN J. CRAIG

**4.1.59 Course Name: Translation of the Quran: Dealings and Commandments****Course Code: QT-401****Credit Hours: 1+0 (NC)****کورس کے اہداف:**

1. طلبا کو صحیح تلفظ سے قرآن کریم اور اس کا ترجمہ پڑھنے کے قابل بنانا
2. معاملات اور احکامات سے متعلق قرآنی موضوعات کا جمع و تعارف کروانا
3. معاملات اور احکامات کے موضوع پر قرآنی نقطہ نظر بیان کرنا
4. طالب علم معاملات اور احکامات کے اہم موضوعات کی اہمیت، مفہوم، فوائد و احکامات کو قرآن حکیم کی روشنی اجاگر کرنا.

**Week Wise Course Coverage Plan**

قرآنی آیات	بنیادی عنوان	S. No.
تدریسی کورس کی اہمیت ، مقاصد، اہداف اور ترتیب منتخب موضوع معاملات اور احکامات کا تعارف	لازمی قرآنی ترجمہ کا نصاب (معاملات اور احکامات)	1.
(نکاح) البقرہ 221، 226-232، النساء3، 22-24 المائدہ 5 النور 33، المائدہ5، الاحزاب 49، المجادلۃ 3-4، الطلاق 1-7	نکاح اور طلاق	2.
(وصیت) البقرہ 180-240، 181، (میراث) ، النساء11-، 176، 19، 33، 12، 4، المائدہ106-108 الانفال75. الاحزاب 6. یس 48-50. الذاریات53. البلد 17-18.	وصیت اور میراث	3.
(قتل) البقرہ 217، النساء92-93، المائدہ32، بنی اسرائیل 33، الفرقان 68، (قتل اولاد) الانعام 151، بنی اسرائیل 33-31، (قصاص) البقرہ، 194، 178-79 المائدہ 45.	حدود اللہ (قتل، قصاص، دیت وغیرہ)	4.
البقرہ 215، 228 النساء 8، 1-2، 29-30، 32، 36، 34، 58 الروم38، الزاریات15-19. الرعد 38-39. ابراہیم41. مریم32. لقمن 14-15. النور 22. الانفال 41. التوبۃ 60. الاحزاب 6.	حقوق العباد (زوجین، والین، پڑوسیوں کے حقوق) وغیرہ	5.
البقرہ 256، 22 النساء ۹۲ آل عمران 103، 190-191 التوبۃ 11، 60 الاحزاب 5 الحجرات 10 یونس 99-100 الرعد 3. النخل 10-11، 44 الروم 8 الحشر21.	بھائی چارہ اور دیگر بنیادی انسانی حقوق (آزادی فکر و مذہب اور غلامی اور مکاتبت کی حوصلہ شکنی)	6.
النساء 107. المائدہ 60، 32-34-38. الانعام 123-124، 160. الاعراف 124. یوسف 79-70، 181-182 طہ 71. الحج 40. الشعراء 49. التکویر 1-9. الممتحنۃ 12.	جرانم (چوری، جادو، شرک اور دیگر گناہ کی سزا)	7.



8.	بيوع (خريد و فروخت) ناپ تول ميں كمى وغيره	البقره 275، 282، 198، النساء 29 ابراهيم 31 النور 37 الجمعه 9. بود 84-86 بنى اسرائيل 35 توبه 24 الانبياء 47 الرحمن 7-9 المطففين 1-6. فاطر 29-30.
9.	حلال، حرام (جانور اور ديگر اشياء خورد و نوش)	(حلال و حرام). البقره 168-169، المائدة 1-3-5 الانعام 6 الاعراف 31-32، الانفال 69، النخل 66، الحج 30، 34، النور 45، 61، النمل 82. فاطر 28. يس 71-73.
10.	سود اور قرض كے احكامات	البقره 245، 275-276، 278-279، 282-283. النساء 11 آل عم 130-الروم 39. التوبه 60، التغابن 17
11.	جهوٹ، دھوكه، فریب، خيانت، ملاوٹ ترك كرنے كے احكام	الحج 30، الزمر 3، المومن 28، المطففين 1-3، النساء 105-107، الانفال 27، 58، الحج 38، المومن 19.
12.	مسلمانوں كے باہمی تعلقات، متحدہ اسلامى قوميت	البقرة 213، 143 النساء 59 آل عمران 104، 110، المائدة 48، 66، الانعام 108 الاعراف 34 الانفال 1، 45-46 يونس 47 النمل 83-84 المومن 5 الفاطر 24 الفتح 29 الجاثية 28. يوسف 45.
13.	دوستى اور دشمنى كى قرآنى اصول	. البقرة 36، 85، 193 آل عمران 28، 103، 118 النساء 29، 91، 144 المائدة 8، 14، 51، 55-58، 64، 82، 91. الاعراف 149، 128
14.	دوستى اور دشمنى كى قرآنى اصول	التوبه 71. الاحزاب 6. الممتحنة 1، 4. حم السجدة 34-35 القصص 28. المنافقون 4. التغابن 14.
15.	مسلمانوں كا غير مسلموں كے ساتھ تعلقات كى نوعيت	آل عمران 118-119 الانعام 108 الاعراف 199 الانفال 61 التوبه 6-7 النجم 29 هود 113 الفرقان 52 القصص 86-87. الاحزاب 48 الجاثية 18-19 الدهر 24.
16.	احكام قتال (كافروں سے جنگ كے احكام اور جنگى قيديوں كے حقوق وغيره)	البقرة 84-85، 190-193، 244 النساء 76، 84، 90، 96-95، الانفال 15-16، 38، 40، 57، 60-62، 65، 71- التوبه 123 محمد 4 الحجرات 9-10 الصف 4

### 1. Books Recommended:

1. The Translation of Holy Quran by Mufti Muhammad Taqi Usmani titled: "The Noble Quran Meaning with Explanatory Notes"
2. Mazameen e Quran Hakeem, By Zahid Malik

3. فتح محمد جالندهرى، ترجمه قرآن
4. مولانا مودودى، ترجمه و تفسير تفهيم القرآن
5. پير محمد كرمشاه بالازبرى: ترجمه جمال القرآن و تفسير ضياء القرآن
6. مفتى محمد شفيق عثمانى، ترجمه و تفسير معارف القرآن
7. فاروق بهاء الحق شاه، خلاصه القرآن
8. ڈاكٲر اطهر محمد اشرف، جامع اشاريه مضامين قرآن
9. زابد ملك، مضامين قرآن حكيم

Course Name: Depth Elective-I

Course Code: EE-4XX

Credit Hours: 3+0

Course Name: Depth Elective-I Lab

Course Code: EE-4XXL

Credit Hours: 0+1

Course Name: Depth Elective-II

Course Code: EE-4XX

**Credit Hours: 3+0**

**Course Name: Depth Elective-II Lab**

**Course Code: EE-4XXL**

**Credit Hours: 0+1**

**Course Name: Senior Design Project-I**

**Course Code: EE-401**

**Credit Hours: 0+3**

**Note:**

**Course offered against depth electives will be decided by Departmental Board of Studies from the list of stream electives**

## **Semester-8**

**Course Name: Depth Elective-III**

**Course Code: EE-4XX**

**Credit Hours: 3+0**

**Course Name: Depth Elective-III Lab**

**Course Code: EE-4XXL**

**Credit Hours: 0+1**

**Course Name: Depth Elective-IV**

**Course Code: EE-4XX**

**Credit Hours: 3+0**

**Course Name: Depth Elective-IV Lab**

**Course Code: EE-4XXL**

**Credit Hours: 0+1**

**Course Name: Depth Elective-V**

**Course Code: EE-4XX**

**Credit Hours: 3+0**

**Course Name: Senior Design Project-II**

**Course Code: EE-401**

**Credit Hours: 0+3**

**Note:**

**Course offered against depth electives will be decided by Departmental Board of Studies from the list of stream electives**

## **ELECTIVE COURSES**

**Course Name: Instrumentation and Measurement**

**Course Code: EE-402**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of op-amp based electronic voltmeters; digital voltmeters and ammeters; frequency measurement; sensors and transducers; analog and digital interfacing of sensors and transducers.

**Course Contents:**

Engineering units and standards; galvanometer; DC ammeters; DC voltmeters; ohmmeters; DC meter calibration; half-wave and full-wave AC voltmeters; energy meters; transistor based electronic voltmeters; op-amp based electronic voltmeters; digital voltmeters and ammeters; frequency measurement; sensors and transducers; analog and digital interfacing of sensors and transducers; high voltage/current measurement; and sensors and IOT.

**Recommended Books**

1. Modern Electronic Instrumentation and Measurements Techniques by A.D.Helfrick, W.D. Cooper
2. Klaas B. Klaassen and Steve Gee, "Electronic Measurement and Instrumentation," 1996, Cambridge University Press, ISBN: 0521477298.T
3. H Kevin, JamesH, "PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control," 2000, Newnes, ISBN: 0750646241.

**Course Name: Instrumentation and Measurement Lab**

**Course Code: EE-402L**

**Credit Hours: 0+1**

**Course Name: Power Generation**

**Course Code: EE-404**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of and techniques of power generation.

**Course Contents:**

Introduction to different power plants; hydroelectric power plants; overview, advantages and disadvantages; schematic arrangement; choice of site, constituents, and problems; steam power station; nuclear power plants; gas and diesel power plants; solar and wind power generation; economic aspects; diversity factor, load factor, plant capacity factor, plant use factor, and load duration curve; tariff; power factor improvement; load scheduling; grounding systems; energy management and substations; and renewable energy.

**Recommended Books**

1. M. V. Deshpande, "Elements of Electrical Power Station Design", 2010, PHI Publishers
2. M. M. El Wakil, "Power Plant Technology", McGraw Hill International Editions, Electrical and Mechanical Engineering Series.
3. Arche W. Culp "Principles of Energy Conversion", Latest Edition.

**Course Name: Power Generation Lab**

**Course Code: EE-404L**

**Credit Hours: 0+1**

**Course Name: Wave Propagation & Antennas**

Pre-Requisite: Electromagnetic Theory

**Course Code: EE- 416**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge and techniques of antenna design.

**Course Contents:**

Wave fundamentals; plane waves; propagation modes; LOS wireless impairments; antennas; types of antennas; radiation mechanism; current distribution on a thin wire antenna; Thevenin equivalent model; antenna parameters; Faris transmission equation and radar range equation; receiving antennas reciprocity; matching and feeding networks; antennas in wireless technology; smith chart; determination of line impedance and admittance; impedance matching; dipole antenna and its radiation mechanism; micro strip patch antennas design; losses in antennas; dielectric substrates; permittivity; and loss tangent.

**Recommended Books**

1. Antenna Theory: Analysis and Design, 4th Edition by Constantine A. Balanis  
SBN: 978-1-118- 64206-1
2. Antennas for all applications (2nd Ed.) by J. D. Krauss
3. Antennas and propagation for wireless communication systems (2nd Ed.) by Simon R. Saunders

**Course Name: Wave Propagation & Antennas Lab**

Pre-Requisite: Electromagnetic Theory

**Course Code: EE- 416L**

**Credit Hours: 0+1**

**Course Name: Electrical Power Transmission**

**Course Code: EE-405**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of Power Transmission.

**Course Contents:**

Overview of power systems, primary parameters of transmission line, Primary Parameters of Transmission Line, Resistance, Skin effect, Line inductance based on flux considerations, Inductance of single phase 2-wire line, Inductance of composite conductor line, use of tables, Inductance of 3-phase line with equilateral and un-symmetrical spacings, Transposition, inductance of bundled conductors., Capacitance of two-wire and 3-phase line, Effect of earth on capacitance; capacitance of bundled conductors, parallel circuit lines, steady state analysis of transmission line, insulator for overhead transmission lines, corona, mechanical design of overhead lines, HVDC transmission.

**Recommended Books**

1. Turan Gonen, "Electrical Power Transmission System Engineering --- Analysis & Design", John Wiley & Sons.
2. Electrical Transmission and Distribution Reference Book by Central Station Engineers, Westinghouse

**Course Name: Electrical Power Transmission Lab**

**Course Code: EE-405L**

**Credit Hours: 0+1**

**Course Name: Power Electronics**

Pre-Requisite: Electronic Devices and Circuits

**Course Code: EE- 401**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of power electronics, converters and applications and power electronic devices.

**Course Contents:**

Principles of power electronics; converters and applications; power electronic devices; half-wave and full-wave rectifiers with resistive and inductive loads; thyristors—characteristics; working; gate driving circuits and protection; single-phase controlled rectifiers; DC to DC converters-buck; boost and buck-boost; DC switched mode power supplies; PWM inverters and their voltage control techniques; three phase un-controlled and controlled rectifiers; power transistors; AC voltage controllers; and cyclo-converters.

**Recommended Books**

1. Ned Mohan, William P. Robbins and Tore M. Undeland, "Power Electronics: Converters, Applications and Design," Media Enhanced, Third Edition, 2003, John Wiley & Sons, Latest Edition.
2. Robert W. Erickson and Dragan Maksimovic, "Fundamentals of Power Electronics," Springer, Latest Edition.
3. Muhammad H. Rashid "Power Electronics: Circuits, Devices & Applications" Prentice Hall, Latest Edition

**Course Name: Power Electronics Lab**

Pre-Requisite: Electronic Devices and Circuits

**Course Code: EE- 401L**

**Credit Hours: 0+1**

**Course Name: Optical Communication**

Pre-Requisite: Communication Systems

**Course Code: EE- 417**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of optical fiber communications.

**Course Contents:**

Introduction to optical fiber communications; basic principles; Snell's law; numerical aperture (NA); Fresnel loss; fiber types; single mode and multimode; optical fiber losses (attenuation, dispersion, and polarization); special optical fibers; light sources (LED, LASER); light detection; components and connectors; link budget calculations; receiver design considerations; modulation schemes; OTDR, DWDM systems; and optical fiber preparation methods.

**Recommended Books**

1. John M. Senior, "Optical Fibre Communications: Principles and Practice", Latest Edition, Prentice Hall, ISBN: 0136354262.
2. Gerd Keiser, "Optical Fibre Communications," Latest Edition, McGraw-Hill, ISBN: 0072360763.
3. Harold Kolimbris, "Fiber Optics Communications," Latest Edition, Prentice Hall, ISBN: 0130158836.

**Course Name: Optical Communication Lab**

Pre-Requisite: Communication Systems

**Course Code: EE- 417L**

**Credit Hours: 0+1**

**Course Name: Industrial Electronics**

Pre-Requisite: Power Electronic

**Course Code: EE- 409****Credit Hours: 3+0****Objectives:**

To equip the students with the knowledge of Industrial Electronics and its applications.

**Course Contents:**

Instrumentation and control; digital instrumentation techniques; analog and digital implementation of PID controllers; DC motor drives; modeling of DC motors; speed control; phase controlled converters; AC motor drives; induction motor model and operational characteristics; steady state and dynamic d-q model; scalar and vector control drives; PLCs architecture and I/O modules; ladder logic; programming; analog and digital signal interfacing; industrial communication; industrial networking; mod-bus and profit-bus; and SCADA system

**Recommended Books**

1. Frank D. Petruzella, "Programmable Logic Controllers," Latest Edition Frank D. Petruzella, "Industrial Electronics," Latest Edition
2. Terry L.M. Bartelt, "Industrial Control Electronics," Cengage Learning, Latest Edition
3. Kelvin T. Erickson, "Programmable Logic Controllers: An Emphasis on Design and Application," Dogwood Valley Press LLC, Latest Edition

**Course Name: Industrial Electronics Lab**

Pre-Requisite: Power Electronic

**Course Code: EE- 409L****Credit Hours: 0+1****Course Name: Digital Communications**

Pre-Requisite: Communication Systems

**Course Code: EE-415****Credit Hours: 3+0****Objectives:**

To equip the students with the knowledge of Digital Communication systems.

**Course Contents:**

Significance of digital communication; probability and random variables; SNR and Eb/No, sampling and quantization (uniform and non-uniform); detection of a binary signal in Gaussian noise; matched filters and correlators; Bayes' decision criterion; maximum likelihood detector; error performance; Inter-Symbol Interference (ISI); root raised cosine pulse; equalization techniques; Gram-Schmidt orthogonality principle; performance analysis of M-array signaling techniques; Error correcting codes; block codes, design, and analysis of convolution codes; and advanced



techniques for digital communication (DS-CDMA, FH-CDMA, OFDM, MIMO techniques).

**Recommended Books**

1. S. Haykin, Communication Systems, 4th edition, John Wiley, 2001.
2. J.G. Proakis, Digital Communications, 4th ed, McGraw Hill, 2001
3. B. Sklar, Digital Communications: Fundamentals and Applications, 2nd edition, Prentice Hall.

**Course Name: Digital Communications Lab**

Pre-Requisite: Communication Systems

**Course Code: EE-415L**

**Credit Hours: 0+1**

**Course Name: High Voltage Engineering**

**Course Code: EE- 410**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of High Voltage Engineering principles.

**Course Contents:**

High voltage engineering; withstand levels; S curves; insulation coordination; breakdown mechanisms in solids, liquids, gases, and vacuum; non-destructive testing of apparatus; insulation resistance; partial discharge measurements; life testing; accelerated life testing; Weibull statistics; system overvoltage occurrence and its characteristics; frequency and harmonics; switching; transients; Bewley lattice diagrams; wave tables; attenuation and distortion of surges; overvoltage protection; rod and expulsion gaps; surge diverters; circuit breakers aims; types and operation; HV testing; HV production for test objects; impulse generators; series resonant AC test sets; DC test sets; and absolute measurement methods.

**Recommended Books**

1. High Voltage Engineering by Y. Kuffel, J. Kuffel and W. S. Zaingi 2nd ed.
2. High Voltage Engineering by M.S. Naidu, V. Kamaraju, 4th ed
3. High Voltage Engineering by Muhammad Naeem Arbab 1st ed

**Course Name: High Voltage Engineering Lab**

**Course Code: EE- 410L**

**Credit Hours: 0+1**

**Course Name: Renewable Energy Systems**

Pre-Requisite: Power Generation

**Course Code: EE- 411****Credit Hours: 3+0****Objectives:**

To equip the students with the knowledge of Fundamentals and main characteristics of renewable energy sources.

**Course Contents:**

Fundamentals and main characteristics of renewable energy sources and their differences, compared to fossil fuels; technological basis for harnessing renewable energy sources; comparison of different renewable energy technologies; designing of renewable/hybrid energy systems that meet specific energy demands; solar energy, wind energy, biomass, hydropower, wave energy, ocean thermal energy, tidal energy, and geothermal energy conversion; and environment and renewable energy.

**Recommended Books**

1. Godfrey Boyle, Renewable Energy and Power for a sustainable future, OUP
2. John Twidell, Tony Weir, "Renewable Energy Resources", Second Edition, 2006, Taylor and Francis, New York and London
3. Aldo V. da Rosa, "Fundamentals of Renewable Energy Processes", Second Edition, 2005, Academic Press.

**Course Name: Renewable Energy Systems Lab**

Pre-Requisite: Power Generation

**Course Code: EE- 411L****Credit Hours: 0+1****Course Name: Wireless and Mobile Communication**

Pre-Requisite: Communication Systems

**Course Code: EE- 419****Credit Hours: 3+0****Objectives:**

To equip the students with the knowledge of wireless communication systems, cellular system design fundamentals and wireless channel models.

**Course Contents:**

Introduction to wireless communication systems; cellular system design fundamentals; wireless channel models; path loss; shadowing; multipath fading; wideband channel models; capacity of wireless channels; digital modulation; performance in wireless fading channels; diversity (time, frequency, and space); equalization; multicarrier modulation (OFDM); spread spectrum (CDMA); cellular concept; frequency reuse; multiuser systems; and wireless networks.

**Recommended Books**

1. Theodore S. Rappaport, "Wireless Communications", Latest Edition
2. William Stallings, "Wireless Communication & Networks" Latest Edition 163
3. William Lee, "Wireless & Cellular Communication", McGraw-Hill, Latest Edition
4. Andrea Goldsmith, "Wireless Communication", Latest Edition

**Course Name: Wireless and Mobile Communication Lab**

Pre-Requisite: Communication Systems

**Course Code: EE- 419L**

**Credit Hours: 0+1**

**Course Name: Electrical Machine Design**

Pre-Requisite: Electrical Machines

**Course Code: EE- 413**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of Industrial standardization, national and international standards, testing laboratories, manufacturing; design considerations.

**Course Contents:**

Industrial standardization; national and international standards; testing laboratories; manufacturing; design considerations; properties and applications of materials for magnetic machine; insulation system and its design considerations; mechanical design considerations; specific loading and output; induction motor; introduction to computer aided design (CAD) and computer aided manufacturing (CAM); safety precautions; troubleshooting and emergency repairs; and installation, commissioning, testing, maintenance, and troubleshooting of power transformers, induction motors, and AC generators.

**Recommended Books**

1. S. Rao, "Commissioning, Operation and Maintenance of Electrical Equipment", Khanna Publisher, India, Latest Edition.
2. M. G. Say, "Alternating Current Machines", Pitman Publishing Ltd.

**Course Name: Electrical Machine Design Lab**

Pre-Requisite: Electrical Machines

**Course Code: EE- 413L**

**Credit Hours: 0+1**

**Course Name: Telecom Transmission and Switching Systems**

Pre-Requisite: Communication Systems

**Course Code: EE- 418**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of Telecommunication transmission systems, routing techniques and line encoding techniques.

**Course Contents:**

Telecommunication transmission systems; routing techniques; line encoding techniques; types of switching circuits; message and packet switching; telecommunication networks (PST and PLMN); digital switches; telecom traffic models; PABX and public exchange traffic; GoS; blocking probabilities; signaling system # 7 (CCS7 or SS7); protocol architecture; mapping with OSI model, MSU, LSSU, and FISU; and next generation networks

**Recommended Books**

1. J. E. Flood, "Telecommunication Switching, Traffic and Networks" First Edition, 1995, Prentice Hall, ISBN-13: 978-0130333094.
2. John Bellamy, "Digital Telephony", Third Edition, 2000, Wiley Interscience, ISBN-13: 978- 0471345718.
3. Roger L. Freeman, "Telecommunications Transmission Handbook", Fourth Edition, 1998, Wiley, ISBN-13: 978-0471672487.
4. David R. Smith, "Digital Transmission Systems", Third Edition, 2012, Springer, ISBN-13: 978- 1461347262.

**Course Name: Telecom Transmission and Switching Systems Lab**

Pre-Requisite: Communication Systems

**Course Code: EE- 418L**

**Credit Hours: 0+1**

**Course Name: Power System Protection**

Pre-Requisite: Power Transmission & Distribution

**Course Code: EE- 406**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of Power generation; types of faults; fuse as protective device; types of fuses; CT and its operation.

**Course Contents:**

Power generation; types of faults; fuse as protective device; types of fuses; CT and its operation; arc voltage, arc interruption, re-striking, and recovery voltage; resistance switching; current chopping circuit breaker; circuit breakers; relays; over-current protection; differential protection of transformers; types of faults in transformer; balanced earthed fault protection; stator inter turn fault protection; bus bar protection;

voltage surges; lightning; mechanism of lightning discharge; types of lightning strokes and protection; earthing screen; and overhead ground wires.

**Recommended Books**

1. William D. Stevenson's Jr, "Elements of Power System Analysis", McGraw Hill, Latest Ed.
2. B. M. Weedy, B. J. Cory, N. Jenkins, Janaka B. Ekanayake, Goran Strbac "Electric Power Systems", John Wiley.
3. Fundamentals of Power System Protection by Y.G. Paithankar and S.R. Bhide.
4. Protective Relaying; Principles and Applications, by J. Lewis Blackburn, Thomas J. Domin.

**Course Name: Power System Protection Lab**

Pre-Requisite: Power Transmission & Distribution

**Course Code: EE- 406L**

**Credit Hours: 0+1**

**Course Name: Power Systems Operation & Control**

**Course Code: EE- 407**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of Characteristics of power generation units, economic dispatch with and without taking transmission loss into account.

**Course Contents:**

Characteristics of power generation units; economic dispatch with and without taking transmission loss into account; unit commitment; hydro-thermal coordination; introduction to power system control and its importance; generation capacity; voltage and frequency control; SCADA system and its application in the power system operation and control; and system operation in deregulation environment.

**Recommended Books**

1. Power Generation, Operation and Control by Allen J. Wood & Bruce F. Wallenberg, John Wiley & Sons, Inc.
2. B. M. Weedy, B. J. Cory, N. Jenkins, Janaka B. Ekanayake, Goran Strbac "Electric Power Systems", John Wiley.

**Course Name: Smart Grid**

Pre-Requisite: Power System Analysis

**Course Code: EE-412****Credit Hours: 3+0****Objectives:**

To equip the students with the knowledge of smart grid.

**Course Contents:**

Smart grid basis, distributed generation, analysis tools, demand side management, communication technology for smart grid, SCADA, wide area monitoring and control by synchro-phasor technology, phasor measurement units, architecture of WAMCS.

**Recommended Books**

1. Power System Analysis by Hadi Saadat McGraw-Hill International Editions
2. The Smart Grid: Enabling Energy Efficiency and Demand Response by Clark W. Gellings.
3. Synchronized Phasor Measurement Units and their applications by A.G Phadke, J.S Thorp

**Course Name: Smart Grid Lab**

Pre-Requisite: Power System Analysis

**Course Code: EE-412L****Credit Hours: 0+1****Course Name: AI Tools****Course Code: EE - 433****Credit Hours: 3+0****Objectives:**

To equip the students with the knowledge of Artificial intelligence.

**Course Contents:**

Introduction (Introduction, basic component of AI, Identifying AI systems, branches of AI, etc.); Reasoning and Knowledge Representation (Introduction to Reasoning and Knowledge Representation, Propositional Logic, First order Logic); Problem Solving by Searching (Informed searching, Uninformed searching, Local searching.); Constraint Satisfaction Problems; Adversarial Search (Min-max algorithm, Alpha beta pruning, Game-playing); Learning (Unsupervised learning, Supervised learning, Reinforcement learning) ;Uncertainty handling (Uncertainty in AI, Fuzzy logic); Recent trends in AI and applications of AI algorithms (trends, Case study of AI systems, Analysis of AI systems).

**Recommended Books**

1. Wang, Weiyu, and Keng Siau. "Artificial intelligence, machine learning, automation, robotics, future of work and future of humanity: a review and research agenda." Journal of Database Management (JDM) 30.1 (2019): 61-79.

2. Makridakis, Spyros. "The forthcoming Artificial Intelligence (AI) revolution: Its impact on society and firms." *Futures* 90 (2017): 46-60.

**Course Name: AI Tools Lab**

**Course Code: EE – 433L**

**Credit Hours: 0+1**

**Course Name: Principles and Design of IoT systems**

Pre-Requisite: Instrumentation & Measurement

**Course Code: EE-434**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of IoT Around Us, Sensors, Multi-sensor Systems and Calibration.

**Course Contents:**

Introduction & Motivation, IoT Around Us, Sensors, Multi-sensor Systems and Calibration, IoT System Overview, Power management & Batteries, Understanding Microprocessors, Microprocessors for IoT Sensors: An Overview, Microcontrollers for IoT Sensors: Resources and Processes, Representation of Numbers, Networking and IoT, esign review of certain aspects of oblu, Big Data, Hadoop and Map Reduce, Revisiting Arduino, An Introduction to Raspberry Pi.

**Recommended Books**

1. Peng, Sheng-Lung, Souvik Pal, and Lianfen Huang. "Principles of Internet of Things (IoT) Ecosystem: Insight Paradigm." (2020).
2. Ghajargar, Maliheh, Mikael Wiberg, and Erik Stolterman. "Designing IoT systems that support reflective thinking: A relational approach." *International Journal of Design* 12.1 (2018): 21-35.

**Course Name: Principles and Design of IoT systems Lab**

Pre-Requisite: Instrumentation & Measurement

**Course Code: EE-434L**

**Credit Hours: 0+1**

**Course Name: Electric Vehicles**

Pre-Requisite: Control System

**Course Code: EE-435****Credit Hours: 3+0****Objectives:**

To equip the students with the knowledge of hybrid electric, hybrid hydraulic and electric vehicle engineering with specific applications to commercial vehicles

**Course Contents:**

Fundamentals of hybrid electric, hybrid hydraulic and electric vehicle engineering with specific applications to commercial vehicles, including highway and terrain trucks, buses, mining and forestry machinery, farm tractors and construction equipment, combat and tactical military vehicles, unmanned ground vehicles, planet rovers. The course focuses on mechatronic system and component design of HEV based on the requirements to power flow management, power conversion and thus to vehicle dynamics and energy/fuel efficiency. Mechanical drive train engineering problems are considered in conjunction with electric drive design and then mechatronic wheel-electric drive, suspension and locomotion System design are presented. The course discusses design of batteries and energy storages and vehicle power electronics and also introduces plug-in hybrid electric vehicles.

**Recommended Books**

1. Deng, Jie, et al. "Electric vehicles batteries: requirements and challenges." *Joule* 4.3 (2020): 511-515.
2. Xu, Yueru, Yuan Zheng, and Ying Yang. "On the movement simulations of electric vehicles: A behavioral model-based approach." *Applied Energy* 283 (2021): 116356.
3. Miao, Yu, et al. "Current Li-ion battery technologies in electric vehicles and opportunities for advancements." *Energies* 12.6 (2019): 1074.

**Course Name: Cyber Security****Course Code: EE-436****Credit Hours: 3+0****Objectives:**

To equip the students with the knowledge cyber security and its application in electrical engineering.

**Course Contents:**

Basic security concepts, Information security terminology, Malware classifications, Types of malware. Server side web applications attacks. Cross-site scripting, SQL Injection, Cross-site request forgery, Planning and policy, Network protocols and service models. Transport layer security, Network layer security, Wireless security, Cloud & IoT security.

**Recommended book:**



1. Security+ Guide to Network Security Fundamentals by Mark Ciampa, th Edition
2. Corporate Computer Society by Randall J.Boyle, 3rd Edition

**Course Name: Digital Control Systems**

Pre-Requisite: Linear Control Systems

**Course Code: EE-431**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge Digital Control Systems and its application in electrical engineering.

**Course Contents:**

Introduction to digital control systems. Discrete time systems- Transform methods- Flow graphs - State variables - Transfer functions. Solutions of the state-equation. Sample/Hold unit with zero-order hold. Sampled-data control systems - Ideal Sampler - Properties & Evaluation of  $E^*(s)$ . Data Re-construction - A/D - D/A.  $E(Z)$  &  $E^*(Z)$  - Pulse TF - Open Loop Systems with digital filter-Modified Z-Transform. Systems with time delays-Nonsynchronous sampling-Discrete state equation. Closed-loop systems: concepts, derivation procedure-State variable models. Time response - Characteristics Equation -Mapping S&Z Planes, Steady state accuracy. Stability - Bilinear transformation - Routh-Hurwitz Criterion - Jury test. Root-Locus, Nyquist Criterion, Bode diagram, Frequency Response. Integration and Differentiation filters, PID Controller Design.

**Recommended book:**

1. Digital Control System Analysis and Design. (3rd Edition) Charles L. Phillips & H. Troy Nagle.
2. Charles L. Phillips and H. Troy Nagle, "Digital Control System Analysis and Design," Third Edition, 1995, Prentice Hall, Latest Edition ISBN: 013309832X.
3. H Benjamin C. Kuo H, "Digital Control Systems," Second Edition, 1995, Oxford University Press, Latest Edition ISBN: 0195120647.
4. Mohammed S. Santina H, Allen R. Stubberud and Gene H. Hostetter, "Digital Control System Design," Second Edition, 1995, Oxford University , Latest Edition Press, ISBN: 0030760127.
5. Katsuhiko Ogata, "Discrete-Time Control Systems," Second Edition, 1995, Prentice Hall, Latest Edition, ISBN: 0130342815
- 6.

**Course Name: Digital Control Systems Lab**

Pre-Requisite: Linear Control Systems Lab

**Course Code: EE-431L**

**Credit Hours: 0+1**

**Course Name: Solid State Devices**

Pre-Requisite: Electronic Devices and Circuits

**Course Code: EE-430****Credit Hours: 3+0****Objectives:**

To equip the students with the knowledge Solid State Devices and its application in electrical engineering.

**Course Contents:**

Introduction to semiconductor materials, basic structure and properties, carrier concentration, energy band gap, carrier transport in semiconductor, pn junction, metal-semiconductor contacts, metal oxide semiconductor FET, bipolar transistors, photonic devices, solar cell, semiconductor devices growth and fabrication techniques.

**Recommended books:**

- Ben Streetman, Sanjay Banerjee “Solid State Electronic Devices”, Prentice Hall, Latest Edition.
- Donald A. Neamen “Semiconductor Physics And Devices: Basic Principles”, McGraw-Hill, Latest Edition.
- Robert F. Pierret, Semiconductor Device Fundamentals, Pearson Education, Latest Edition.
- Jasprit Singh, Semiconductor Device Physics and Design, Wiley, Latest Edition.
- S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley, Latest Edition

**Course Name: Introduction to Nanotechnology**

Prerequisite: Applied Physics

**Course Code: EE-429****Credit Hours: 3+0**

**Objectives:** To equip the students with the knowledge Nanotechnology and its application in electrical engineering.

**Course Contents:**

Introduction, nano-scale phenomena, nanoparticles, carbon nanostructures, nano-wires, nano-structured, materials, self-assembly, surface probe microscopy, other nano-scale characterization, nanolithography, nano-scale devices and systems, applications of nanotechnology.

**Recommended books:**

1. Charles P. Poole Jr. and Frank J. Owens, “Introduction to Nanotechnology,” 2003, John Wiley & Sons, ISBN: 0471079359.

2. Massimiliano Di Ventra, Stephane Evoy and James R. Heflin Jr. (Editors), "Introduction to Nanoscale Science and Technology," 2004, Kluwer Academic Publishers, ISBN: 1402077203.
3. Mark A. Reed and Takhee Lee (Editors), "Molecular Nanoelectronics," 2003, American Scientific Publishers, ISBN: 1588830063.

**Course Name: VLSI Design**

Pre-Requisite: Electronic Devices & Circuits

**Course Code: EE-427**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge VLSI Design and its application in electrical engineering.

**Course Contents:**

Conductors, insulators, semiconductors, intrinsic material, extrinsic material. Integrating circuits manufacturing technology economics. CMOS Technology. Power consumption, design and testability. Design Abstraction. Translation and layout fabrication steps. Structure of a transistor. Transistor modeling parasitic, tubties and latch up. Leakage and sub threshold currents. Wires and Vias, skin Effect. Stick diagrams, physical layout, fabrication Errors. Static complementary gates. Switch logic. Delay through Resistive interconnects. Low power gates, Delay through Inductive interconnect. Fan-out path delay Cross Talk, Buffer insertion. Latches and flip flop. Clocking Disciplines. Sequential system design. Floor planning methods. Design validation. Off chip Connections. Implementation of VLSI design techniques using VHDL/Verilog HDL/Mentor Graphics modules.

**Recommended Books:**

1. Wayne Wolf, "Modern VLSI Design", Prentice Hall, 2002
2. Neil Weste & David Harris "CMOS VLSI Design, A Circuit and System Perspective", Addison Wesley, 3rd Ed., 2004

**Course Name: Optoelectronics**

**Course Code: EE-426**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge Optoelectronics and its application in electrical engineering.

**Course Contents:**

Optics Review: Snell's Law, Numerical Aperture, Total internal reflection, Fresnel Equations, Dispersion, Pulse broadening and distortion, Resonant cavities. Dielectric slab optical waveguide, optical fiber waveguide. Laser principles, population inversion and threshold conditions, laser modes. Light emitting diodes and laser diodes: operating characteristics and typical structures, Types of laser diodes (monomode/tunable) such as DBR and DFB. Light Detectors: Principles of photo-

detection, types of semiconductor photodiodes. Analog / Digital Modulation and corresponding opto-electronic circuits. Noise: Thermal and Shot noise, and signal to noise ratio in electro-optical systems. Optoelectronics in energy and telecommunications such as photo-voltaic devices and wavelength division multiplexing.

**Recommended books:**

1. Harold Kolimbris, "Fibre Optics Communications," First Edition, 2004, Prentice Hall, latest edition.
2. John M. Senior, "Optical Fiber Communications: Principles and Practice", Prentice Hall, latest edition.
3. Henry Zanger, Cynthia Zanger, "Fiber Optics: Communications and other Applications", Maxwell

**Course Name:** Optoelectronics Lab

**Course Code:** EE-426L

**Credit Hours:** 0+1

**Course Name: Microelectronics Technology**

Pre-Requisite: Applied Physics, Electronic Devices & Circuits

**Course Code:** EE-425

**Credit Hours:** 3+0

**Objectives:**

To equip the students with the knowledge Microelectronics Technology and its application in electrical engineering.

**Course Contents:**

Introduction to scaling, Moore's law and International Technology Roadmap of Semiconductors (ITRS); Integrated Chip (IC) Wafers & Substrate (Crystal Growth & Wafer Processing), Oxidation and Thermal Processing, Thin Film Technology (Physical and Chemical Vapour Deposition, Epitaxy, Silicon-on-insulator), Doping (Dopant Diffusion, Ion Implantation), Pattern Making (Lithography, Etching), Contact Metallization & Interconnects, Re-capping/Process Integration of BJT and MOSFET/CMOS fabrication

**Recommended Books:**

1. Peter Van Zant, "Microchip Fabrication", McGraw.Hill, 6th Ed., 2014.
2. Richard C. Jaeger, "Introduction to Microelectronic Fabrication", Prentice Hall; 2nd Ed., 2001
3. Stephen A. Campbell, "The Science and Engineering of Microelectronic Fabrication", Oxford University Press, New York, 2nd Ed., 2006.
4. C. Y. Chang & S. M. Sze, "ULSI Technology", McGraw-Hill International Ed., 1996.

**Course Name: Integrated Electronics****Course Code: EE-424****Credit Hours: 3+0****Objectives:**

To equip the students with the knowledge Integrated Electronics and its application in electrical engineering.

**Course Contents:**

Detailed design of pulse and switching circuits; mono-stable, a-stable and bi-stable circuits; Schmitt trigger; logic families (DTL, TTL, ECL, I<sup>2</sup>L, CMOS); Introduction to the fabrication of digital microelectronic pMOS, nMOS, CMOS, and BiCMOS circuits; epitaxy, ion implantation and oxidation; amplifier; linear and non-linear applications. analogue and digital circuit interface with applications; RC-coupled amplifier, transformer-coupled amplifier, direct-coupled amplifier. Audio-frequency amplifier, radio-frequency amplifier, tuned amplifiers. Basic theory, tank circuit, damped and undamped oscillations, phase-shift oscillator, Colpitt oscillator, Hartley oscillator, Wein Bridge oscillator, Clapp oscillator.

**Recommended books:**

1. S. Sedra and K. C. Smith, "Microelectronic Circuits", Oxford University Press, Latest edition.
2. Behzad Razavi "Fundamentals of Microelectronics," Wiley, Latest edition. Robert L.
3. Boylestad and Louis Nashelsky "Electronic Devices and Circuit Theory", Prentice Hall, Latest edition.
4. Thomas L. Floyd "Electronic Devices (Conventional Current Version)", Prentice Hall, Latest edition

**Course Name: Integrated Electronics Lab****Course Code: EE-424L****Credit Hours: 0+1****Course Name: Advanced Electrical Machines**

Pre-Requisite: Electrical Machines

**Course Code: EE-408****Credit Hours: 3+0****Objectives:**

To equip the students with the knowledge of Advanced Electrical Machines and its application in electrical engineering.

**Course Contents:**

Construction, Equivalent circuit, voltage regulation and efficiency, types of connections, tap changer and parallel operation. Details of different armature windings in AC machines and comparison with the windings of DC machines . Production of rotating field and torque, construction, synchronous speed, slip and its effect on rotor frequency and voltage, equivalent circuit calculations, power and torque, speed regulation, synchronous impedance method and ampere turn method for voltage regulation, losses, efficiency and power factor, torque-speed characteristic, starting and speed control, induction generator. Operation, Equivalent circuit, parallel

operation, ratings, torque speed characteristics, power factor correction, starting of synchronous motors, speed control, voltage regulation. Introduction to Special Purpose Motors

### **Recommended Books**

1. Stephen J. Chapman, "Electric Machinery Fundamentals", McGraw-Hill. (Latest Edition)
2. T. J Miller, "Electronic Control of Switched Reluctance Motor", Latest Book.
3. Charles I. Hubert, "Electric Machines", Maxwell Macmillan (Latest edition)

### **Course Name: Advanced Electrical Machines Lab**

Pre-Requisite: Electrical Machines Lab

**Course Code: EE-408L**

**Credit Hours: 0+1**

### **Course Name: Navigation and Radar Systems**

Pre-Requisite: Communication Systems

**Course Code: EE-422**

**Credit Hours: 3+0**

### **Objectives:**

To equip the students with the knowledge of Navigation and Radar Systems and its application in electrical engineering.

### **Course Contents:**

Radar Basics, Radar frequencies, Application of the Radar, Origin of the Radar. Radar Equations: Detection of signals in noise, receiver noise and signal to noise ratio, Probability of detection and false alarm, Integration of the Radar pulses, Radar cross section of targets, Transmitter power pulse repetition frequency. MTI and Doppler Radar: Delay line cancellers, Staggered pulse repetition frequencies, Limitation to MTI performance. Tracking Radar: Tracking with Radar, Monopulse tracking, Conical scan and sequential lobing. Radar Transmitters and Receivers: Linear beam power tubes, Solid state RF power sources, Magnetron, Cross field amplifiers, Other RF power sources, The receiver noise figure, Super Heterodyne receiver, Duplexers and receiver protectors, Radar displays. Propagation of the Radar Waves: Forward Scattering from a flat earth, Scattering from the round earth surface, Atmospheric Refraction, Standard and non-standard propagation, Diffraction, Attenuation by atmospheric gases, External environmental noise, Other propagation effects. Navigational aids: Terminology used in navigational Systems, Global and regional navigational systems, Direction finding, GPS, Laser Gyro, Decca, Loran, Beacon system. Introduction to GNSS: Conventional navigation, Comparison of GNSS with other navigation systems, GNSS Transmitter and Receiver, GNSS Applications

### **Recommended Books**

1. Merrill I. Skolnik, "Introduction to Radar Systems", Latest edition.
2. Gerry L Eaves & Edward K Reedy, "Principles of Modern Radar", Latest Edition.

3. Teunissen, Montenbruck, "Springer handbook of Global Navigation Satellite Systems" 2017.

**Course Name: Navigation and Radar Systems Lab**

Pre-Requisite: Communication Systems Lab

**Course Code: EE-422L**

**Credit Hours: 0+1**

**Course Name: Satellite Communication**

Pre-Requisite: Communication Systems

**Course Code: EE-420**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of Satellite Communication and its application in electrical engineering.

**Course Contents:**

Introduction to Satellite Communication, Space-segment and ground segment , Orbital Mechanics, Geostationary and Non geostationary Orbits, Launching and Spacecraft subsystems, Look angle determination, Orbital perturbations, Orbital effects in communication system performance space craft and its subsystem , Satellite Link Design, Propagation Characteristics of Satellite Links, Channel Modeling, Access Control Schemes, Modulation Schemes, Multiple Access Schemes, Coding. System Performance Analysis, System Design, Space standards, Earth Station Technology. Satellite Applications such as earth observation, weather, and communication, VSATs and Network Architectures, GPS, Future trends

**Recommended Books**

1. Tom Logsdon, "Mobile Communication Satellites: Theory and Applications", McGraw-Hill, (Latest edition).
2. Gerald M., Michel Bousquet, "Satellite Communication Systems: Systems, Techniques and Technologies", John Willey, (Latest Edition).
3. Leon W. Couch, "Digital & Analog Communication Systems", Latest Edition, Prentice Hall, ISBN: 0131424920.
4. Timothy Pratt, Charles W. Bostian and Jeremy E. Allnutt, "Satellite Communications," Latest Edition, 2003, John Wiley & Sons, ISBN: 0471429120.
5. Dennis Roddy, "Satellite Communications", Latest Edition

**Course Name: RF and Microwave Engineering**

**Course Code: EE-421**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of RF and Microwave Engineering and its application in electrical engineering.

**Course Contents:**

Basics of RF Circuits and Microwave Devices, Planar and 3D Transmission Lines. Performance Parameters: Reflection Coefficient, VSWR, s-parameters . RF / Microwave Device Analysis: Two port / Multi port Network Analysis using Scattering Parameters, Stability Circles, Noise performance, Smith Charts, Waveguides, Couplers, Power Dividers / Combiners / Isolators / Duplexers, Microwave Switches. Microwave Filters: Types, Responses, Performance Parameters, Complete Filter Design including impedance matching and other design constraints, Different types of filters . Solid State Devices Introduction, Energy band Diagram, RFICs and MMICs . Microwave Active Devices: BJT, HBT, HEMT, MOS Capacitor, FETs, MOSFET . Microwave Amplifier Design: Introduction, Power Gain Equations, Stability Constraints, Noise Figure .Applications of RF / Microwaves: Microwave Oscillators, Microwave Power Amplifiers, Travelling Wave Tubes, Microwave detectors and mixers

**Recommended Books**

1. Microwave Engineering: David Pozar
2. Antennas for all applications (2nd Ed.) by J. D. Krauss
3. Antennas and propagation for wireless communication systems (2nd Ed.) by Simon R. Saunders

**Course Name: RF and Microwave Engineering Lab**

**Course Code: EE-421L**

**Credit Hours: 0+1**



**Course Name: Machine Learning**

**Course Code: EE-414**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge Machine learning techniques and its application in electrical engineering.

**Course Contents:**

Introduction to machine learning and statistical pattern recognition. Supervised learning: Part I (Graphical models (full Bayes, Naïve Bayes), Decision trees for classification & regression for both categorical & numerical data, Ensemble methods, Random forests, Boosting (Adaboost and Xgboost), Stacking; Part II (Four Components of Machine Learning Algorithm (Hypothesis, Loss Functions, Derivatives and Optimization Algorithms), Gradient Descent, Stochastic Gradient Descent, Linear Regression, Nonlinear Regression, Perceptron, Support vector machines, Kernel Methods, Logistic Regression, Softmax, Neural networks); Unsupervised learning: K-means, Density Based Clustering Methods (DBSCAN, etc.), Gaussian mixture models, EM algorithm, etc.; Reinforcement learning; Tuning model complexity; Bias-Variance Tradeoff; Grid Search, Random Search; Evaluation Metrics; Reporting predictive performance

**Recommended book:**

- Elements of Statistical Learning
- Pattern Recognition & Machine Learning, 1st Edition, Chris Bishop
- Machine Learning: A Probabilistic Perspective, 1st Edition, Kevin R Murphy
- Applied Machine Learning, online Edition, David Forsyth, <http://luthuli.cs.uiuc.edu/~daf/courses/LearningCourse17/learning-book-6-April-nn-revision.pdf>

**Course Name: Machine Learning Lab**

**Course Code: EE-414L**

**Credit Hours: 0+1**

**Course Name: Digital System Design**

**Course Code: EE-428**

**Credit Hours: 3+0**

**Objective:**

The unit will focus on design methodology, hardware modeling and high-level synthesis of the digital systems; hardware description language, combinational and sequential logic synthesize and optimization methods, partitioning, mapping to regular structures. Emphasis is given to reconfigurable logic as an implementation medium. The topic material will be supported by industry standard EDA tools for design, synthesis, simulation, verification and implementation.

**Course Outline:**

Basic VHDL Elements and Semantics, Industry standard EDA tools for logic description, simulation and synthesis, VHDL Design Styles, Sequential and Concurrent Code, Programmable Logic architecture (i.e., PLD, FPGA and CPLD and particularly how these structures affect the outcomes of the synthesize process), Digital Design and FPGAs; FPGA Based System Design; FPGA Fabrics (SRAM-Based FPGAs, Permanently Programmed FPGAs, Chip I/O, Circuit Design of FPGA Fabric); Embedded Blocks, Multipliers, Adders, Carry Chains, Embedded Processors, and interfaces, Advanced VHDL Coding Topics (Procedure, Functions and etc), FPGA Design Flow based on VHDL (Place and Route, Synthesize & Fitting), State Machine Design, Optimization and principles Using VHDL, Arithmetic Circuits (Addition, Subtraction, and Division), Architectures for Basic Building Blocks, Adder, Compression Trees, and Multipliers, Barrel Shifter, Abstract hardware models; compilation and optimization techniques

**Recommended Books:**

1. Wayne Wolf, "FPGA Based System Design", PRENTICE HALL, 2004, ISBN: 0-13-142461-0.
2. Volei A. Pedroni "Circuit Design and Simulation with VHDL", MIT Press, 2<sup>nd</sup> Edition, 2010, ISBN: 978-81-203-4301-6.
3. Charles H. Roth, Jr. "Digital System Design Using VHDL", Cengage Learning, 2<sup>nd</sup> edition, 2008, ISBN: 978-0534384623.
4. Kenneth L. Short "VHDL For Engineers", Prentice Hall, 2008, ISBN: 978-0131424784.

**Course Name: Digital System Design Lab****Course Code: EE-428L****Credit Hours: 0+1**

**Course Name: Biomedical Instrumentation**

**Course Code: EE-432**

**Credit Hours: 3+0**

### **OBJECTIVES**

This course covers the fundamentals of bio-medical instruments and devices in compliance with the appropriate electrical safety regime.

### **COURSE OUTLINE:**

#### **Introduction:**

- Precision, resolution, sensitivity, accuracy, uncertainty.
- Principles and development of biomedical instrumentation.
- Problems encountered in living systems.

#### **Biological Systems:**

- Study of various physiological systems, related biopotentials and physiological parameters.

#### **Diagnostic Equipment:**

- Invasive and noninvasive measurement techniques and related equipment.

#### **Cardiovascular Measurements:**

- Electrocardiography
- Measurement of blood pressure
- Blood flow
- Cardiac output

#### **Biomedical Sensors & Transducers:**

- Principles and design
- Speed and position
- Temperature, light and pressure transducers
- Programmable logic controller
- PLC interfacing
- Memory processor

#### **Patient Monitoring Equipment:**

- Patient monitors
- Central monitoring system
- Telemetry system
- Gas exchange and distributions
- Respiratory therapy equipment

#### **Therapeutic Equipment:**

- Ventilator
- Inhaler
- Defibrillator
- Pacemaker
- Heart lung machines

#### **Radiological Equipment:**

- Concept of ionization and non-ionization radiation and related equipment
- Medical lasers and applications

#### **Safety in Medical Equipment:**

- Electrical/mechanical safety

- Standards of medical devices
- Biohazards and safety regulations

**Quality Assurance and Control:**

- Calibration, maintenance and reparability of monitoring equipment

**Recommended Books:**

1. Biomedical Instrumentation System by Shakti Chatterjee, Edition 1st, Cengage, 2010
2. Biomedical Instrumentation: Technology and Applications by R Khandpur, Edition 1st, McGraw Hill Education, 2004
3. Medical Instrumentation: Application and Design by J G Webster, Edition 4th, Wiley India Private Limited, 2009.

**Course Name: Biomedical Instrumentation Lab**

**Course Code: EE-432L**

**Credit Hours: 0+1**

**Course Name: Medical Robotics**

**Course Code: EE-437**

**Credit Hours: 3+0**

**OBJECTIVES**

This course provides a thorough background to the field of medical robotics.

**COURSE OUTLINE**

**Introduction:**

- Fundamentals of medical robotics
- kinematics of medical robots
- Teleportation and cooperative manipulation

**Robot dynamics and simulation:**

- Trajectory generation
- Surgeon's perspective
- Medical imaging and image-guided interventions

**Tracking and surgical navigation:**

- Motion planning, prediction, correlation, replication and learning
- Basic methods behind robots like DaVinci system, the cyberknife, motorized C-arms and operating microscopes as well as strategic frames

**Broad spectrum of medical and healthcare robotics:**

- Robots for neuroscience

**RECOMMENDED BOOKS:**

1. Medical Robotics by Achim Schweikard and Floris Ernst, Edition 1<sup>st</sup>, Springer, 2015
2. Medical Robotics by Jocelyne Troccaz, Edition 1<sup>st</sup>, Wiley-ISTE, 2012

**Course Name: Medical Robotics Lab**

**Course Code: EE-437L**

**Credit Hours: 0+1**

**Course Name: Digital Image Processing**

**Course Code: EE-423**

**Credit Hours: 3+0**

**Course outline:**

- Concept of digital image, Types of images
- Visual Perception, Light & Electromagnetic Perception
- Image sensing & acquisition
- Spatial and luminance resolution parameters, Image Sampling and quantization, Imaging defects, Noise, Histogram Processing
- Spatial Filtering, Convolution & Correlation, Smoothing & Sharpening
- Fourier Transform, Discrete Fourier Transform
- Frequency based filtering, Contrast enhancement & adjustment
- Noise elimination: smoothing, Histogram manipulation (equalization, compression & Stretching, Image Restoration & Reconstruction
- Edge detection, Image segmentation, Segmentation, Feature extraction
- Image Coding & Compression,
- Applications

**Text and Reference books:**

1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing".
2. R. C. Gonzalez and R. E. Woods, "Digital Image Processing using Matlab"  
Third Edition

**Course Name: Digital Image Processing Lab**

**Course Code: EE-423L**

**Credit Hours: 0+1**

## **COURSES OFFERED BY EED FOR OTHER DEPARTMENTS**

**Course Name: Fundamentals of Electrical Engineering**

**Course Code: EE-220**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge and techniques of analyzing electrical networks.

**Course Contents:**

Introduction to DC, series, and parallel circuits; theory of alternating current; resistance, inductance, and capacitance of AC circuits; power factor; resonance in RLC circuits; current and voltage relationship in phase and line circuits; *and* types, characteristics and testing of motors and transformers.

**Recommended books:**

1. S. Franco, "Electric Circuits Fundamentals", Oxford University Press, (Latest Edition).
2. R E Thomas, A J Rosa and G J Toussaint, "The Analysis and Design of Linear Circuits" John Wiley, 6th Edition, 2009
3. C Alexander and M Sadiku, "Fundamentals of Electric Circuits", McGraw-Hill, 4th Edition, 2008

**Course Name: Fundamentals of Electrical Engineering Lab**

**Course Code: EE-220L**

**Credit Hours: 0+1**

**Course Name: Analog and Digital Systems**

**Course Code: EE-320**

**Credit Hours: 3+0**

**Objectives:**

To equip the students with the knowledge of analog and digital system design.

**Course Contents:**

Analog and digital signals and transmission; analog AM and FM; digital PCM, ADPCM and DM; digital data transmission; data encoding; clock recovery and BER; modulation techniques such as ASK, FSK, PSK and QAM and the effects of noise and bandwidth; modern satellite; *and* cellular and cable communication systems.

**Recommended Books**

1. M. Morris Mano and Micheal D. Ciletti, "Digital Design with an introduction to the Verilog HDL", Prentice Hall, 5th Edition.
2. Morris Mano and Charles R. Kime, "Logic and Computer Design Fundamentals", Prentice Hall. Latest Edition

3. Tocci and Widmer, "Digital Systems: Principles and Applications". Prentice Hall.  
Latest Edition

**Course Name: Analog and Digital Systems Lab**

**Course Code: EE-320L**

**Credit Hours: 0+1**

**Standard 2-1**

The curriculum must be consistent and support the program's documented objectives.

**4.6.1 Group 1: Computer Engineering**

EC-112 Object oriented Programming, EC-110 Computing Fundamentals, EC-222 Data Structure and Algorithm

**4.6.2 Group 2 General Sciences**

Engineering Physics

**4.6.3 Group 3 Electrical Engineering**

EE-101 Engineering Workshop, EE-102 Electric Circuits, EE-103 Network Analysis, EE-203 Digital Logic Design, EE-204 Electrical Machines-I, EE-205 Electronic Devices and Circuits, EE-302 Signal and Systems, EE-303 Microprocessor and Interfacing Techniques, EE-307 Electronic System Design, EE-305 Linear Control System, EE-306 Digital Signal Processing, EE-308 Instrumentation and Measurement, EE-405 Power Electronics, EE-403 Computer Communication Networks, EE-301 Electromagnetic theory, EE-304 Communication System, EE-411 Digital Communication, EE-402 Wave Propagation and Antenna, EE-304 Communication Systems, EE-301 Power Generation, EE-431 Power System Protection, EE-404 Power Transmission and Distribution, EE-429 Power System Analysis.

**4.6.4 Group 4 Humanities**

HS-101 English, HS-102 Pakistan Studies, IS-211 Islamic Studies, HS-103 Communication Skills, HS-201 Technical Report Writing,

**4.6.5 Group 5: Mathematical Sciences**

MT-101 Calculus and Analytical Geometry, MT-103 Differential Equations, MT-203 Linear Algebra, MT- 201 Complex variable and Transforms, MT-302 Probability and Statistics, MT-202 Numerical methods.

**4.6.6 Group 6: Projects**

Design and Implementation Projects



## Course Groups and Program Objectives

Courses Groups	Objectives					
	1	2	3	4	5	6
1		X				
2			X			
3	X		X	X		
4			X		X	X
5	X			X		
6	X		X	X	X	

**Table: Courses versus Program Objectives**

### Standard 2-2

**Theoretical backgrounds, problem analysis and solution design must be stressed within the program's core material.**

Elements	Courses
Theoretical Background	EE-303 Microprocessor and Interfacing Techniques, MT-103 Differential Equations, EE-308 Instrumentation and Measurement, EE-102 Electric Circuit, EE-305 Linear Control System, EE-302 Signal and Systems, , EE-203 Digital Logic Design, , EE-405 Power Electronics, EE-304 Communication Systems, , EE-411 Digital Communications, , MT-101 Calculus and Analytical Geometry, MT-103 Differential Equations
Problem Analysis	EE-301 Electromagnetic Theory, EE-411 Digital Communication, EE-417 Embedded System, EE-402 Wave Propagation and Antenna, MT-101 Calculus and Analytical Geometry, MT-103 Differential Equations
Solution Design	CE-103 Object oriented Programming, EE-203 Digital Logic Design, EE-305 Linear Control System, EE-302 Signal and Systems, EE-306 Digital Signal Processing, EE-304 Communication System, EE-727 Optical Fiber Communication, EE-712 Digital Image Processing, EE-417 Embedded System, EE-402 Wave Propagation and Antenna, MT302 Probability and Statistics

**Table 5: Standard 2-2 Requirement (table 4.5)**

### Standard 2-3

**The Curriculum must satisfy the core requirements for the program as specified by the respective accreditation body.**

BS Electrical Engineering (Communication) program is accredited by the Pakistan Engineering Council (PEC) and has no deviation from PEC requirements. Minimum Requirements for each program (Program Semester Credit Hours)

Program	Maths & General Sciences	Engineering Topics (Electrical)	General Education (Humanities & Management Sciences)	Others (Computer Sciences)	Electives
BS Electrical Engineering	18+5	63+26	16	6+4	

**Table 6: Program Credit Hours**

**Standard 2-4**

**The curriculum must satisfy the major requirements for the program as specified by the respective accreditation body.**

Same as Standard 2-3.

**Standard 2-5**

**The curriculum must satisfy general education, arts and professional and other discipline requirements for the program as specified by the respective accreditation body.**

Same as standard 2-3 and Standard 2-1 (table 4.4) as defined above.

**Standard 2-6**

**Information technology component of the curriculum must be integrated throughout the program**

Semester 1 contains the 4 credit hours of information technology topics (Computing Fundamentals), out of which 3 credit hours are for theoretical work and 1 credit hour is for laboratory work. This course covers basic computer programming concepts and logic, thus enhancing student's learning capability regarding computers, hardware and software to support their engineering learning and research.

Semester 2 contains the 4 credit hours of information technology topics (Object Oriented Programming), out of which 3 credit hours are for theoretical work and 1 credit hour is for laboratory work. This course introduces students to object oriented programming by teaching concepts of program specification, design, coding and testing using a modern software development environment. This course will help students to identify and practice the use of C++ classes and class libraries, develop their own C++ classes for a number of application scenarios covered during the course.

**Standard 2-7**

**Oral and written communication skills of the student must be developed and applied in the program.**

3 credit hours subject Communication Skills in 2<sup>nd</sup> semester and 2 credit hours subject Technical Report Writing in 3<sup>rd</sup> semester are taught to develop the oral and written communication skills of the students.

## 5.0 Criterion 3: Laboratories and Computing Facilities

HITEC University has established multiple laboratories for students to practice their learning outcomes. Following is the list of available laboratories:

1. IT Lab
2. Computing Lab
3. Communication Lab
4. RF & Microwave Lab
5. Digital Systems Lab
6. Electronic Workshop
7. Power Lab
8. Control Lab
9. Electronics Lab
10. Electrical Machine Lab
11. Network/ DSP Lab
12. Project Lab
13. High Voltage Lab

The details about these laboratories are provided on the following pages:

Laboratory Title	IT Lab	Computing Lab	Communication Lab
<b>Location &amp; Area</b>	Israr Block(1 <sup>st</sup> Floor)	Israr Block(2 <sup>nd</sup> Floor)	Israr Block (1 <sup>st</sup> Floor)
<b>Objectives</b>	Provide students with IT facility and practice software applications and programming languages.	Provide students with IT facility and practice software applications and programming languages.	To provide students different Software and hardware to stimulate various communication techniques and their applications.
<b>Adequacy for Instruction</b>	All required instructions are displayed in the lab at appropriate places for use by faculty, students and support staff.	All required instructions are displayed in the lab at appropriate places for use by faculty, students and support staff.	All required instructions are displayed in the lab at appropriate places for use by faculty, students and support staff.
<b>Courses Taught</b>	<ol style="list-style-type: none"> <li>1. Introduction to Computing</li> <li>2. Data Structure &amp; Algorithm</li> <li>3. Object Oriented programming</li> <li>4. Computer organization &amp;</li> </ol>	<ol style="list-style-type: none"> <li>1. Computer Fundamentals</li> <li>2. Engineering Workshop Lab</li> <li>3. Computer Aided engineering drawing</li> </ol>	<ol style="list-style-type: none"> <li>1. Communication System</li> <li>2. Wireless Communication</li> <li>3. Digital Communication</li> </ol>

	Assembly 5. Data base system		
<b>Software Available</b>	MS Office, Visual Studio, Turbo C, AUTOCAD, Oracle, Protieus, Emulator8086, MATLAB	MS Office, MATLAB, MS Visio, Protieus, Pspice, AutoCad, Visual Studio	MS Office, MATLAB
<b>Major Apparatus / Equipment</b>	<ul style="list-style-type: none"> <li>• Computers,</li> <li>• Multimedia</li> </ul>	<ul style="list-style-type: none"> <li>• Computers,</li> <li>• Multimedia</li> </ul>	<ul style="list-style-type: none"> <li>• Analog and Digital Communication Trainers</li> <li>• Mobile Communication Trainers</li> <li>• Fiber Optic Trainer</li> <li>• Four Channel Analog TDM Trainer</li> <li>• DSB/SSB Transmitter and Receiver Trainer</li> <li>• QAM Trainer</li> <li>• FM Communication Trainer</li> <li>• Audio Input and Output Module</li> <li>• PAM, PPM, PWM Modulation and Demodulation Trainer</li> <li>• TDM Pulse Code Modulation and Demodulation Trainer</li> <li>• GPS Trainer</li> <li>• GSM Trainer</li> <li>• Sampling &amp; Reconstruction Trainer</li> <li>• Carrier Demodulation &amp; Data Reformatting Receiver Trainer</li> <li>• TDM Pulse Amplitude Demodulation Trainer</li> <li>• Noise Audio Amplifier Trainer</li> <li>• PN Sequence Generator</li> <li>• Digital Storage Oscilloscope</li> <li>• Frequency Modulation and Demodulation Trainer</li> <li>• Computer</li> </ul>
<b>Safety Regulations</b>	Safety regulations are being strictly followed. See Annex I for details of Laboratory Precautions.	Safety regulations are being strictly followed. See Annex I for details of Laboratory Precautions.	Safety regulations are being strictly followed. See Annex I for details of Laboratory Precautions.

**Table 7: Laboratories Details 1**

Laboratory Title	RF & Microwave Lab	Digital Systems Lab	Electronics Workshop
Location & Area	Israr Block (1 <sup>st</sup> Floor)	Israr Block (1 <sup>st</sup> Floor)	Israr Block (1 <sup>st</sup> Floor)
Objectives	To enable students to practice and design different types of Antennas and analyse antenna parameters.	To enable students to design and practice logic gates and circuits , interfacing of Microcontroller circuits	To enable students to practice and implement different circuits and analysis techniques and concept of soldering and wiring in detail
Adequacy for Instruction	All required instructions are displayed in the lab at appropriate places for use by faculty, students and support staff.	All required instructions are displayed in the lab at appropriate places for use by faculty, students and support staff	All required instructions are displayed in the lab at appropriate places for use by faculty, students and support staff
Courses Taught	1. Wave propagation and Antenna	1. Digital Logic Design 2. Microprocessor and Interfacing Techniques 3. Analog & Digital System	1. Electric circuits 2. Engineering Workshop 3. Fundamental of Electrical Engineering System
Software Available	MS Office, MATLAB, HFSS		-
Major Apparatus / Equipment	<ul style="list-style-type: none"> <li>• Antenna Trainers</li> <li>• Wave propagation trainers</li> <li>• Transmission line Trainer</li> <li>• Satellite communication Trainer</li> <li>• Radar Trainer</li> <li>• Computer</li> </ul>	<ul style="list-style-type: none"> <li>• Digital Logic Trainer</li> <li>• Advance Digital Logic Trainer</li> <li>• Digital Trainer</li> <li>• Microprocessor Trainer 8086 Based</li> <li>• Micro Controller 8051 based M-51-02</li> <li>• Embedded Trainer</li> </ul>	<ul style="list-style-type: none"> <li>• Power Supply</li> <li>• Signal Generator</li> <li>• Oscilloscope</li> <li>• Multimeters</li> <li>• Wiring Trainer</li> <li>• Meggar</li> <li>• Soldering Iron</li> <li>• Project board</li> </ul>
Safety Regulations	Safety regulations are being strictly followed. See Annex I for details of Laboratory Precautions.	Safety regulations are being strictly followed. See Annex I for details of Laboratory Precautions.	Safety regulations are being strictly followed. See Annex I for details of Laboratory Precautions.

**Table 8: Laboratories Details 2**

Laboratory Title	Power Lab	Control Lab	Electronic Lab
<b>Location &amp; Area</b>	Israr Block (1 <sup>st</sup> Floor)	Israr Block (1 <sup>st</sup> Floor)	Israr Block (1 <sup>st</sup> Floor)
<b>Objectives</b>	To enable the students to perform different techniques of Power generation, transmission, distribution and utilization	To enable the students to study different control techniques like PID to control different Systems	To enable the students to perform and design electronic devices circuits (Diode, transistors, MOSFET, Amplifier)
<b>Adequacy for Instruction</b>	All required instructions are displayed in the lab at appropriate places for use by faculty, students and support staff.	All required instructions are displayed in the lab at appropriate places for use by faculty, students and support staff	All required instructions are displayed in the lab at appropriate places for use by faculty, students and support staff
<b>Courses Taught</b>	<ol style="list-style-type: none"> <li>1. Electrical Power System</li> <li>2. Power Distribution &amp; Utilization</li> </ol>	<ol style="list-style-type: none"> <li>1. Power Electronics</li> <li>2. Industrial Electronics</li> <li>3. Instrumentation &amp; Measurements</li> <li>4. Linear Control Systems</li> </ol>	<ol style="list-style-type: none"> <li>1. Network Analysis</li> <li>2. Electronic Devices &amp; Circuits</li> <li>3. Basic Electronics</li> <li>4. Electronics System Design</li> </ol>
<b>Software Available</b>		MS Office, MATLAB, Protieus, Pspice	MS Office, MATLAB, Protieus, Pspice
<b>Major Apparatus / Equipment</b>	<ul style="list-style-type: none"> <li>• Power Engineering Lab Unit (1&amp;2)</li> </ul>	<ul style="list-style-type: none"> <li>• Power Supply</li> <li>• Signal Generator</li> <li>• Oscilloscope</li> <li>• Computers</li> <li>• Ball &amp; Beam</li> <li>• Inverted Pendulum</li> <li>• Servo Motor Trainer</li> <li>• Magnetic levitation System</li> <li>• Traffic Signal Control</li> <li>• Water level Control</li> <li>• Temperature Control</li> <li>• Conveyor Control</li> <li>• Elevator Control Trainer</li> <li>• PID Trainer</li> <li>• PLC Trainer</li> <li>• Relay control Trainer</li> <li>• Analog Control System</li> </ul>	<ul style="list-style-type: none"> <li>• Workbenches</li> <li>• Signal Generator</li> <li>• Oscilloscope</li> <li>• Multimeters</li> <li>• DC Power supply</li> <li>• Electric city Trainer Module</li> <li>• Computers</li> </ul>
<b>Safety Regulations</b>	Safety regulations are being strictly followed. See Annex I for details of Laboratory Precautions.	Safety regulations are being strictly followed. See Annex I for details of Laboratory Precautions.	Safety regulations are being strictly followed. See Annex I for details of Laboratory Precautions.

**Table 9: Laboratories Details 3**

Laboratory Title	Electrical Machines Lab	Network/ DSP Lab	Project Lab
<b>Location &amp; Area</b>	Israr Block (1 <sup>st</sup> Floor)	Israr Block (1 <sup>st</sup> Floor)	Israr Block (1 <sup>st</sup> Floor)
<b>Objectives</b>	To enable the students to analyze different types of DC motors, Single/three Phase AC Motors and transformers	To enable the students to perform networking protocols and enabling them to design networks on software	Dedicated to Final Year students to perform their Final Year Projects
<b>Adequacy for Instruction</b>	All required instructions are displayed in the lab at appropriate places for use by faculty, students and support staff.	All required instructions are displayed in the lab at appropriate places for use by faculty, students and support staff	
<b>Courses Taught</b>	1. Electrical Machine	1. Computer Network 2. DSP	
<b>Software Available</b>		MS Office, MATLAB, Protieus, Pspice	MS Office, MATLAB, Protieus, Pspice
<b>Major Apparatus / Equipment</b>	<ul style="list-style-type: none"> <li>• Single Phase Transformer</li> <li>• DC/AC Machine</li> <li>• Three Phase Motor</li> <li>• Three Phase Transformers</li> </ul>	<ul style="list-style-type: none"> <li>• Data Communication Trainer</li> <li>• LAN Trainers</li> <li>• FPGA Kits</li> <li>• DSP Kits</li> </ul>	<ul style="list-style-type: none"> <li>• Oscilloscope</li> <li>• Function Generator</li> <li>• DMM</li> <li>• Power supply</li> <li>• Soldering Station</li> <li>• Drill machines</li> <li>• Computers</li> </ul>
<b>Safety Regulations</b>	Safety regulations are being strictly followed. See Annex I for details of Laboratory Precautions.	Safety regulations are being strictly followed. See Annex I for details of Laboratory Precautions.	Safety regulations are being strictly followed. See Annex I for details of Laboratory Precautions

**Table 10: Laboratories Details 4**



<b>Laboratory Title</b>	<b>High Voltage Lab</b>
<b>Location &amp; Area</b>	Behind Israr Block
<b>Objectives</b>	To enable the students to analyze different types of High Voltage Equipment's Behavior
<b>Adequacy for Instruction</b>	All required instructions are displayed in the lab at appropriate places for use by faculty, students, and support staff.
<b>Courses Taught</b>	High Voltage Engineering
<b>Software Available</b>	
<b>Major Apparatus / Equipment</b>	<ul style="list-style-type: none"> <li>• Three Phase Supply</li> <li>• Control Panel</li> <li>• Three Phase Transformers etc.</li> </ul>
<b>Safety Regulations</b>	Safety regulations are being strictly followed. See Annex I for details of Laboratory Precautions.

**Table 10: Laboratories Details 5**

### **5.1 Standard 3-1**

**Laboratory manuals/documentation/instructions for experiments must be available and easily accessible to faculty and students.**

All manuals and instructions are available in the respective Laboratory and copies of these are also available in EE coordinator office. Faculty members and students can easily access the lab manuals from the laboratory assistants. HITEC University has state of the art laboratories equipped with fine equipment's and can easily meet the growing standards of the world.

### **5.2 Standard 3-2**

**There must be support personal for instructions and maintaining the laboratories.**

Each laboratory has 2 staff members: a laboratory assistant and a laboratory attendant.

Laboratory assistant is responsible for overall maintenance of laboratory and maintains the manuals and instructions while laboratory attendant is responsible to maintain the laboratory equipment and general duties within the lab.

### **5.3 Standard 3-3**

**The University computing infrastructure and facilities must be adequate to support program's objectives.**

The computer laboratories are equipped with state of the art computers and relevant equipment. The program objectives require the students to be equipped with IT skills at the end of the program and facilities (equipment and software) provided in the computer laboratories are adequate to achieve program objectives.

## 6.0 Criterion 4: Student Support and Advising

Since the launch of HITEC University in year 2007, all its programs have started and finished on schedule. The culture in HITEC is that teachers and students have facility of frequent interaction, even after classes, for any professional and academic advice. This aspect is even highlighted and indicated by the students in the feedback on HEC Performa number 10, taken by the QEC in the university.

### Standard 4-1

**Courses must be offered with sufficient frequency for students to complete the program in a timely manner.**

The department strategy to offer courses (core and electives) for the subject program is based on schedule approved by Pakistan Engineering Council (PEC), given in university prospectus. The required and elective courses are offered in a logical sequence that grooms the students to obtain the program's defined objectives and outcomes. The courses offered outside the department belongs to department of Mechanical Engineering, department of Mathematics and department of Computer Science and Engineering. The Engineering program coordinator collaborates with the respective department coordinators and accommodate the desired courses in program's time table. This is done well in advance prior to the commencement of classes to avoid any clashes in the schedule.

### Standard 4-2

**Courses in the major area of study must be structured to ensure effective interaction between students, faculty and teaching assistants.**

Courses are structured in the board of studies before commencement of each semester. Faculty members interact frequently among themselves and with students. Contact hours for students to visit the respective faculty members are also displayed. Students are encouraged to

participate in providing feedback and their views about course contents during and after the course.

#### **Standard 4-3**

**Guidance on how to complete the program must be available to all students and access to qualified advising must be available to make course decisions and career choices.**

Students are informed about the program requirements at the start of the session during orientation week by chairman of the department. Chairman acts as advisor to guide students to choose appropriate courses and provide guidance on different issues. He also maintains a list of guidance points provided to students during the semester. These points are evaluated at the end of the program to take necessary improvement.

Director student's affair provides professional counseling to students as per need. Students can get in touch directly with him/her for any advice.

Director student affairs and senior faculty members arrange industrial tours for students to improve their subject vision and technical knowledge. They also invite professionals from different industries to conduct interactive sessions with students for advice on professional matters and future career planning.

Program coordinator maintains a list of professional societies and technical bodies, which is provided to students on demand. Students can get membership of such organizations on individual basis.

## 7.0 Criterion 5: Process Control

### Standard 5-1

**The process by which students are admitted to the program must be based on quantitative and qualitative criteria and it should be clearly documented. This process must be periodically evaluated to ensure that it is meeting its objectives.**

The program has a well-defined admission criterion, which includes evaluation of students' previous education and admission test results. Admissions are entertained annually in fall semester.

Students who have scored more than 60% marks in SSC and HSSC examination (pre-engineering group) or A levels or equivalent with Physics, Chemistry and Mathematics or Diploma of Associate Engineering in Electrical, are eligible to appear in the admission test of the program. Admission is granted strictly on the basis of academic record and admission test results.

Students from accredited universities are eligible to transfer their credits to HITEC University. Students have to submit complete course curriculum and internal evaluation certificate of each subject from his/her previous institution duly signed by head of the department/principal. Student's applications in this regard are dealt on case-to-case basis. Such applications are discussed in Board of Studies for evaluation and decision. Controller of examination is the final authority to make decision regarding credit transfers.

This admission criterion is reviewed annually by the board of faculties and academic council in the light of instructions issued by PEC and HEC. Minor adjustments are made under those recommendations.

### Standard 5-1

**The process by which students are registered in the program and monitoring of students' progress to ensure timely completion of the program must be documented. This process must be periodically evaluated to ensure that it is meeting its objectives.**

On completion of admission process including deposit of dues, the applicants will be registered as students at the University. Applicants are

required to provide original academic certificates and documents to the Registrar Office at the time of registration. After registration, Registrar Office will issue registration number and university registration card to all students.

Students are evaluated through quizzes, assignments, case studies/ seminars/workshops, practical/laboratory tests, semester projects and final year projects. In addition, there are two sessional examinations (per semester) and a final examination carrying weightage of 30% and 50% respectively. The performance of each student in a course of study is based on relative grading system, mentioned below.

<b>Grade</b>	<b>Grade Point</b>
A	4.00
A-	3.67
B+	3.33
B	3.00
B-	2.67
C+	2.33
C	2.00
C-	1.67
D	1.00
F	0.00
I	Incomplete

Only qualified students, based upon above mentioned criterion, in each semester are eligible to pick courses for the next semester. We are currently working to develop an evaluation system to periodically check the significance of this whole process.

### **Standard 5-3**

**The process of recruiting and retaining highly qualified faculty members must be in place and clearly documented. Also processes and procedures for faculty evaluation and promotion must be consistent with institution mission statement. These processes must be periodically evaluated to ensure they meet the objectives.**

Vacant and newly created positions are advertised in the national newspapers. Applications are received by the Registrar office, scrutinized by the respective head of departments. Call letters are issued to the short-listed candidates on the basis of experience, qualification, publications and other qualities/activities as determined by the University in the light of HEC guidelines. Before appearing in the interview, the short listed candidates have to present their work in front of senior faculty members. The candidates are interviewed by the University Selection Board comprising of head of department, dean engineering, vice chancellor, treasure and registrar. Induction of new candidates depends upon the number of approved vacancies.

Faculty members are retained by giving them good remuneration, favorable teaching environment, research facilities and management support. The teaching responsibilities are reasonable to let faculty members focus on research and innovation. Research work published in renowned journals is awarded monetary support. To retain highly qualified faculty, on campus family accommodation is provided to PhD qualified faculty members. Schooling facility is provided to children of faculty members, the first kid is taught at HITEC School for free and second child for 75% fee.

On yearly basis faculty performance is evaluated as per HEC Performance number 10; head of department's recommendations and with the counter signature of vice chancellor. The annual increment is based on the recommendations of the Dean and the vice chancellor.

#### **7.4 Standard 5-4**

**The process and procedures used to ensure that teaching and delivery of course material to the students emphasizes active learning and that course learning outcomes are met. The process must be periodically evaluated to ensure that it is meeting its objectives.**

The program is actively evaluated by Dean, Chairperson of the department and QEC department. The feedback of the subject taught is the best instrument to measure that the course outcomes were compatible with the course objectives. The students give feedback on

Performa number 1 regarding course contents and its delivery. Through Performa number 10, students evaluate and comment on teacher's efforts, to deliver the course contents, his/her general conduct in the class, the environment he/she maintains and extra efforts, he/she makes to satisfy students' quest for knowledge.

Faculty feedback is also received on HEC Performa number 2 (Faculty Course Review Report) and Performa number 5 (Faculty Survey) which is a very useful activity to evaluate the course contents, learning and teaching environment and overall teacher's satisfaction level. Course evaluation by teachers also indicates what percentage of desired outcome has been achieved by the course contents and what needs to be improved or changed.

This exercise is repeated every semester. The feedback is discussed with Chairperson, who focuses on making improvements in the weak areas, identified by the students. Each teacher is graded out of 5 marks. The grades indicate level of performance of teachers, as visualized by the students. QEC formally submits these feedback results to VC, Dean Engineering and Technology and Chairman for their information and for necessary corrective measures.

#### **7.5 Standard 5-5**

**The process that ensures that graduates have completed the requirements of the program must be based on standards, effective and clearly documented procedures. This process must be periodically evaluated to ensure that it is meeting its objectives.**

The program is being run on semester basis and at the end of each semester examinations are held to evaluate the student's progress. Qualified students are allowed to join next semester and this cycle continues till the end of 8<sup>th</sup> semester which is the final semester. At the end of the 8<sup>th</sup> semester all students are required to submit their respective final year projects. Student's results are announced on the basis of projects and examination results.

Requirements of this standard are met through three Performa issued by HEC. The feedback is documented, and its evaluation indicates degree



of satisfaction of the graduates. The first of these Performa is Performa 3 i.e. Survey of Graduating Students (Annexure-A). Second Performa is Perform 7 i.e. Alumni Survey (Annexure-A) and third Performa is Performa 8 i.e. Employer Survey (Annexure-A). These mentioned Performa are extremely good instruments to measure the program outcomes.

The feedback is received on annual basis. A reasonably huge number of alumni were highly satisfied with the knowledge provision and its application in practice. Also, they were satisfied with the skills like communication, interpersonal and management to be good enough for the field. They were also contented with the current status of electrical engineering faculty. The suggestions given by the graduating students and graduates working in the industry are given due weightage. For example, a few graduates through Alumni survey indicated that communication skills courses like English and technical writing must be improved. They also pointed out the importance of offering courses in accordance with the market demand and balance of practical courses versus theoretical courses. All recommendations are forwarded to academic council to grant approval for change, where required.

The process of feedback collection from employer is still in progress. This survey is suffering due to non-responsiveness of the employers.

## 8.0 Criterion 6: Faculty

### 8.1 Standard 6-1

There must be enough full-time faculties who are committed to the program to provide adequate coverage of the program areas/courses with continuity and stability. The interests and qualifications of all faculty members must be sufficient to teach all courses, plan, modify and update courses and curricula. All faculty members must have a level of competence that would normally be obtained through graduate work in the discipline. The majority of the faculty must hold a Ph.D. in the discipline.

Program Area of Specialization	Courses in the area and average number of sections per year	Number of faculty members in each area	Number of faculty with PhD Degree
Electrical	EE-301, EE-302, EE-303, EE-307, EE-304, EE-305, EE-306, EE-308, EE-402, EE-405, EE-403, EE-411, EE-410, EE-422, EE-427,	8	3
<b>Total</b>	<b>15</b>	<b>8</b>	<b>3</b>

**Table 11: Faculty Distribution by Program Area**

### 8.2 Standard 6-2

All faculty members must remain current in the discipline and sufficient time must be provided for scholarly activities and professional development. Also, effective programs for faculty development must be organized.

Faculty concurrency in the discipline is determined based on the criterion set by the University in accordance with HEC guidelines. All faculty members submit their professional resumes on HEC Performa number 9 (Faculty Resume) once a year (Annexure-E). This information is compared with the existing criterion set by university for the concurrency of the post.

All full-time faculty members are allocated teaching hours as per HEC defined limit, which enables the faculty to have enough spare time to perform scholarly activities. All faculty members allocate separate work hours for discussion and interaction with students.

Faculty members are provided with adequate resources for research and academic activities. Faculty members also have access to library materials for academic and research activities. Professional training is also provided to faculty to enhance their capabilities. A training workshop is organized for faculty members in summer to improve their method of teaching and critical thinking.

Special arrangements are made by the department to facilitate faculty participation in professional development courses. Recently, university has organized training workshop titled, 'Quality Assurance in Education' for senior faculty members who will then mentor junior faculty members. The university encourages the faculty to participate in research activities by providing them sufficient financial support within or outside university, to publish in conferences and journals.

### **8.3 Standard 6-3**

**All faculty members should be motivated and have job satisfaction to excel in their profession.**

Faculty members are motivated through documented appreciation (annual performance evaluation report) in addition to faculty recreational tours funded by university and interdepartmental sports events.

The faculty survey of the program using HEC Performa number 5 indicates the mix reactions of the faculty, which indicates that teaching load be distributed evenly, and more relaxed environment be generated. Faculty Survey results are attached in Annexure F.

## 9.0 Criterion 7: Institutional Facilities

### 9.1 Standard 7-1

**The institution must have the infrastructure to support new trends in learning such as e-learning.**

The university has provided e-learning facilities to faculty members and students. All faculty members and students have access to internet and e-learning library section through LAN and wireless.

A separate team from within the IT Department is working to maintain and improve system for supporting e-learning. The team is adequately staffed and is well trained and capable of providing on the spot support. The university has provided enough funding to support the e-learning based on Moodle software.

A total of 25 desktop computer systems are available to students, in the library, to access electronic library resources. Also, university website supports a Moodle system for easy access of students to the lectures and other course related material.

A Content Management System (CMS) is used to handle student's attendance and semester results in a collaborative environment. The team is also working to integrate fee payments and admission processes into the CMS.

### 9.2 Standard 7-2

**The library must possess an up-to-date technical collection relevant to the program and must be adequately staffed with professional personnel.**

The university library has enough technical books in hard copies to support the program learning. Online library management system helps faculty to search the required books and manage books that are already issued to them.

The library is staffed with 3 professional staff members and 2 para-technical staff and 4 non-technical staff members. Total 9 staff members are working in 2 shifts (Morning and Evening) to help students and faculty members to get access to required book or learning material efficiently.

### **9.3 Standard 7-3**

**Classrooms must be adequately equipped, and offices must be adequate to enable faculty to carry out their responsibilities.**

The department has sufficient number of classrooms to accommodate all sessions as per university schedule. All classrooms are equipped with air conditioners to provide a good working environment, with proper lighting and ventilation. Most classrooms also have fixed/portable multimedia resources.

Faculty offices are sub-divided into cubicles to maintain privacy and to provide a noise free environment, which will enable faculty members to focus on research activities. Each faculty office is equipped with air conditioner, printer and internet connectivity. Administrative department helps maintain the infrastructure and perform regular repair and maintenance.

## 10.0 Criterion 8: Institutional Support

### 10.1 Standard 8-1

**There must be sufficient support and financial resources to attract and retain high quality faculty and provide the means for them to maintain competence as teachers and scholars.**

University allocates enough financial resources each year to hire competent faculty as required. A research fund of worth Rs. 500,000 had been created to support faculty supervised final year projects.

As already listed in standard 5-3, faculty members are retained by giving them good remuneration, favorable teaching environment, research facilities and management support. On premise residence is provided to PhD qualified faculty and there is a plan to build a faculty hostel.

As listed in standard 6-2, faculty members are provided with adequate resources for research and academic activities to maintain their competence. Faculty members have also access to library materials for academic and research activities. Professional training is provided to faculty not only to enhance their capabilities, but also resulting in career growth.

### 10.2 Standard 8-2

**There must be an adequate number of high-quality graduate students, research assistants and Ph.D. students.**

The university follows the guidelines of PEC for admission in this program. The number of graduate students given admission during the last three years is 30, including ten PhD students. Currently there are two research assistants in the department.

Faculty to graduate student's ratio for the last three years remained in the range of 3:1 to 9:1.

### 10.3 Standard 8-3

**Financial resources must be provided to acquire and maintain Library holdings, laboratories, and computing facilities.**

Library at HITEC University holds more than 20000 books for all programs. The library provides number of computers for supporting student learning. Library is organized to accommodate more than 60

students (male, female) in the library commons. The computers in the library commons are equipped with internet facility.

Laboratories at HITEC University are adequately stocked with equipment and supporting material which enable students to carry out the desired experiments and laboratory work. Each year a fixed amount of budget is allocated to each laboratory to maintain and upgrade the equipment and other facilities.

Computing facilities provide excellent platform to students to enhance their learning capabilities. There are 10 computer laboratories, which are fully equipped for providing IT related infrastructure support.

## 11.0 Conclusion

The self-assessment report of the Department of Electrical Engineering, HITEC University is an important document, which gives strengths and weaknesses of the program. The management is striving hard to improve infrastructure for establishment of conducive environment for studies. The faculty is focused on imparting quality education, introducing innovative techniques for conducting quality research to produce competent engineers. The report has been prepared after evaluating the program in the light of 8 criterion and 31 standards given in HEC's Self-Assessment Manual. The program mission objectives and outcomes are assessed, and strategic plans are presented to achieve the goals, which are again measurable through definite standards. Teachers' evaluation revealed satisfactory standards, the score of 15 teachers of the program ranged from 3.50 to 4.90. Students' course evaluation score ranged between 3.50 and 4.85 with a mean of 4.20 points in 0-5 scale. Alumni surveys revealed variable results regarding knowledge, interpersonal skills, management and leadership skill. Weaknesses are identified which are related to lack of career counseling, laboratories and equipment. Improvements in curriculum design and infrastructure are suggested which are based upon set, well defined and approved criteria. Pre-requisites are fully observed, examinations are held according to fixed schedules, academic schemes are prepared well in advance, transparent admission, registration and recruiting policy, excellent student teacher ratio are some of the strong areas of this program. The number of courses along with titles and credit hours for each semester are thoroughly planned. Their efficacy was measured through different standards, and it was found to be satisfactory. The need of refresher courses for the fresh faculty on methods of teaching cannot be over emphasized.

Proper steps are taken to guide the students for program requirements, communication, meetings, tutorial system, tours, students-teacher interaction etc. Some improvements have been suggested regarding the process control covering admission, registration, recruiting policy, courses and delivery of material, academic requirements, performance and grading. The university, Pakistan Engineering Council as well as Higher Education Commission have



set forth proper rules, which are properly followed. At present there are thirty-nine faculty members who are highly qualified in their fields. However, faculty members need motivation for advanced knowledge, research, and external training.

Institutional facilities were measured through Criterion 7; infrastructure, library, classroom and faculty offices and in each case, short comings and limitations are highlighted. Institutional facilities need to be strengthened. Accordingly, institutional support will greatly promote and strengthen academic, research, management, and leadership capabilities.

In conclusion, the strong and weak areas of the program are as under: -

### **11.1 Strong Areas**

- Curriculum Design, development and organization are based upon set, well defined and approved criteria.
- Pre-requisites fully observed.
- Examinations according to fixed schedule.
- Academic schemes fully prepared in advance.
- The number of courses along with their titles and credit hours for each semester, course contents for degree program are fully planned.
- Transparent admission, registration and recruiting policy.
- PEC and HEC guidelines are fully followed.
- Excellent students-teacher ratio
- Efficient and capable senior faculty

### **11.2 Weaknesses**

- Low number of case studies
- Training of junior faculty members

# Annexture A

## Alumni and Employer Survey Results

Form No. QAC-05

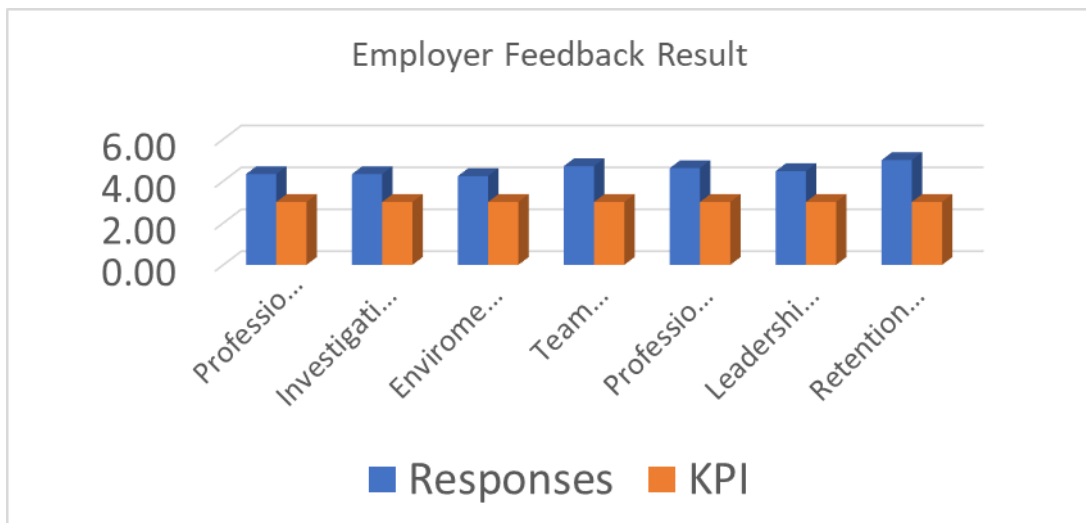
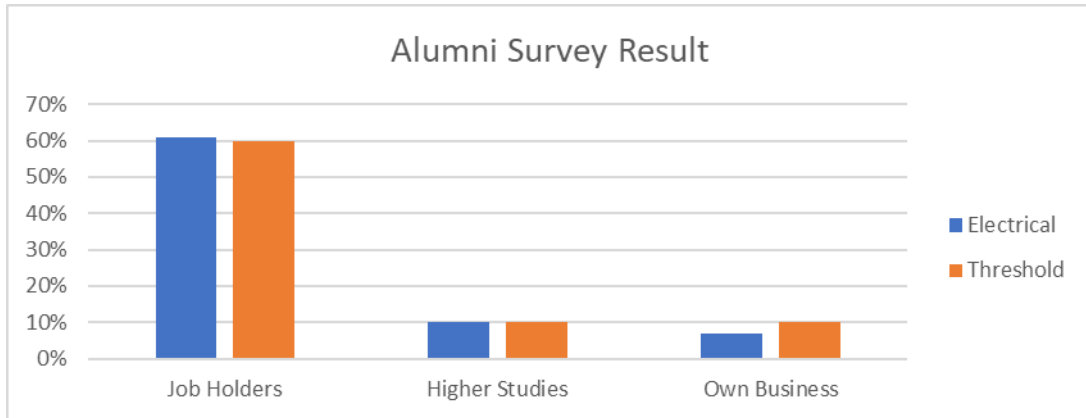
### HITEC UNIVERSITY TAXILA DIRECTORATE OF QUALITY ASSURANCE & COLLABORATION ALUMNI FEEDBACK FORM

Name:					
Alumni No:		Graduating Year:			
Present Address:					
Email:					
Present Status:	• Job Holder	• Higher Studies	• Unemployed	• Own Business	• Internship
Present Employer:					
Present Employer Address: ( <i>Contact Number, Email &amp; Mailing Address</i> )					

Please tick (√) one of the three choices:

1.	Did you get your first job after graduation within:-	
	<i>1st year</i>	<i>1 – 2 years</i>
		<i>2 – 3 years</i>
2.	To what extent you apply the knowledge gained at HITEC University in your profession?	
	<i>Sparingly</i>	<i>Sometimes</i>
		<i>Extensively</i>
3.	Have you been appreciated for making any innovative suggestions towards your professional activity?	
	<i>Not, so far</i>	<i>Only once</i>
		<i>More than one time</i>
4.	Did you get the chance to attend a professional short-course / seminar/ workshop so far?	
	<i>No</i>	<i>Only once</i>
		<i>More than one time</i>
5.	Do you feel the need for updating your professional knowledge on self-help basis even if you have not attended any short-course / seminar /workshop?	
	<i>I do not feel the need</i>	<i>Sometimes I do feel the need</i>
		<i>I continuously update myself</i>
6.	A professional engineer is an important person of the society he lives in. Do you remain mindful of societal issues while exercising your profession?	
	<i>Sometimes I have to be mindful</i>	<i>Most of the times I have to be mindful</i>
		<i>I am always mindful of this aspect</i>
7.	An engineer has to deal with his superior / colleagues / subordinates etc. Do you conduct yourself in a supportive manner?	
	<i>Sometimes</i>	<i>Most of the times</i>
		<i>Always</i>
8.	Did you ever get the experience of working in a multidisciplinary team to create a solution of an engineering problem?	
	<i>Sparingly</i>	<i>Sometimes</i>
		<i>Extensively</i>
9.	Did you get a chance to lead and manage a team of employees in developing a solution to an engineering problem?	
	<i>Opportunity Awaited</i>	<i>Only Once</i>
		<i>More than once</i>
10.	Have you been involved in any informal activity, other than your profession?	
	<i>None</i>	<i>Social activity</i>
		<i>Community service, charity</i>
11.	Please indicate your satisfaction to the appropriateness of the above mentioned questions. To make your feedback more comprehensive, we welcome your suggestions:	

PEO	Objectives	Assessment Method	KPI Threshold	Attained Result
1	Our graduates will be proficient engineers in industry, academia or manage self-initiated business activity.	Alumni Record	60 % should be employed	61%
			At least 10 % should go for higher studies	10%
			At least 10 % should manage self-initiated business	7%
		Employer Survey Q-1	3 out of 5	4.32
2	They will exhibit adaptation to advancements in knowledge for creating solutions of complex problems.	Alumni Record	At least 10 % should go for higher studies	10%
		Alumni Survey Q-3	60 %	73.5%
		Alumni Survey Q-8	60 %	79%
		Employer Survey Q-2	3 out of 5	4.32
3	They will contribute as effective team members and managers in their organizations	Alumni Record	At least 10 % should manage self-initiated business	7%
		Alumni Survey Q-9	60 %	53%
		Employer Survey Q-4	3 out of 5	4.68
		Employer Survey Q-6	3 out of 5	4.40
		Employer Survey Q-7	3 out of 5	5.0
4	In dealing with others, they will conduct with dignity, integrity and demonstrate commitment to social responsibilities.	Alumni Survey Q-6	60 %	50%
		Alumni Survey Q-7	60 %	67%
		Employer Survey Q-3	3 out of 5	4.24
		Employer Survey Q-5	3 out of 5	4.56



DIRECTORATE OF QUALITY ASSURANCE & COLLABORATIONS					
ALUMNI SURVEY RESULTS: Year 2021 (Batch 2016), Year 2022 (Batch 2017) and Year 2023 (Batch 2018)					
Department	Total Responses	Job Holders	Higher Studies	Own Business	Unemployed
Electrical	99	61	10	7	21
%age					
		61%	10%	7%	21%
Threshold according to KPIs		60%	10%	10%	-

**HITEC UNIVERSITY TAXILA**  
**DIRECTORATE OF QUALITY ASSURANCE & COLLABORATION**

**EMPLOYER FEEDBACK FORM**

<b>Name of Organization:</b>	
<b>Address:</b>	
<b>Contact No.:</b>	
<b>Web Address:</b>	
<b>Email:</b>	

<b>Main activity of the Organization:</b>				
<i>Research/Development</i>	<i>Production</i>	<i>Marketing</i>	<i>Academic</i>	<i>Service Provider</i>

<b>Name of HITEC University graduate you are evaluating:</b>
<b>Position of HITEC University graduate you are evaluating:</b>

Please answer the following questions indicating your choice as:-

**1: Highly Unsatisfied -- 5: Highly Satisfied**

Questions	Score
1. Is he / she able to demonstrate application of professional knowledge concerning his / her area of specialization?	
2. Is he / she able to demonstrate the ability to investigate, analyze and design solutions of given problems?	
3. Does he / she take into account the environmental and societal concerns in his / her professional practice?	
4. Is he / she able to work in a team and cooperate with others?	
5. Has he / she been noted for upholding ethical values in exercising his / her profession?	
6. Has he / she been observed demonstrating, effective leadership qualities, while leading a team of peers or subordinates?	
7. Would you like to retain him / her in your organization in future as well?	Yes/No
8. Please indicate your satisfaction to the appropriateness of all the above mentioned questions. To make your feedback more comprehensive, we welcome your valued suggestions:	

**DIRECTORATE OF QUALITY ASSURANCE & COLLABORATIONS**  
**ELECTRICAL ENGINEERING DEPARTMENT**  
**EMPLOYER'S FEEDBACK SURVEY: Year 2021 (Batch 2016) – Year 2022**  
**(Batch 2017)**

Employer	Q1	Q2	Q3	Q4	Q5	Q6	Q7
1	5	5	5	5	5	5	5
2	4	4	4	4	4	4	4
3	4	4	4	4	4	4	4
4	4	4	3	5	4	3	3
5	4	4	5	4	4	3	4
6	4	4	5	5	4	4	4
7	4	4	5	4	5	4	4
8	3	4	5	5	4	4	4
9	3	4	4	5	5	4	4
10	4	4	5	4	3	4	4
11	4	4	4	5	3	4	4
12	3	4	4	4	5	5	3
13	4	4	3	5	4	5	4
14	4	3	4	5	5	4	4
15	5	5	4	5	3	4	4
16	5	5	5	4	5	3	4
17	5	5	4	5	5	3	4
18	3	4	5	5	4	4	4
19	5	5	4	4	3	4	4
20	5	5	5	4	5	3	4
21	5	4	5	5	3	4	4
22	4	5	4	5	3	5	4
23	4	5	3	4	5	4	4
24	5	4	4	3	4	5	4
25	4	5	3	4	5	4	4
26	5	4	3	4	5	4	4
27	4	5	3	4	5	5	5
28	4	5	3	4	5	4	4
29	5	3	4	5	4	4	4
30	5	4	4	5	4	3	4
31	4	5	3	4	5	4	3
32	4	5	3	4	5	4	4
33	5	4	3	4	5	4	4
34	5	3	5	4	5	5	4
35	5	5	5	4	4	5	4
36	5	5	5	5	5	5	5
37	5	5	5	5	5	4	5

38	5	4	3	4	4	5	4
39	5	4	4	5	5	3	4
40	5	4	5	5	4	4	4
Total	4.375	4.325	4.1	4.45	4.35	4.075	4.025

## Annexture B

### Course Evaluation

Form No. QAC-02

HITEC UNIVERSITY TAXILA  
DIRECTORATE OF QUALITY ASSURANCE & COLLABORATION

#### Course Evaluation Form (To be filled by the student)

Department: \_\_\_\_\_ Semester: \_\_\_\_\_

Course Title: \_\_\_\_\_ Instructor Name: \_\_\_\_\_

*Student Name & Registration No. (Optional):* \_\_\_\_\_

Please indicate your level of satisfaction by assigning a number to each of the following statements as given below:-

**1: Highly Unsatisfied 5: Highly Satisfied**

Statements	Score
1. The Class Room facilities and overall environment were conducive to learning.	
2. The recommended Textbook was student-friendly i.e. a student can easily follow it after attending the class lecture.	
3. The library resources, i.e. other books, internet facility, magazines etc. were adequate in supporting the learning.	
4. The concepts were clearly explained.	
5. The course created interest in me to know more about it.	
6. Quizzes, Sessionals and Assignments etc. were helpful in learning this course.	
7. The lab experiments were synchronized with the theory classes.	
8. The lab experiments were helpful in learning the subject.	
9. The lab support was satisfactory.	
10. The course workload was manageable.	
11. I had the knowledge of pre-requisite subjects and mathematics for this course.	Yes/No

Any additional comments:

--



<b>S. No.</b>	<b>Subject</b>	<b>Evaluation</b>
1	English	4.76
2	Network Analysis	4.75
3	Electrical Machines-I	4.71
4	Network Analysis Lab	4.70
5	Electronic Devices & Circuits Lab	4.69
6	Electrical Machines-I Lab	4.68
7	Analog & Digital Systems	4.67
8	Power Generation	4.61
9	Analog & Digital Sys. Lab	4.60
10	Electronic Devices & Circuits	4.58
11	Analog & Digital Systems	4.58
12	Communication Systems Lab	4.56
13	Communication Skills (CS)	4.53
14	Computer Communication Network Lab	4.52
15	Microprocessor & Interfacing Techniques Lab	4.51
16	Computer Communication Network	4.49
17	Health Safety and Environment	4.48
18	High Voltage Engineering	4.48
19	Fundamentals of Electrical Engineering Lab	4.46
20	Analog & Digital Sys. Lab	4.46
21	Analog & Digital Systems	4.45
22	Professional Values & Ethics	4.44
23	Management and Entrepreneurship	4.43
24	High Voltage Engineering Lab	4.43

25	Power Generation Lab	4.42
26	Technical Report Writing	4.41
27	Communication Systems Lab	4.41
28	Analog & Digital Systems Lab	4.41
29	Microprocessor & Interfacing Techniques	4.37
30	Numerical Methods Lab	4.37
31	Electronic Systems Design Lab	4.37
32	Power Electronics Lab	4.36
33	Communication Skills	4.34
34	Fundamentals of Electrical Engineering	4.32
35	Electronic Systems Design	4.28
36	Electronic Systems Design Lab	4.26
37	Telecom Transmission and Switching Systems	4.24
38	Power Systems Operations and Control	4.19
39	Fundamentals of Electrical Engineering Lab	4.18
40	Electrical Machines-I Lab	4.07
41	Electronics Devices and Circuits Lab	4.04
42	Electronics Devices and Circuits	4.03
43	Analog & Digital Systems	4.01
44	Wireless & Mobile Communications Lab	3.98
45	Wireless & Mobile Communications	3.93
46	Communication Systems	3.90
47	Power Electronics	3.80

## Annexture C

### Teacher Evaluation

Form No. QAC-01

HITEC UNIVERSITY TAXILA  
DIRECTORATE OF QUALITY ASSURANCE & COLLABORATION

**Teacher Evaluation Form**  
(To be filled by the student)

Semester: \_\_\_\_\_

*Student Name & Registration No. (Optional):* \_\_\_\_\_

Please indicate your level of satisfaction by assigning a number to each of the following statements as given below:-

**1: Highly Unsatisfied      5: Highly Satisfied**

Statements	Score
1. The teacher distributed the course plan well in time for the current semester.	
2. The course plan contained objectives, topics, Course Learning Outcomes (CLOs), Grading policy etc.	
3. The teacher was punctual.	
4. The teacher communicated the subject matter clearly and effectively and solved sufficient examples.	
5. The teacher encouraged class participation.	
6. The teacher was fair in marking exam papers.	
7. The teacher returned all marked quizzes, assignments, sessionals etc. in reasonable amount of time.	
8. The teacher was available for consultation during the specified visiting hours.	
9. The teacher encouraged students to use Library resources to supplement learning of course topics.	
10. The teacher covered all topics as given in the course plan.	
11. The teacher clearly indicated those questions which were meant for CLOs evaluation.	
12. The teacher encouraged innovative thinking.	
13. You want to be taught by this teacher in the next semester	

Comments:

## Spring 2022

S. No.	Name	Subject	Evaluation
1	Teacher 1	English	4.76
2	Teacher 2	Network Analysis	4.75
3	Teacher 3	Electrical Machines-I	4.71
4	Teacher 4	Network Analysis Lab	4.70
5	Teacher 5	Electronic Devices & Circuits Lab	4.69
6	Teacher 6	Electrical Machines-I Lab	4.68
7	Teacher 7	Analog & Digital Systems	4.67
8	Teacher 8	Power Generation	4.61
9	Teacher 9	Analog & Digital Sys. Lab	4.60
10	Teacher 10	Electronic Devices & Circuits	4.58
11	Teacher 11	Analog & Digital Systems	4.58
12	Teacher 12	Communication Systems Lab	4.56
13	Teacher 13	Communication Skills (CS)	4.53
14	Teacher 14	Computer Communication Network Lab	4.52
15	Teacher 15	Microprocessor & Interfacing Techniques Lab	4.51
16	Teacher 16	Computer Communication Network	4.49
17	Teacher 17	Health Safety and Environment	4.48
18	Teacher 18	High Voltage Engineering	4.48
19	Teacher 19	Fundamentals of Electrical Engineering Lab	4.46
20	Teacher 20	Analog & Digital Sys. Lab	4.46
21	Teacher 21	Analog & Digital Systems	4.45
22	Teacher 22	Professional Values & Ethics	4.44
23	Teacher 23	Management and Entrepreneurship	4.43

24	Teacher 24	High Voltage Engineering Lab	4.43
25	Teacher 25	Power Generation Lab	4.42
26	Teacher 26	Technical Report Writing	4.41
27	Teacher 27	Communication Systems Lab	4.41
28	Teacher 28	Analog & Digital Systems Lab	4.41
29	Teacher 29	Microprocessor & Interfacing Techniques	4.37
30	Teacher 30	Numerical Methods Lab	4.37
31	Teacher 31	Electronic Systems Design Lab	4.37
32	Teacher 32	Power Electronics Lab	4.36
33	Teacher 33	Communication Skills	4.34
34	Teacher 34	Fundamentals of Electrical Engineering	4.32
35	Teacher 35	Electronic Systems Design	4.28
36	Teacher 36	Electronic Systems Design Lab	4.26
37	Teacher 37	Telecom Transmission and Switching Systems	4.24
38	Teacher 38	Power Systems Operations and Control	4.19
39	Teacher 39	Fundamentals of Electrical Engineering Lab	4.18
40	Teacher 40	Electrical Machines-I Lab	4.07
41	Teacher 41	Electronics Devices and Circuits Lab	4.04
42	Teacher 42	Electronics Devices and Circuits	4.03
43	Teacher 43	Analog & Digital Systems	4.01
44	Teacher 44	Wireless & Mobile Communications Lab	3.98
45	Teacher 45	Wireless & Mobile Communications	3.93
46	Teacher 46	Communication Systems	3.90
47	Teacher 47	Power Electronics	3.80

Following is the list of teachers that are being evaluated (in fall 2022) by the students along with the serial number and graded scores.

<b>S. No.</b>	<b>Name</b>	<b>Subject</b>	<b>Evaluation</b>
1	Teacher 1	Applied Physics	4.77
2	Teacher 2	Wave Propagation and Antennas Lab	4.72
3	Teacher 3	Wave Propagation and Antennas	4.70
4	Teacher 4	Applied Physics Lab	4.69
5	Teacher 5	Economics	4.65
6	Teacher 6	Power System Analysis Lab	4.64
7	Teacher 7	English	4.61
8	Teacher 8	Applied Physics	4.61
9	Teacher 9	Power System Analysis	4.61
10	Teacher 10	Power Transmission and Distribution Lab	4.61
11	Teacher 11	English	4.61
12	Teacher 12	Power Transmission and Distribution	4.60
13	Teacher 13	Basic Electro-Mechanical Lab	4.60
14	Teacher 14	Basic Electro-Mechanical Engineering	4.58
15	Teacher 15	Linear Circuit Analysis	4.53
16	Teacher 16	Oral Communication	4.50
17	Teacher 17	Renewable Energy Resources	4.49
18	Teacher 18	Renewable Energy Resources	4.47
19	Teacher 19	English	4.45
20	Teacher 20	English	4.41
21	Teacher 21	Linear Circuit Analysis Lab	4.31
22	Teacher 22	Digital Signal Processing Lab	4.27

23	Teacher 23	Computing Fundamentals	4.23
24	Teacher 24	Linear Control Systems Lab	4.16
25	Teacher 25	Electrical Machine-II Lab	4.14
26	Teacher 26	Signals and Systems	4.13
27	Teacher 27	Applied Physics Lab	4.09
28	Teacher 28	Linear Control Systems	4.08
29	Teacher 29	Electromagnetic Theory	4.08
30	Teacher 30	Workshop Practice	4.04
31	Teacher 31	Instrumentation & Measurement Lab	4.03
32	Teacher 32	Digital Logic Design	4.02
33	Teacher 33	Communication Skills	4.02
34	Teacher 34	Data Structure & Algorithms Lab	4.01
35	Teacher 35	Industrial Electronics Lab	4.01
36	Teacher 36	Communication Skills	4.00
37	Teacher 37	Digital Logic Design Lab	4.00
38	Teacher 38	Electrical Machine-II	3.99
39	Teacher 39	Probability and Statistics	3.98
40	Teacher 40	Instrumentation & Measurement	3.98
41	Teacher 41	Computing Fundamentals Lab	3.95
42	Teacher 42	Data Structure & Algorithms	3.95
43	Teacher 43	Industrial Electronics	3.86
44	Teacher 44	Digital Signal Processing	3.67

## Annexure D: Research Papers List

### RESEARCH PUBLICATIONS

Sr. No.	Name of Authors	Title of Research Paper	Name of Journal Indexed by ISI	Impact Factor
1	C. A. Hanif, <b>Mughal M. A.</b> , M. A. Khan, U. Tariq, Y. J. Kim et al	Human gait recognition based on sequential deep learning and best features selection		
2	Khurshid, A.; <b>Mughal, M.A.</b> ; Othman, A.; Al-Hadhrami, T.; Kumar, H.; Khurshid, I.; Arshad; Ahmad, J	Optimal Pitch Angle Controller for DFIG-Based Wind Turbine System Using Computational Optimization Techniques		
3	Shoukat, A., <b>Mughal, M. A.</b> , Gondal, S. Y., Umer, F., Ejaz, T. et al	Optimal Parameter Estimation of Transmission Line Using Chaotic Initialized Time-Varying PSO Algorithm. CMC-Computers		
4	Niazi M, <b>Mughal MA</b> , Hussain A	Stability Analysis of Two Area Power System in the Presence of DDSG Wind Turbine and Fault. International Journal of Computing and Digital Systems		
5	T. Ejaz, A. Sami, <b>Mughal M.A.</b> , and H. Ur Rahman	Volume Fraction Extraction for Binary Mixture of Ethanol and Methanol Using Optimized Microwave Microfluidic Sensor		
6	<b>Mughal, M.A.</b> ; Ejaz, T.; Arshad; Hussain, A.	Metaheuristic Regression Equations for Split-Ring Resonator Using Time-Varying Particle Swarm Optimization Algorithm		<i>2.11</i>
7	Arshad; <b>Mughal, M.A.</b> ; Nekahi, A.; Khan, M.; Umer, F	Influence of Single and Multiple Dry Bands on Critical Flashover Voltage of Silicone Rubber Outdoor Insulators		<i>2.676</i>



8	<b>Mughal, M.A.;</b> Ma, Q.; Xiao, C	Photovoltaic Cell Parameter Estimation Using Hybrid Particle Swarm Optimization and Simulated Annealing		2.676
9	Lina Wang, Deng Jie, <b>Mughal, M.A.</b>	Two SiC JFET Simulation Model Considering Temperature Influence		
10	Umer F. , Sabir S.U. , Khan N., <b>Mughal M.A.</b> , Gauhar H., Almani A.A., Shan G.F.	De-Coupled Power System Analysis Using Parameter Injection Method		

<b>Dr. Syed Kashif Imdad</b>				
1	Salahuddin, Humayun, <b>Kashif Imdad</b> , Muhammad Umar Chaudhry, Muhammad Munwar Iqbal, Vadim Bolshev, Aamir Hussain, Aymen Flah, Vladimir Panchenko, and Marek Jasiński	Electric Vehicle Transient Speed Control Based on Vector Control FM-PI Speed Controller for Induction Motor	<i>Applied Sciences</i>	2.887
2	Salahuddin, Humayun, <b>Kashif Imdad</b> , Muhammad Umar Chaudhry, Dmitry Nazarenko, Vadim Bolshev, and Muhammad Yasir	Induction Machine-Based EV Vector Control Model Using Mamdani Fuzzy Logic Controller	<i>Applied Sciences</i>	2.887
3	Khan, Saadat Ullah, Muhammad Rafiq, and <b>Kashif Imdad</b>	Temporal Effects of Thermal Stresses on Solid Dielectric Materials under Diverse Voltage Conditions	<i>Pakistan Journal of Engineering and Technology</i>	Y(HEC)
4	<b>Imdad, Kashif</b> , and Ijaz Hussain	An Extensive Study on Condition Monitoring of Distribution Transformer under Transients.	<i>University of Wah Journal of Science and Technology (UWJST)</i>	Y(HEC)
5	Faisal, Haseeb, <b>Kashif Imdad</b> , Najeeb Hussain, and Faisal Sharif	Frequencies Dominations for Different Rating of Distribution Transformer under Transients	<i>International Journal of Engineering Works</i>	Y(HEC)
6	Naqvi, Syed AamirRaza, and <b>Syed Kashif Imdad</b>	Temperature and hydrophobicity of silicon rubber	<i>Electrical Insulations</i>	1.25
7	<b>Imdad, Syed Kashif</b> , and Muhammad Amin	Aging of polymeric insulator installed at colombian environment	<i>Electrical Insulations</i>	1.25
8	<b>Kashif Imdad</b>	<a href="#">Assessing Wetland ecosystem health in Sundarban Biosphere Reserve using pressure-state-response model</a>	<i>Applied Physics</i>	2.2
9	<b>Kashif Imdad</b>	<a href="#">Analysis of the Heat and Mass Transfer in the MHD Flow of a Generalized Casson Fluid in a Porous Space Via Non-Integer Order Derivatives without a Singular Kernel</a>	<i>Applied Mathematics</i>	0.25
10	<b>Kashif Imdad</b>	<a href="#">A passive verses active exposure of mathematical smoking model: A role for optimal and dynamical control</a>	<i>Applied Mathematics</i>	0.25
<b>Engr. Iftikhar Ahmed</b>				

1	Iftikhar Ahmed, Sultan Shoaib, Raza Ali Shah	Qud-Sector HMSIW Trpered Slot Antenna array or milimeter wave applications	MDPI Electronics	2.9
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<b>Engr. M. Shahzad</b>				
1	Muhammad Shahzad, Irum Misbah and Ejaz Muhammad.	Fuzzy Logic Based Time Series Prediction Algorithm Using Nearest Neighbourhood Clustering	Journal of Engg. Research	0.62
2	Shahzad, Muhammad, et al.	Adaptive control of distributed generation and demand side management in a microgrid.	2021 IEEE Conference on Technologies for Sustainability (SusTech). IEEE, 2021 USA.	
3	Shahzad, Muhammad, et al.	An Efficient Energy Management System for Renewable Energy Sources Based Microgrid for Remote Areas	2023 IEEE Conference on Technologies for Sustainability (SusTech). IEEE, 2023 USA.	
4	Sadiq, Rehan, Umair Naeem, and Muhammad Shahzad	Power system stabilization using unified power flow controller and model predictive control.	International Symposium on Recent Advances in Electrical Engineering (RAEE).	-
5	Shahzad, Muhammad, et al.	Fuzzy logic-based algorithm for wind energy prediction	International Symposium on Recent Advances in Electrical Engineering (RAEE).	
<b>Engr. Safee Ullah</b>				
1	Ali, Muhammad Umair, Kamran dad kallu, Haris, <b>Safee Ullah</b> et al.	"A Robust Computer-Aided Automated Brain Tumor Diagnosis Approach Using PSO-Relief Optimized Gaussian and Non-Linear Feature Space." <i>Life</i> 12.12 (2022): 2036.	MDPI life	3.253
2	Sattar, Muhammad Nasir, <b>Safee Ullah</b> et al.	"Design and performance analysis of fuzzy supervisory	<i>Mehran University Research Journal</i>	-

		controller for a magnetic levitation system." <i>Mehran University Research Journal of Engineering &amp; Technology</i> 41.2 (2022): 91-99.	<i>of Engineering &amp; Technology</i>	
<b>Engr. M. Adnan Khan</b>				
1	Khan, M.A.; Saleh, A.M.; Waseem, M.; Sajjad, I.A.	Artificial Intelligence Enabled Demand Response: Prospects and Challenges in Smart Grid Environment.	IEEE Access	3.47
2	M. Adnan Khan, M. Waseem, A. Goudarzi, S. Fahad, I. A. Sajjad, and P. Siano,	Incorporation of Blockchain Technology for Different Smart Grid Applications: Architecture, Prospects, and Challenges	Energies	3.25
3	Khan, M.A.; Saleh, A.M.	Design and Implementation of Deep Learning based controllers for Rotor Current Control of DFIG Based Wind Turbine	International journal of Energy Research	4.67
4	Khan, M. A., & Ali, A	Hybrid Fuzzy-PI and ANFIS Controller Design for Rotor Current Control of DFIG Based Wind Turbine	Conference	-
5	Khan, M.A.; Sajjad, I.A.; Tahir, M.; Haseeb	IOT Application for Energy Management in Smart Homes	Engineering Proc	Track

## Annexure E: Faculty Resume

S.No	Name	PEC #	Designation	Joining Date	Details of Qualifications			Specialization	Experience Teaching (Total Years)	Dedicated / Shared
					Degree	Year	Institution			
1.	Dr. Tahir Nadeem Malik	Elect/4987	Professor	11/9/2019	PhD	2009	UET Taxila	Power	33	Dedicated
					MS	1993	UET Lahore	Power		
					BS	1985	UET Lahore	Power		
2.	Dr. Kashif Imdad	Elect/24868	Assistant Professor	01/11/2007	PhD	2017	UPC, Barcelona Spain	Elect. Power Systems	14	Dedicated
					MS	2010	UET Taxila	Elect Power Systems		
					BS	2007	UET Peshawar	Elect Power System		
3.	Dr. Muhammad Ali Mughal	ELECT/25636	Assistant Professor	15-2-2018	PhD	2018	Beihang University, Beijing China	Electrical Machines and Electric Apparatus	11	Dedicated
					MS	2014	Beihang University, Beijing China	Power Electronics & Drives		
					BS	2008	Quaid-e-Awam University Nawabshah	Electrical Engineering (Power)		
4.	Engr. Talha Asghar	Elect/31483	Assistant Professor	4/2/2013	PhD	In Progress	COMSATS Institute of Information Technology, Islamabad	Electrical Engineering	09	Dedicated
					MS	2012	COMSATS Institute of Information Technology, Islamabad	MS Electrical Engineering		
					BS	2011	COMSATS Institute of Information Technology, Islamabad	Electrical Engineering		
5.	Engr. Zeeshan Ahmad	Electro/10116	Assistant Professor	28/9/2009	PhD	In Progress	HITEC University Taxila	Electrical Engineering	13	Dedicated
					MS	2013	HITEC University Taxila	Electrical Engineering		

					BS	2008	International Islamic University, Islamabad	Electronics		
6.	Engr. Iftikhar Ahmed	Elect/34142	Asst Professor	4/2/2013	PhD	In Progress	HITEC University, Taxila.	Electrical Engineering	09	Dedicated
					MS	2014	COMSATS Institute of Information Technology, Islamabad	Electrical Engineering		
					BS	2011	COMSATS Institute of Information Technology, Islamabad	Electrical Engineering		
7.	Engr. Muhammad Shahzad	Elect/33472	Lecturer	9/1/2014	PhD	In Progress	HITEC University, Taxila.	Electrical Engineering	10	Dedicated
					MS	2015	HITEC University Taxila	Electrical Engineering		
					BS	2011	HITEC University Taxila	Electrical Engineering		
8.	Engr. Safee Ullah	Electro/15792	Lecture	15/09/2014	PhD	In Progress	HITEC University, Taxila.	Electrical Engineering	10	Dedicated
					MS	2018	HITEC University Taxila	Electrical Engineering		
					BS	2011	Wah Engineering College, Wah	Electronics		
9.	Engr. Waqas Ali	Elect/35866	Lecturer	18/09/2017	PhD.	In Progress	HITEC University Taxila Cantt	Electrical Engineering	10	Dedicated
					MS	2015	HITEC University Taxila Cantt	Electrical Engineering		
					BS	2012	UET Taxila	Electrical Engineering		
10.	Engr. Mehwish Bibi	Elect/84926	Lab Engineer	14/09/2020	PhD	-	-	-	02	Dedicated
					MS	In Progress	NUST, Rawalpindi	Electrical Engineering		
					BS	2020	HITEC Taxila	Electrical Engineering		
11.	Engr. Mustansir Karim	Elect/78028	Lab Engineer	14/09/2020	PhD	-	-	-	02	Dedicated
					MS	2023	HITEC University, Taxila.	Electrical Engineering		
					BS	2019	HITEC Taxila	Electrical Engineering		
12.	Engr. Muhammad Adnan	Elect/79354	Lab Engineer	13/02/2023	MS	2022	UET, Taxila.	Electrical Engineering	Less than 1 year	Dedicated
					BS	2019	UET, Taxila	Electrical Engineering		

## **Annexure F:            Lab Safety Precautions**

- Be calm and relaxed, while working in Lab.
- When working with voltages over 40 V or with currents over 10 A, there must be at least two people in the Lab at all times
- Oscilloscopes are among the most expensive instruments in the lab. Be careful when working with one.
- Make sure the multi-meter is set to proper mode for the measurement being made. Never put in current mode for any other measurement.
- Apply low voltages or low power to check proper functionality of circuits
- No loose wires or metal pieces should be lying on table or near the circuit, to cause shorts and sparking.
- Avoid using long wires, that may get in your way while making adjustments or changing leads.
- Keep high voltage parts and connections out of the way from accidental touching and from any contacts to test equipment or any parts, connected to other voltage levels.
- When working with inductive circuits, reduce voltages or currents to near zero before switching open the circuits.
- BE AWARE of bracelets, rings, metal watch bands, and loose necklace (if you are wearing any of them), they conduct electricity and can cause burns. Do not wear them near an energized circuit.



## **Annexure – G: Assessment Team (AT) Findings**

### **Self Assessment Team Report Submission**

01 March 2022

### **Self Assessment Program**

Successful self assessment program include:

- a) Purpose identification
- b) Outcomes identification
- c) Measurements and evaluation design
- d) Data collection
- e) Analysis and evaluation
- f) Decision making regarding actions to be taken.

### **Self Assessment Objectives**

- a) Review and maintain academic standards.
- b) Measure and verify to check whether existing programs meet their objectives and department goals.
- c) Provide feedback for quality assurance of academic programs.
- d) Prepare the implementation plan for departmental review.

### **Self Assessment Team**

- Constituted by Quality Enhancement Cell after getting approval from Vice Chancellor, Dean, and Department Heads
- Members
  - i. Dr. Muhammad Ali Mughal
  - ii. Dr. Raza Ali Shah

### **Conclusions of SAR**

- a) Training of new faculty members must be conducted.
- b) Teacher-student interaction may be improved.
- c) Faculty members should be motivated, and faculty development courses must be arranged.
- d) Research facilities should be enhanced.
- e) Seminars/workshops on advanced and modern technology will be arranged.

In conclusion, the strong and weak areas of the program are as under:

### **Strong Areas**

1. Curriculum Design, development and organization are based upon set, well defined and approved criteria.
2. Rigorous, intensive, and rewarding program
3. Capable Faculty
4. Academic Schemes fully prepared in advance.
5. The number of courses along with their titles and credit hours for each semester, course contents for degree program are fully planned.
6. PEC & HEC rules fully followed.

## **Weak Areas**

1. Insufficient infrastructure
2. Low number of industry-oriented courses
3. Classrooms improvements
4. New & State of the art equipment for Labs
5. Faculty training and development courses for faculty members

Salient recommendations of self assessment team are:

## **Insufficient Infrastructure**

- a) Some classrooms have inadequate seating capacities.
- b) Infrastructure not available for foundry shop
- c) Infrastructure not available for woodwork shop
- d) Infrastructure not available for forging shop

## **Regular Teacher Training**

- e) Excellent communication skills are required.
- f) Training of Young Faculty
- g) Improve the Teaching Methodology
- h) Seminars and workshops must be arranged on advanced topics.
- i) Preparation and delivery of lectures
- j) Evaluation of students

## **Facilities for Students**

- k) Common Room for Male students
- l) Ample sitting facilities in lawns and under shade
- m) Sport facilities –(Basketball, Badminton, Table tennis, Cricket ground)
- n) Industrial and Educational tours

## **Faculty Development**

- o) Indigenous Plans for faculty development
- p) Practical skills should be enhanced.
- q) Research facilities and funds must be available and enhanced.
- r) Balance of teaching workload and research activities
- s) Student teacher ratio should be adequate.
- t) Training of new hiring must be arranged.

## **Syllabi Review**

- u) Syllabi review should be done on quarterly or yearly basis according to industry requirements.


**BS Electrical Engineering - HITEC University**  
**Annexure – E: Implementation Plan (Summary)**

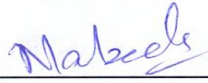
AT Finding	Corrective Action	Implementation Date	Responsible Body	Present Status
<b>Regular Teaching Training</b>				
Training on Communication Skills	Introduction of teacher's training at department and university level	December 2016	Chairman	One Faculty Development Session was conducted last year
Orientation Session for New Faculty Members	Introduction of Orientation sessions for new faculty members	By 31 <sup>st</sup> December, 2016	Chairman, Registrar	Orientation Session are being planned for new hiring
<b>Facilities for Students</b>				
No proper sitting place for male students	Common room allotment for male students/More benches to be installed	By 31 <sup>st</sup> December, 2016	Director Admin	Ongoing
Sports Facilities for students	Updating student sports facilities for cricket, badminton and table tennis	--	DSA	Sports Events are being held at regular intervals
Industrial Tours	Develop university-industry linkage for more tour facilities for students	Ongoing and Scheduled	Faculty, DSA, Registrar	Faculty members are encouraged to arrange visits
<b>Faculty Development</b>				
Seminars/ workshops for all the faculty members	Conduct seminars/workshops at interdepartmental level	Ongoing and Scheduled	Dean, Chairman	Seminars/Workshops are being scheduled and formalized
Non attendance of faculty in seminars/workshops	Encourage and motivate faculty members to attend various seminars/workshops	--	Chairman	Communication was made to all the faculty members regarding their participation and response is encouraging after that
Technical training of support staff	Conduct training of handling lab equipment	--	Chairman	Training session of support staff will be arranged when required. Lab engineers train support staff on their own

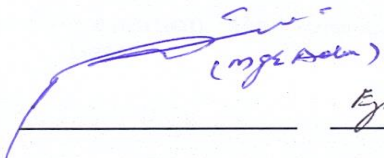
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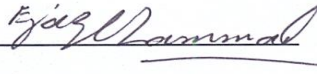
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TO: Implimentation plan, EE.  
HITEC University - 2015-16

Stakeholders Involved in Implementation Plan

  
\_\_\_\_\_  
Head of Department

  
\_\_\_\_\_  
Treasurer

  
\_\_\_\_\_  
Director Admin

  
\_\_\_\_\_  
Dean QAC

## **Annexure – F: Faculty Course Review Report**

Department of Electrical Engineering is running 39 courses for the BS Electrical Engineering program. All courses curriculum is reviewed periodically by the faculty to assess its effectiveness and contribution in achieving program objectives. Course review also contributes towards making any changes in the syllabi and enhancements required in areas identified as a result of Alumni Survey and Graduating Students Feedback.

PT members launched HEC Performa 2 (Faculty of Course Review Report) to all the faculty members, to obtain their feedback about courses.

The summary of the overall feedback of all courses identified the following improvement points:

- a. Syllabi review to improve communication skills.
- b. Change in course curriculum to emphasis on design component.
- c. Provision of more technical resources to execute final projects.
- d. Improvement in technical report writing skills.
- e. Provision to interact more with industrial units during study period.

Board of Studies scrutinized these points and presented in the Board of Faculty that will review and suggest the implementation as deemed necessary.

## Annexure – G:

## Rubric Report

<b>Self Assessment Report</b>						
<b>Criterion 1 – Program Mission, Objectives and Outcomes</b>			<b>Weight = 0.20</b>			
<b>Factors</b>			<b>Score</b>			
1.	Does the program have document measurable objectives that support faculty/ college and institution mission statements?	5	4	3	2	1
1.	Does the program have documented outcomes for graduating students?	5	4	3	2	1
2.	Do these outcomes support the Program objectives?	5	4	3	2	1
3.	Are the graduating students capable of performing these outcomes?	5	4	3	2	1
4.	Does the department assess its overall performance periodically using quantifiable measures?	5	4	3	2	1
5.	Is the result of the Program Assessment documented?	5	4	3	2	1
<b>Total Encircled Value (TV)</b>			<b>19</b>			
<b>SCORE 1 (S1) = [TV/ (No. of Question * 5)] * 100 * 0.20</b>			<b>15.2</b>			

<b>Criterion 2– Curriculum Design and Organization</b>			<b>Weight = 0.15</b>			
<b>Factors</b>			<b>Score</b>			
1.	Is the curriculum consistent?	5	4	3	2	1
2.	Does the curriculum support the program's documented objectives?	5	4	3	2	1
3.	Are the theoretical background, problem analysis and solution design stressed within the program's core material?	5	4	3	2	1
4.	Does the curriculum satisfy the core requirements laid down by PEC?	5	4	3	2	1
5.	Does the curriculum satisfy the major requirements laid down by HEC and the PEC?	5	4	3	2	1
6.	Does the curriculum satisfy the professional requirements as laid down by PEC?	5	4	3	2	1
7.	Is the information technology component integrated throughout the program?	5	4	3	2	1
8.	Are oral and written skills of the students developed and applied in the program?	5	4	3	2	1
<b>Total Encircled Value (TV)</b>			<b>31</b>			
<b>SCORE 1 (S1) = [TV/ (No. of Question * 5)] * 100 * 0.15</b>			<b>11.625</b>			

<b>Criterion 3– Laboratories and Computing Facilities</b>			<b>Weight = 0.15</b>			
<b>Factors</b>			<b>Score</b>			
1.	Are the laboratory manuals/ documentation/ instructions etc. for experiments available and readily accessible to faculty and students?	5	4	3	2	1
2.	Are there adequate number of support personnel for instruction and maintaining the laboratories?	5	4	3	2	1
3.	Are the University's infrastructure and facilities adequate to support the program's objectives?	5	4	3	2	1
<b>Total Encircled Value (TV)</b>			<b>12</b>			
<b>SCORE 1 (S1) = [TV/ (No. of Question * 5)] * 100 * 0.15</b>			<b>12</b>			

<b>Criterion 4– Student Support and Advising</b>		<b>Weight = 0.10</b>				
<b>Factors</b>		<b>Score</b>				
1. Are the courses being offered in sufficient frequency and number for the students to complete the program in a timely manner?	5	4	3	2	1	
2. Are the courses in the major area structured to optimize interaction between the students, faculty and teaching assistants?	5	4	3	2	1	
3. Does the university provide academic advising on course decisions and career choices to all students?	5	4	3	2	1	
<b>Total Encircled Value (TV)</b>		<b>12</b>				
<b>SCORE 1 (S1) = [TV/ (No. of Question * 5)] * 100 * 0.10</b>		<b>8</b>				

<b>Criterion 5– Process Control</b>		<b>Weight = 0.10</b>				
<b>Factors</b>		<b>Score</b>				
1. Is the process to enroll students to a program based on quantitative and qualitative criteria?	5	4	3	2	1	
2. Is the process above clearly documented and periodically evaluated to ensure that it is meeting its objectives?	5	4	3	2	1	
3. Is the process to register students in the program and monitoring their progress documented?	5	4	3	2	1	
4. Is the process above periodically evaluated to ensure that it is meeting its objectives?	5	4	3	2	1	
5. Is the process to recruit and retain faculty in place ad documented?	5	4	3	2	1	
6. Are the process for faculty evaluation & promotion consistent with the institution mission?	5	4	3	2	1	
7. Are the process in 5 and 6 above periodically evaluated to ensure that they are meeting their objectives?	5	4	3	2	1	
8. Do the processes and procedures ensure that teaching and delivery of course material emphasize active learning and that course learning outcomes are met?	5	4	3	2	1	
9. Is the process in 8 above periodically evaluated to ensure that it is meeting its objectives?	5	4	3	2	1	
10. Is the process to ensure that graduates have completed the requirements of the program based on standards and documented procedures?	5	4	3	2	1	
11. Is the process in 10 above periodically evaluated to ensure that it is meeting its objectives?	5	4	3	2	1	
<b>Total Encircled Value (TV)</b>		<b>43</b>				
<b>SCORE 1 (S1) = [TV/ (No. of Question * 5)] * 100 * 0.10</b>		<b>7.81</b>				

<b>Criterion 6– Faculty</b>		<b>Weight = 0.10</b>				
<b>Factors</b>		<b>Score</b>				
1. Are there enough full time faculty members to provide adequate coverage of the program areas/courses with continuity and stability?	5	4	3	2	1	
2. Are the qualifications and interest of faculty members sufficient to teach all courses, plan, modifies and updates courses and curricula?	5	4	3	2	1	
3. Do the faculty members possess a level of competence that would be obtained through graduate work in the discipline?	5	4	3	2	1	
4. Do the majority of faculty members hold a Ph.D. degree in their discipline?	5	4	3	2	1	
5. Do faculty members dedicate sufficient time to research to remain current in their disciplines?	5	4	3	2	1	
6. Are there mechanisms in place for faculty development?	5	4	3	2	1	
7. Are faculty members motivated and satisfied so as to excel in their profession?	5	4	3	2	1	

Total Encircled Value (TV)	<b>22</b>
SCORE 1 (S1) = [TV/ (No. of Question * 5)] * 100 * 0.10	<b>6.29</b>

<b>Criterion 7– Institutional Facilities</b>		<b>Weight = 0.10</b>				
<b>Factors</b>		<b>Score</b>				
1. Does the institution have the infrastructure to support new trends such as e-learning?	5	4	3	2	1	
2. Does the library contain technical collection relevant to the program and is it adequate staffed?	5	4	3	2	1	
3. Are the class rooms and offices adequately equipped and capable of helping faculty carry out their responsibilities?	5	4	3	2	1	
Total Encircled Value (TV)		<b>13</b>				
SCORE 1 (S1) = [TV/ (No. of Question * 5)] * 100 * 0.10		<b>7.33</b>				

<b>Criterion 8– Institutional Support</b>		<b>Weight = 0.10</b>				
<b>Factors</b>		<b>Score</b>				
1. Is there sufficient support and finances to attract and retain high quality faculty?	5	4	3	2	1	
2. Are there an adequate number of high-quality graduate students, teaching assistants and Ph.D. students?	5	4	3	2	1	
Total Encircled Value (TV)		<b>8</b>				
SCORE 1 (S1) = [TV/ (No. of Question * 5)] * 100 * 0.10		<b>8</b>				

$$\begin{aligned}
 \text{Overall Assessment Score} &= S1 + S2 + S3 + S4 + S5 + S6 + S7 + S8 \\
 &= 15.2 + 11 + 12 + 8 + 7.81 + 6.29 + 7.33 + 8 \\
 &= 75.63
 \end{aligned}$$