

HITEC UNIVERSITY, TAXILA



SELF ASSESSMENT REPORT

BS Robotics and Automation

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 Robotic and Automation 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 Robotic and Automation 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 Robotic and Automation 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 stake-holders. 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 proof read 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, Chairperson 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 Robotic and Automation Program to be assessed by the Assessment Team in the third week of June 2023.

The findings of the Assessment Team will be given in the annexure-J. It outlines the improvements required in the infrastructure, syllabi and training of the faculty and supporting staff. The implementation plan (annexure-K) was prepared after discussion with all the stake-holders 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 Robotic and Automation.

- a. BS Robotic and Automation Session 2022

In addition to above program, department also offers BS, 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

BS Robotic and Automation program aims to provide quality education at undergraduate level, thereby producing proficient technologists 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 Robotic and Automation.
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 Robotic and Automation 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, introduction to robotics, robotic and automation, robotic machine design, network analysis, linear circuit analysis, electrical machines, digital logic design, communication systems, engineering management, communication skills & 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 Control system Laboratory Work
- c. RF and DSP Laboratory Work
- d. Engineering Workshop Laboratory Work
- e. 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

Table 1: Program Objectives Assessment

Objective	How Measured	When Measured	Improvement Identified	Improvement Made
1	Alumni Survey	N.A		
2	Alumni Survey	N.A		

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 Robotic and Automation field.
2. Students shall be able to use software related to Robotic and Automation.
3. Students shall have interpersonal skills.
4. Students shall be able to perform technical and non-technical jobs in Robotic and Automation 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:

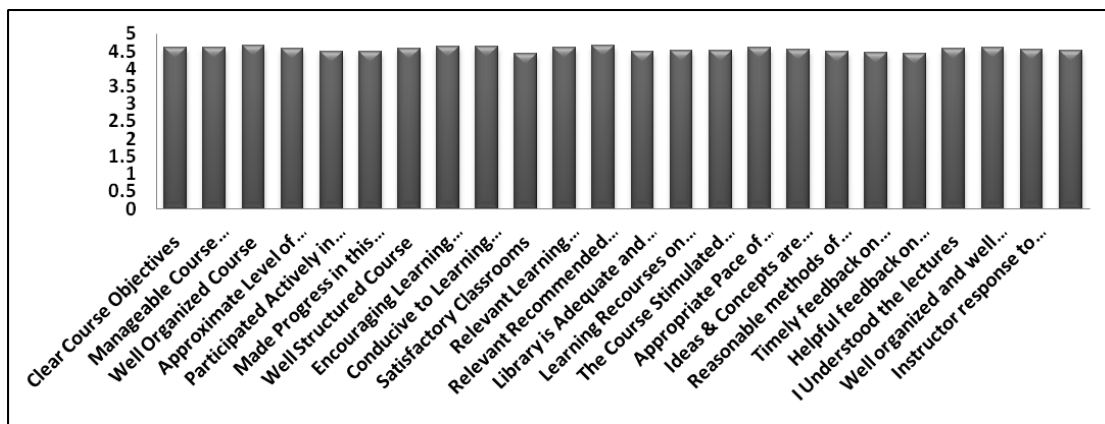


Figure 1: Course Evaluation Bar Chart

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.

S. No.	Subject	Evaluation
1	English	4.76
2	Calculus and Analytical Geometry	4.75
3	Linear Circuit Analysis	4.71
4	Computing Fundamentals	4.70
5	Workshop Practice	4.69
6	Applied Electronics	4.68
7	Linear Circuit Analysis Lab	4.72
8	Applied Electronics Lab	4.51

Teachers Evaluation

Teacher's evaluation for semester fall 2022 is shown in the following graphical charts:

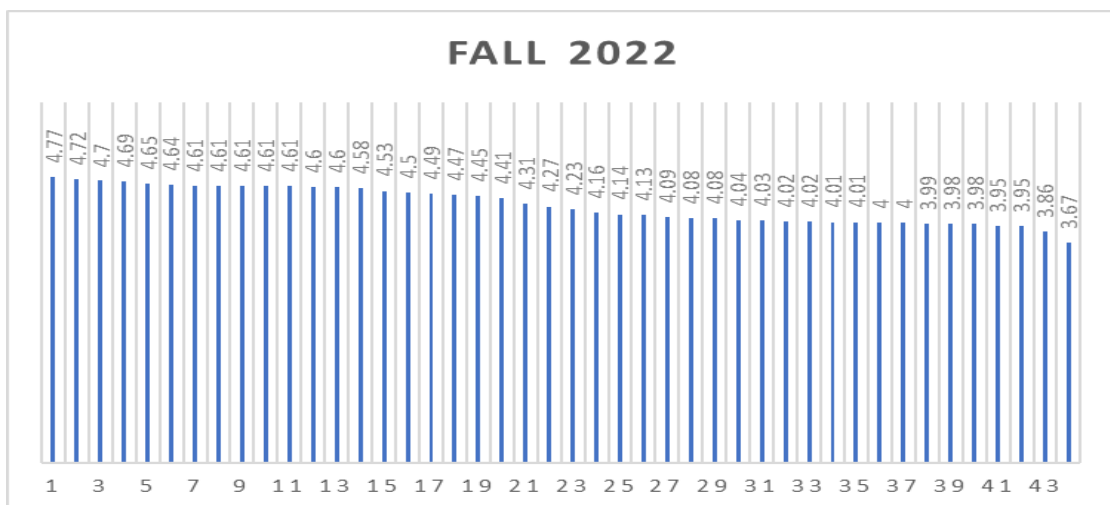


Figure 2: Teachers Evaluation Graph

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 by the students along with the serial number and graded scores.

S. No.	Name	Subject	Evaluation
1	Teacher 1	English	4.76
2	Teacher 2	Calculus and Analytical Geometry	4.75
3	Teacher 3	Linear Circuit Analysis	4.71
4	Teacher 4	Computing Fundamentals	4.70
5	Teacher 5	Workshop Practice	4.69
6	Teacher 6	Applied Electronics	4.68
7	Teacher 7	Linear Circuit Analysis Lab	4.67
8	Teacher 8	Applied Electronics Lab	4.61

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

The Dean and the Chairperson 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 number of case studies
- b. 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 robotics and automation 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 4 students enrolled during the last one year. The yearly breakdown is as follows:

- Year 2022 04

Students, who enrolled during the last one year, have not yet graduated.

3.1.2 Student Faculty Ratio:

BS Robotics and automation is program under Electrical Engineering Department. Student faculty ration of EED is 19.62:1

3.1.3 Average GPA per semester:

Average GPA per semester for the batch enrolled in year 2022 is as under:

Semester 1 3.30

Currently session 2022 is in semester 2.

3.1.4 Average Completion time

Average Completion time for undergraduate program is 4 years.

3.1.5 Employer Satisfaction

N.A

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.

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 Robotics and Automation

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 2022)

SEMESTER-1		
Course Code	Course Title	Credit Hours
HS-101	English	3+0
MT-101	Calculus and Analytical Geometry	3+0
EE-102	Linear Circuit Analysis	3+0
EC-110	Computing Fundamentals	2+1
EE-101	Workshop Practice	0+1
RB-101	Applied Electronics	3+0
EE-102L	Linear Circuit Analysis Lab	0+1
RB-101L	Applied Electronics Lab	0+1
QT-101	Translation of the Quran: Beliefs	1+0 (NC)
Total Credit		18

SEMESTER-2		
Course Code	Course Title	Credit Hours
Code	Course Title	CH
MT-103	Differential Equations	3+0
HS-201	Technical Report Writing	3+0
IS-211	Islamic Studies	2+0
HS-102	Pakistan Studies	2+0
EC-112	Object Oriented Programming	2+1
EE-103	Electrical Network Analysis	3+0
EE-103L	Electrical Network Analysis Lab	0+1
HS-203	Community Service	0+1 (NC)
Total Credit		17

SEMESTER-3		
Code	Course Title	CH
MT-201	Complex Variables & Transforms	3+0
HS-103	Communication Skills	3+0
EE-203	Digital Logic Design	3+0
ME-211	Engineering Drawing	0+1
EC-221	Data Structure & Algorithms	2+1
RB-201	Engineering Mechanics- I	3+0
RB-201L	Engineering Mechanics- I Lab	0+1
EE-203L	Digital Logic Design Lab	0+1
QT-201	Translation of the Quran: Worships	1+0 (NC)
Total Credit		18
SEMESTER-4		
Code	Course Title	CH
RB-203	Operating Systems	3+0
MT-303	Applied Linear Algebra	2+0
EE-204	Introduction to Embedded Systems	3+0
MT-302	Probability and Statistics	3+0
RB-202	Engineering Mechanics- II	3+0
RB-202L	Engineering Mechanics- II Lab	0+1
EE-204L	Introduction to Embedded Systems Lab	0+1
RB-203L	Operating Systems Lab	0+1
Total Credit		17

SEMESTER-5		
Code	Course Title	CH
EE-309	Electrical Machines	3+0
RB-301	Database Systems	2+0
RB-302	Introduction to Robotics	2+0
EE-305	Linear Control Systems	3+0
EE-304	Communication Systems	3+0
EE-309L	Electrical Machines Lab	0+1
EE-305L	Linear Control Systems Lab	0+1
RB-301L	Database Systems Lab	0+1
RB-302L	Introduction to Robotics Lab	0+1
EE-304L	Communication Systems Lab	0+1
QT-301	Translation of the Quran: Moral Values	1+0 (NC)
Total Credit		18
SEMESTER-6		
Code	Course Title	CH
MT-202	Numerical Methods	2+1
ME-407	Health Safety and Environment	1+0
RB-306	Robotics & Automation	3+0
RB-303	Robotics Machine Design	3+0
HS-402	Economics	2+0
RB-306L	Robotics & Automation Lab	0+1
RB-305	Signal Processing	3+0
RB-305L	Signal Processing Lab	0+1
Total Credit		17

SEMESTER-7		
Code	Course Title	CH
RB-4XX	Depth Elective- I	3+0
RB-4XX	Depth Elective- II	3+0
HS-403	Management and Entrepreneurship	3+0
RB-403	Sensors & Transducers	3+0
HS-404	Foreign Language	1+1
RB-401	Senior Design Project -I	0+3
QT-401	Translation of the Quran: Dealings and Commandments	1+0 (NC)
Total Credit		17
SEMESTER-8		
Code	Course Title	CH
RB-4XX	Depth Elective- III	3+0
RB-402	Artificial Intelligence	3+0
RB-403	Hydraulic & Pneumatic Actuators	3+0
RB-401	Senior Design Project -II	0+3
HS-401	Professional Values and Ethics	2+0
Total Credit		14

List of Electives		
Code	Course Title	CH
RB-404	Model Predictive Control	3+0
RB-405	Industrial Automation	3+0
RB-406	Mechatronics System Design	3+0
RB-407	Machine Vision	3+0
RB-408	Industrial Drives	3+0
RB-409	Robot Communications	3+0
RB-410	Special Topics in Robotics	3+0

Curriculum Breakdown

Domain	Knowledge Area	BS-Robotics and Automation	
		Total	Overall
		Credits	%
Humanities and Natural Sciences	Humanities	16	30.15%
	Management Sciences	5	
	Natural Sciences	20	
	Sub Total	41	
Domain Courses	Computing	9	69.85%
	Foundation Courses	28	
	Core Breadth Courses	37	
	Specialization	9	
	Inter-Disciplinary Engineering Breadth (Electives)	7	
	Senior Design Project	6	
	Industrial Training (Summer)	0	
Sub Total	95		
	Total	136	100.00%

Courses Information

COURSE CONTENTS

SEMESTER 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. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2

Course Name: Calculus and Analytical Geometry

Course Code: MT-101

Credit Hours: 3+0

Objectives:

To equip the students with the knowledge of limits, continuity, differentiation, integration, and analytical geometry and its applications.

Course Contents:

Functions and graphs, limits & continuity, differentiation and applications, extreme values of a function, differentials and approximation, indeterminate forms, Leibnitz theorem, integration, rules of integration, applications of definite integrals, length of a plane curve, volumes of solids of revolution, , conic sections, vectors in 3-dimensional space, vector valued functions and motion in space, analytical geometry in 3- dimensional space, functions of several variables, partial derivatives, tangent planes and normal lines, extrema of functions of two variables.....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. .Dot Products, Cross Products .Lines and Planes in Space .Spherical, Polar and Cylindrical Coordinates. . Vector-Valued Functions and Space Curves, 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, Vector Calculus. Directional Derivatives. Divergence, Curl of a Vector Field. . Conic Sections.

Recommended Books:

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

Course Name: Linear Circuit Analysis

Course Code: EE-102

Credit Hours: 3+1

Objectives:

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

Course Contents:

This course aims to teach basics of Electric quantities, electric circuits, Kirchhoff's laws, circuit elements, resistance, series parallel combination, voltage and current dividers, resistive bridges and ladders, practical sources and loading, instrumentation and measurement, 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, capacitance, inductance, natural response of RC and RL circuits, response to DC forcing function, transient response of first order circuits, step, pulse and pulse train responses, transient response and step response of second order circuits. , electric signals, The operational amplifier, basic op-amp configurations, ideal op-amp circuit analysis, summing and difference amplifiers, amplifier types .Capacitance, inductance (including mutual inductance),

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: 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.

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.

Course Name: Applied Electronics

Pre-Requisite: College Physics

Course Code: RB-202**Credit Hours: 3+1****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:

Conductors, semi-conductors and insulators; energy bands; insulators used in electrical systems; super conductors; soft magnetic materials and permanent magnet materials; semi-conductor materials; PN-junction; fabrications; epitaxially grown, diffused and ion-implanted junction; depletion layer in Zener, varactor and tunnel diodes; LED; laser diode; fiber optics; materials for sensors; and transducers and surface acoustic wave devices. 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
3. Electronics Principles, Alberto P Malvino ISBN: 978-0073373881

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 والوں 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 پہلونیکی ہلاکت کا سبب	10.
Surah Hood No.17,23,29,36,53.	ہے ایمان کیلیے 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 QURAQN 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. بيرسٹر فاروق بهاء الحق شاه، خلاصه القرآن
8. ڈاكٽر اطهر محمد اشرف، جامع اشاريه مضامين قرآن
9. زاہد ملك، مضامين قرآن حكيم

5.0 SEMESTER 2

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

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

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 st 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 nd 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 مسلمی 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 المذہب	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، بولی 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

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.

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

Course Name: Electrical Network Analysis

Pre-Requisite: Electric Circuit Analysis

Course Code: EE-103**Credit Hours: 3+1****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, 6th Edition, 2009
4. C. Alexander and M. Sadiku, "Fundamentals of Electric Circuits", McGraw-Hill, 4th Edition, 2008
5. J. D. Irwin and R. M. Nelms, "Basic Engineering Circuit Analysis", Wiley, 9th Edition, 2008
6. W. Hayt, J. Kemmerly and S. Durbin, "Engineering Circuit Analysis", McGraw-Hill, 7th Edition, 2007.

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.

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.

6.0 SEMESTER 3

Course Name: Complex Variables and 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.

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

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

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.

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.

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.

Course Name: Engineering Mechanics-I

Course Code: RB-101

Credit Hours: 3+1

Objectives:

To equip the students with the knowledge of static mechanics. Fundamental concepts and principles of mechanics.

Course Contents:

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 circular pipes.....Moment, Couple and Resultants (Two dimensional Force systems)
..Equilibrium ..Mechanical system isolation and Equilibrium condition in two dimensions ..Equilibrium Conditions-Equilibrium in three Dimensions ..Structures
..Plane Trusses ..Method of joints. Method of Sections and Space Trusses ..Frames and Machines ..Friction ..Types of Friction.

Recommended Books:

1. J L Meriam, L G Kraig, *Engineering Mechanics (Statics)*: John Wiley & Sons Inc.
2. Beer & Johnston, *Vector Mechanics for Engineers: Statics & Dynamics*, McGraw Hill
3. RC Hibbeler, *Engineering Mechanics (Statics)*, Prentice Hall
4. Anthony M Bedford, Wallace Fowler. *Engineering Mechanics (Statics)*, Prentice Hall
5. E. Nelson, *Engineering Mechanics: Statics*, Schaum's outline series New York.

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، العمران 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 29، 31
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، 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، الدھر 8، 9، اللیل 18 تا 21، الماعون 3
12.	نفلی صدقہ و خیرات	البقرہ 270 تا 273، 276 تا 268، 254، 215، العمران 180، 92، بنی اسرائیل 100، التغابن 17، الدھر 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، 198، 125، 127، 128، 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 کرم شاہ بالازہری: ترجمہ جمال القرآن و تفسیر ضیاء القرآن
6. مفتی محمد شفیع عثمانی، ترجمہ و تفسیر معارف القرآن
7. فاروق بہاء الحق شاہ، خلاصہ القرآن
8. ڈاکٹر اطہر محمد اشرف، جامع اشاریہ مضامین قرآن
9. زاہد ملک، مضامین قرآن حکیم

7.0 SEMESTER 4

Course Name: Operating systems

Course Code: RB-302

Credit Hours: 3+1

Objectives:

To equip the students with the basic concepts of Operating Systems, various types of programming components and impact of various parameters related to deadlock and optimization.

Course Contents:

The concepts covered are; Definition of a process; process states and state transitions; process control block; operations on processes; interrupt processing; parallel processing; resource allocation; shared and unshared allocation; critical sections; semaphores; deadlock; deadlock prevention, avoidance, detection, and recovery; memory management; memory allocation schemes; virtual memory; paging and segmentation; page replacement strategies; working sets; demand paging; job and processor scheduling; scheduling levels, objectives, and criteria; various scheduling algorithms; multi-processor considerations; file system functions; file organization; tree structured file systems; space allocation; file catalogs; file access control mechanisms; operating systems security, device drivers.

Recommended Books

1. Silberschatz, Galvin & Gagne, "Operating System Concepts", Wiley, Latest Edition
2. A. S. Tanenbaum, "Modern Operating Systems", Prentice Hall, Latest Edition

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 Kernel 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

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

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 Raspberry 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.

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.

Course Name: Engineering Mechanics-II

Course Code: RB-202

Credit Hours: 3+1

Objectives:

To equip the students with the knowledge of static mechanics. Fundamental concepts and principles of mechanics.

Course Contents:

1. Introduction to subject and Basic Concepts. 2. Kinematics of Particles Rectilinear Motion , Plane Curvilinear Motion , Space Curvilinear Motion ,Motion Relative to Trans Axes , Constrained Motion of Connected Particles **3. Kinetics of Particles** Second Law & Equation of Motion , Work and Energy , Linear Impulse and Momentum Impact , Angular Momentum **4. Kinematics of Rigid Bodies** Plane Motion , Relative Velocity , Relative Acceleration **5. Kinetics of Rigid Bodies** Kinetics of Rigid Bodies

Recommended Books:

1. J L Meriam, L G Kraig. *Engineering Mechanics (Dynamics)*: John Wiley & Sons Inc.
2. Beer & Johnston. *Vector Mechanics for Engineers: Statics & Dynamics*, McGraw-Hill
3. RC Hibbeler. *Engineering Mechanics (Dynamics)*,13th Ed., Prentice Hall
4. Anthony M Bedford, Wallace Fowler. *Engineering Mechanics (Dynamics)*, Prentice Hall
5. E. Nelson, *Engineering Mechanics: Statics*, Schaum's outline series New York.

8.0 SEMESTER 5

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"

Course Name: Electrical Machines Lab

Course Code: EE-309L

Credit Hours: 0+1

Course Name: Database Systems

Course Code: RB-301

Credit Hours: 2+1

Objectives:

To equip the students with the knowledge of fundamental database concepts. Conceptual, logical and physical database schemas using different data models. Structured Query Language (SQL) for database definition and manipulation in any DBMS

Course Contents:

Basic database concepts, Database approach vs file-based system, database architecture, three level schema architecture, data independence, relational data model, attributes, schemas, tuples, domains, relation instances, keys of relations, integrity constraints, relational algebra, selection, projection, Cartesian product, types of joins, normalization, functional dependencies, normal forms, entity relationship model, entity sets, attributes, relationship, entity-relationship diagrams, Structured Query Language (SQL), Joins and sub-queries in SQL, Grouping and aggregation in SQL, concurrency control, database backup and recovery, indexes, NoSQL systems

Recommended Books

1. Database Systems: A Practical Approach to Design, Implementation, and Management, 6th Edition by Thomas Connolly and Carolyn Begg.
2. Database Systems: The Complete Book, 2nd Edition by Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom
3. Database System Concepts, 6th Edition by Avi Silberschatz, Henry F. Korth and S. Sudarshan.
4. Database Management Systems, 3rd Edition by Raghu Ramakrishnan, Johannes Gehrke

Course Name: Introduction to Robotics

Course Code: RB-302

Credit Hours: 2+1

Objectives:

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

Course Contents:

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. Introduction to Robotics, by J. J. Craig, Addison-Wesley, Latest Edition
2. Introduction to Robotics, by O. Khatib and K. Kolarov, Latest edition
3. Robot dynamics and Control, by M. W. Spong and M. Vidyasagar, Wiley & Sons, Latest Edition
4. Robotics and Automation: An introduction to Cams, Mechanisms, and Robotics, by D. Tesar and S. Todunoglu., Latest edition
5. Robot Analysis: The Mechanics of Serial and Parallel Manipulators, by Lung-Wen Tsai, John Wiley & Sons, Latest edition

Course Name: Linear Control Systems

Pre-Requisite: Signal & Systems

Course Code: EE-305

Credit Hours: 3+1

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

Course Name: Communication Systems

Course Code: EE-304

Credit Hours: 3+1

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.

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 اس کا 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	1. لازمی قرآنی تعلیم ترجمہ کے ساتھ: کورس کا تعارف
سورة البقرة 83 سورة الممتحنة 4، 6، سورة الأنبياء: 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 حسنہ: 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 127، 126، اور 40، الحج 34، 35، سورة لقمان 17، سورة حم السجدة 34، 35، ابراهيم 07،	صبر و شکر	6.
سورة البقرة 27، سورة الرعد 22، 21، اور 25 سورة النساء 01،	صلح رحمی	7.
سورة البقرة 105، 155 تا 157، سورة ال عمران 8، سورة الانعام 54، 148، سورة الاعراف 56، 57، بنی اسرائیل 100، الكهف 10، الانبياء 107	شفقت و رحمت	8.
سورة البقرة 195، الاعراف 56، التوبة 120، سورة يونس 26، النحل 90، بنی اسرائیل 7، سورة النجم 31، سورة الرحمن 60	عفو و درگزر اور احسان	9.
سورة البقرة 83، سورة لقمان 19، سورة المجادلة 9، سورة النور 27، سورة المجادلة 11،	آداب گفتگو و مجلس	10.
سورة البقرة 168، 169، سورة المائدة 1 تا 5، 96، سورة الاعراف 31، 32، سورة الانفال 69، سورة النحل 114، 116، سورة الحج 26، 30، سورة النور 61،	رزق حلال	11.
سورة البقرة 40، سورة النساء 105 تا 107، سورة المائدة 1، سورة الانفال 27، 58، سورة بنی اسرائیل 34، سورة الحج 38، سورة المومن 19،	ردائل اخلاق: خیانت وعدہ خلافی	12.
سورة النساء 36، 172، 173، سورة النحل 22، 23، 29، سورة القصص 83، سورة لقمان 18، 19، سورة المومن 27، 60	تکبر	13.
سورة البقرة 96، 109، سورة النساء 53، 54، 128، سورة الحشر 9، سورة التغابن 16، سورة الفلق	حرص و حسد	14.
سورة الحجرات 11، 12، سورة الانعام 116، 148، سورة يونس 36،	غیبت، طعنہ ظنی، لڑائی جھگڑا	15.
سورة البقرة 173، سورة المائدة 91، 90، 87، 3، سورة الانعام 145، 21، سورة المطففين 1 تا 3،	دھوکہ، حرام خوری	16.

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 شفيع عثمانى، ترجمه و تفسير معارف القرآن
7. فاروق بهاء الحق شاه، خلاصه القرآن
8. ڈاكٲر اظهر محمد اشرف، جامع اشاريه مضامين قرآن
9. زايد ملك، مضامين قرآن حكيم

9.0 SEMESTER 6

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

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

Course Name: Robotics & Automation

Course Code: RB-306

Credit Hours: 3+1

Objectives:

To develop a working knowledge of the mathematical aspects of robot manipulator analysis and control. After this course, the students would be able to understand the automation requirements of a modern industrial set-up.

Course Contents:

Industrial and specially Manufacturing Automation, Automation Theory; Computer Numerical Control (CNC) Machining Requirements, Limitations of Conventional Machining, Introduction of Numerical Control, Building blocks of CNC, CNC Programming, Machining Codes, Sensors/actuators/control cards used in CNC machines. 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. Introduction to Robotics, by J. J. Craig, Addison-Wesley, Latest Edition
2. Introduction to Robotics, by O. Khatib and K. Kolarov, Latest edition
3. Robot dynamics and Control, by M. W. Spong and M. Vidyasagar, Wiley & Sons, Latest Edition
4. Robotics and Automation: An introduction to Cams, Mechanisms, and Robotics, by D. Tesar and S. Todunoglu., Latest edition
5. Robot Analysis: The Mechanics of Serial and Parallel Manipulators, by Lung-Wen Tsai, John Wiley & Sons, Latest edition.

Course Name: Robotic Machine Design

Course Code: RB-303

Credit Hours: 3+1

Objectives:

Robotics and Intelligent Systems provides students with a working knowledge of methods for design and analysis of robotic and intelligent systems. Particular attention is given to modeling dynamic systems, measuring and controlling their behavior, and making decisions about future courses of action.

Course Contents:

The course is aimed at developing skills on how to design and implement the capabilities of a robotic platform. Introduction to robot design. Mechanisms and kinematic of wheeled robots. Sensors used for the perception capabilities of the robot. Perception applied to allow the robot to understand the context of operation. Motion planning and control of the robot in complex contexts. Optimal planning (Dynamic Programming-approach).

Recommended books:

1. McComb, Gordon. Robot builder's bonanza. McGraw-Hill Education, 2011.
2. Dahiya, Ravinder S., and Maurizio Valle. Robotic tactile sensing: technologies and system. New York, NY, USA:: Springer, 2013.
3. Hanson, David, and Yoseph Bar-Cohen. The coming robot revolution: Expectations and fears about emerging intelligent, humanlike machines. Springer New York, 2009.

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.
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

Course Name: Signals Processing

Pre-Requisite: Network Analysis

Course Code: RB-305**Credit Hours: 3+1****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. 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

10.0 SEMESTER 7

Course Name: Management and 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

Course Name: Sensors & Transducers

Course Code: RB-403

Credit Hours: 3+0

Objectives:

To equip the students with the knowledge of Selection and Applications of Sensors & Transducers.

Course Contents:

Principle of transduction, classifications and the characteristics of different transducers and study its biomedical applications, introduction to Sensing, Static and Dynamic Characteristics of Sensors, Motion and Dimensional Sensors, Force, Torque, and Power Sensors, Pressure, Fluid Flow and Temperature Sensors, Electro-Magnetic Principle, Classification of Electrical Actuators, DC and AC Motors Modelling and Drivers, Stepper Motors Modelling and Drivers, Description of Fluid Behavior, Hydraulic Actuator and System, Pneumatic Actuator and System, Selection and Applications of Sensors & Actuators: Technological properties, accuracy and precision, response time, Stability, Cost, Applications in process and other industries, Interfacing of sensing devices and actuators to computer systems

Recommended books:

1. Kaltenbacher, Manfred. Numerical simulation of mechatronic sensors and actuators. Vol. 2. Berlin: Springer, 2007.
2. Gusev, Evgeni, Eric Garfunkel, and Arthur Dideikin, eds. Advanced Materials and Technologies for Micro/Nano-Devices, Sensors and Actuators. Springer, 2010.
3. Vetelino, John, and Aravind Reghu. Introduction to sensors. CRC press, 2017.

Course Name: Model Predictive Control

Course Code: RB-402

Credit Hours: 2+0

Objectives:

Recognize control problems where Model Predictive Control (MPC) offers advantages over classical control methods (e.g., PID and pole-placement) and modern optimal control methods (e.g., LQR).

Course Contents:

This course will tackle the problem of optimal control of dynamical systems with constraints. This is done through an optimization-based method called Model Predictive Control, or MPC. The course covers, basic concepts of system theory, including state-estimation and hybrid systems, convex optimization, constrained and unconstrained optimal control, concepts of stability, reachability, invariant sets, Model Predictive Control formulations, and associated mathematical guarantees on robustness, optimality and recursive feasibility, numerical methods for MPC.

Recommended books:

1. Allgöwer, Frank, and Alex Zheng, eds. Nonlinear model predictive control. Vol. 26. Birkhäuser, 2012.
2. Fernandez-Camacho, Eduardo, and Carlos Bordons-Alba. Model predictive control in the process industry. Springer London, 1995.
3. Kouvaritakis, Basil, and Mark Cannon. "Model predictive control." Switzerland: Springer International Publishing 38 (2016).

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، 236 النساء، 22-24 المائدہ 5 النور 33، المائدہ 5، الاحزاب 49، المجادلہ 3-4، الطلاق 1-7	نکاح اور طلاق	2.
(وصیت) البقرہ 180-181، 240-181، (میراث) النساء 11-، 176، 19، 33، 12، 4. المائدہ 106-108 الانفال 75. الاحزاب 6. یس 48-50. الذاریات 53. البلد 17-18.	وصیت اور میراث	3.
(قتل) البقرہ 217، النساء 92-93، المائدہ 32، بنی اسرائیل 33، الفرقان 68، (قتل اولاد) الانعام 151، بنی اسرائیل 33-31، (قصاص) البقرہ 194، 178-179 المائدہ 45.	حدود اللہ (قتل، قصاص، دیت وغیرہ)	4.
البقرہ 215، 228 النساء، 8، 1-2، 29-30، 32، 36، 34، 58 الروم 38، الزاریات 15-19. الرعد 38-39. ابراہیم 41. مریم 32. لقمن 14-15. النور 22. الانفال 41. التوبہ 60. الاحزاب 6.	حقوق العباد (زوجین، والدین، پڑوسیوں کے حقوق) وغیرہ	5.
البقرہ 256، 22 النساء ۹۲ آل عمران 103، 190-191. التوبہ 11، 60 الاحزاب 5 الحجرات 10 یونس 99-100 الرعد 3. النخل 10-11، 44 الروم 8 الحشر 21.	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 70-79، 181-182 طہ 71. الحج 40. الشعراء 49. التکویر 1-9. الممتحنہ 12.	جرائم (چوری، جادو، شرک اور دیگر گناہ کی سزا)	7.
البقرہ 275، 282، 198، النساء 29 ابراہیم 31 النور 37 الجمعہ 9. ہود 84-86 بنی اسرائیل 35 توبہ 24 الانبیاء 47 الرحمن 7-9 المطففین 1-6. فاطر 29-30.	بیوع (خرید و فروخت) ناپ تول میں کمی وغیرہ	8.
(حلال و حرام) البقرہ 168-169، 173، المائدہ 1-3-5 الانعام 6 الاعراف 31-32، الانفال 69، النخل 66، 116، الحج 30، 34، 5 النور 45، 61. النمل 82. فاطر 28. یس 71-73.	حلال، حرام (جانور اور دیگر اشیاء خورد و نوش)	9.
البقرہ 245، 275-276، 278-279، 282-283. النساء 11 آل عمران 130. الروم ۳۹. التوبہ 60، التغابن 17	سود اور قرض کے احکامات	10.
الحج 30، الزمر 3، المؤمن 28، المطففین 1-3، النساء 105-107، الانفال 27، 58، الحج 38، المؤمن 19.	جھوٹ، دھوکہ، فریب، خیانت، ملاوٹ ترک کرنے کے احکام	11.
البقرہ 213، 143 النساء 59 آل عمران 104، 110، المائدہ 48، 66، الانعام 108 الاعراف 134 الانفال 1، 45-46 یونس 47 النمل 83-84 المؤمن 5 فاطر 24 الفتح 29 الجاثیہ 28. یوسف 45.	مسلمانوں کے باہمی تعلقات، متحدہ اسلامی قومیت	12.
. البقرہ 36، 85، 193 آل عمران 28، 103، 118 النساء 29، 91، 144 المائدہ 8، 14، 51، 55-58، 64، 82، 91. الاعراف	دوستی اور دشمنی کی قرآنی اصول	13.

	149، 128	
14.	دوستی اور دشمنی کی قرآنی اصول	التوبة 71 . الاحزاب 6 . الممتحنة 1 ، 4 . حم السجدة 34-35 القصص 28 . المنافقون 4 . التغابن 14 .
15.	مسلمانوں کا غیر مسلموں کے ساتھ تعلقات کی نوعیت	آل عمران 119-118 الانعام 108 الاعراف 199 الانفال 61 التوبة 6-7 النجم 29 هود 113 الفرقان 52 القصص 86-87 . الاحزاب 48 الجاثية 18-19 الدهر 24 .
16.	احکام قتال (کافروں سے جنگ کے احکام اور جنگی قیدیوں کے حقوق وغیرہ)	البقرة 84-85 ، 190-193 ، 244 النساء 76 ، 84 ، 90 ، 95-96 ، الانفال 15-16 ، 38 ، 40 ، 57 ، 60-62 ، 65 ، 71- التوبة 123 محمد 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 جالندھری، ترجمہ قرآن
4. مولانا مودودی، ترجمہ و تفسیر تفہیم القرآن
5. پیر محمد کریم مشابہ الزبیری: ترجمہ جمال القرآن و تفسیر ضیاء القرآن
6. مفتی محمد شفیع عثمانی، ترجمہ و تفسیر معارف القرآن
7. فاروق بہاء الحق شاہ، خلاصہ القرآن
8. ڈاکٹر اطہر محمد اشرف، جامع اشاریہ مضامین قرآن
9. زاہد ملک ، مضامین قرآن حکیم

11.0 SEMESTER 8

Course Name: Hydraulic & Pneumatic Actuators

Course Code: RB-304

Credit Hours: 3+0

Objectives:

To equip the students with the knowledge of Hydraulic and Pneumatic Actuators, Selection and Applications of Sensors & Actuators.

Course Contents:

Introduction to Sensing, Static and Dynamic Characteristics of Sensors, Motion and Dimensional Sensors, Force, Torque, and Power Sensors, Pressure, Fluid Flow and Temperature Sensors, Electro-Magnetic Principle, Classification of Electrical Actuators, DC and AC Motors Modelling and Drivers, Stepper Motors Modelling and Drivers, Description of Fluid Behavior, Hydraulic Actuator and System, Pneumatic Actuator and System, Selection and Applications of Sensors & Actuators: Technological properties, accuracy and precision, response time, Stability, Cost, Applications in process and other industries, Interfacing of sensing devices and actuators to computer systems

Recommended books:

1. Kaltenbacher, Manfred. Numerical simulation of mechatronic sensors and actuators. Vol. 2. Berlin: Springer, 2007.
2. Gusev, Evgeni, Eric Garfunkel, and Arthur Dideikin, eds. Advanced Materials and Technologies for Micro/Nano-Devices, Sensors and Actuators. Springer, 2010.

Course Name: Professional Values & Ethics
Course Code: HS-401
Credit Hours: 3+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

12.0 ELECTIVE COURSES

List of Electives		
Code	Course Title	CH
RB-404	Artificial Intelligence	3+0
RB-405	Industrial Automation	3+0
RB-406	Mechatronics System Design	3+0
RB-407	Machine Vision	3+0
RB-408	Industrial Drives	3+0
RB-409	Robot Communications	3+0
RB-410	Special Topics in Robotics	3+0

Course Name: Artificial Intelligence

Course Code: RB-404

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. Stuart Russell and Peter Norvig, Artificial Intelligence. A Modern Approach, 3rd edition, Prentice Hall, Inc., 2010.
2. Hart, P.E., Stork, D.G. and Duda, R.O., 2001. Pattern classification. John Willey & Sons.
3. Luger, G.F. and Stubblefield, W.A., 2009. AI algorithms, data structures, and idioms in Prolog, Lisp, and Java. Pearson Addison-Wesley.

Course Name: Industrial Automation

Course Code: RB-405

Credit Hours: 3+0

Objectives:

This course covers industrial automation with particular reference to CNC and PLC. After this course, the students would be able to understand the automation requirements of a modern industrial set-up.

Course Contents:

Industrial and specially Manufacturing Automation, Automation Theory; Computer Numerical Control (CNC) Machining Requirements, Limitations of Conventional Machining, Introduction of Numerical Control, building blocks of CNC, CNC Programming, Machining Codes, Sensors/actuators/control cards used in CNC machines. Programmable Logic Controllers (PLC) Introduction to PLC, PLC Architecture and Operation, Advantages / Limitations of PLC, Ladder Logic and other Programming Formats, Relay Logic, Timers, Counters, Comparator, Math Instructions, Bit Shift Registers, Advanced instructions, industrial data communication 54 protocols, SCADA, HMI.

Recommended Books

1. Jon Stenerson, "Fundamentals of PLCs, Sensors and Communication", 3rd Ed., Prentice Hall, Upper Saddle River, New Jersey, 2004
2. Robots and Manufacturing Automation, by C. Ray Asfahl, John Wiley & Sons, Latest Edition
3. CAD/CAM Principles and Applications, by P N Rao, McGraw Hill, Latest edition 4. Programmable C

Course Name: Mechatronics System Design

Course Code: RB-406

Credit Hours: 3+0

Objectives:

This course focuses on the synergetic integration of the knowledge of mechanical engineering, electronics, and computer engineering to achieve a functional mechatronic system.

Course Contents:

Mechanical Design: Mathematical Model. General equation of motion for a mechatronic system. Estimating Motor torques based on inertia of the system and the desired maximum velocity and acceleration. Estimating frictional forces due to dry friction and misalignment. Designing for low friction and high-rigidity systems. Design of mechanical drive system. Ball screw design. Design of Linear Motion guides. Preparing workshop drawings of various mechanical components using CAD. Preparing part program files for CNC machining of components using G-Simple or any other CAD/CAM package. These drawings and CNC codes will later become part of the final design document. Electronics and Software Design Evolving schematic circuit diagrams for the electronic circuitry. H-bridge circuit design for servo motor control. Components selection. Development of computer hardware using modern microcontrollers or DSPs. Pulse encoder interface circuit. Implementation of PID control algorithm. Interfacing other sensors with the microcontroller. Path planning algorithm, trajectory generation. Front-end design. Data communication with other devices.

Recommended Books

1. David Alciatore, "Introduction to Mechatronics and Measurement Systems" Latest edition
2. Devdas Shetty and Richard Kolk "Mechatronics System Design", Brooks/Cole CENGAGE Learning, Latest edition
2. Rajput, R K. "A Text Book of Mechatronics", S. Chand & Company Ltd., Latest edition.
3. Saeed B. Niku "Introduction to Robotics Analysis, Systems, Applications", Pearson Education Inc., NJ, USA, Latest edition.

Course Name: Machine Vision

Course Code: RB-407

Credit Hours: 3+0

Objectives:

To equip the students with advanced vision systems for interactive systems using advanced image processing techniques.

Course Contents:

Introduction to machine vision, image processing tools and techniques, Hough Transform, Morphological operators, Edge detection, Image Segmentation, 3D vision, Shape description and modelling, Geometry of projection and co-ordinate transformations, Surface reconstruction, Recognizing and tracking objects, Recognizing activities and events, Image registration, Texture analysis, Applications of machine vision.

Recommended Books

1. Image Processing, Analysis, and Machine Vision by Milan Sonka, Vaclav Hlavac and Roger Boyle, 2014
2. Digital Image Processing Using Matlab by Rafael C. Gonzalez and Richard E. Woods, Pearson Education, 2004

Course Name: Industrial Drives

Pre-Requisite: Power Electronic

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

To equip the students with the knowledge of Industrial Drives 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: Robot Communications

Pre-Requisite: Communication System

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

To develop an understating of the control topologies and parameters required in modern manipulators and mobile robots and be able to apply these controls to real-world robotic manipulators and platforms.

Course Contents:

Kinematic and dynamic modelling of mobile platforms, Kinematic and dynamic models of serial chain manipulators, Trajectory planning of serial chain manipulators, Path planning of mobile platforms, Feedback control topologies, Digital implementation of control laws, Model identification, Parameter estimation techniques, Robotics and the industry, communication and its applications in the field of robotics.

Recommended Books

1. Robotics, Vision and Control: Fundamental Algorithms in MATLAB (Springer Tracts in Advanced Robotics) by Peter Corke
2. Kinematics, Dynamics, and Control (2nd Edition) by Jazar, Reza N. 3. A Mathematical Introduction to Robotic Manipulation by R. M. Murray, Z. Li, S. S. Sastry

Course Name: Special Topics in Robotic

Course Code: RB- 410

Credit Hours: 3+0

Objectives:

One completing this course students should be able to identify and explain the different analogies that can be made between all system dynamics, use fundamental concepts of robotics systems to derive and apply simplified system dynamics models, evaluate and construct robotics models using Bond Graphs and interpret the simulation results accordingly, derive state-space equations from Bond Graphs for the purpose of control system design.

Course Contents:

An Overview of System Dynamics and Mechatronics Systems, Elementary Mechanical Systems, Elementary Electric Circuits and Networks, Basic Techniques of Equation Formulation, The evaluation of existing and future active safety systems, Introduction to a Bond Graphs Simulation Tool, The evaluation of existing and future trends in engine, transmission and integrated powertrain control techniques, General Modelling of Mechatronics Systems: Sensors, Transducers, Conventional Powertrain, Alternative Powertrain

Recommended Books

1. Electric and Hybrid Vehicles: Technologies, Modeling and Control - A Mechatronic Approach by Amir Khajepour, M. Saber Fallah, Avesta Goodarzi
2. Mechatronic Systems Techniques and Applications, Cornelius T. Leondes.

Standard 2-1

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

4.6.1 Group 1: Computer Domain Courses

EC-112 Object oriented Programming, EC-110 Computing Fundamentals, EC-221 Data Structure and Algorithm

4.6.2 Group 2 General Sciences

Engineering Physics

4.6.3 Group 3 Robotics and Automation Domain

EE-101 Workshop Practice, EE-102 Linear Electric Circuits, EE-103 Electrical Network Analysis, RB-201 Engineering Mechanics, RB-203 Operating Systems, EE-203 Digital Logic Design, EE-309 Electrical Machines, EE-205 Electronic Devices and Circuits, RB-301 Data Base System, RB-302 Introduction to Robotics, RB-306 Robotics and Automation, RB-303 Robotic Machine Design, EE-206 Signal and Systems, EE-204 Introduction to Embedded Systems, EE-305 Linear Control System, EE-306 Signal Processing, EE-308 Instrumentation and Measurement, EE-304 Communication Systems, RB-403 Sensors & Transducers, RB-403 Hydraulic & pneumatic Actuators, RB-404 Model Predictive Control, RB-405 Industrial Automation, RB-406 Mechatronics System Design, RB-407 Machine Vision, RB-408 Industrial Drives, RB-409 Robot Communications, RB-410 Special Topics in Robotics

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-101 Workshop Practice, EE-102 Linear Electric Circuits, EE-103 Electrical Network Analysis, RB-201 Engineering Mechanics, RB-203 Operating Systems, EE-203 Digital Logic Design, EE-309 Electrical Machines, EE-205 Electronic Devices and Circuits, RB-301 Data Base System, RB-302 Introduction to Robotics
Problem Analysis	, RB-306 Robotics and Automation, RB-303 Robotic Machine Design, EE-206 Signal and Systems, EE-204 Introduction to Embedded Systems, EE-305 Linear Control System, EE-306 Signal Processing, EE-308 Instrumentation and Measurement, EE-304 Communication Systems, MT-101 Calculus and Analytical Geometry, MT-103 Differential Equations
Solution Design	RB-403 Sensors & Transducers, RB-403 Hydraulic & pneumatic Actuators, RB-404 Model Predictive Control, RB-405 Industrial Automation, RB-406 Mechatronics System Design, RB-407 Machine Vision, RB-408 Industrial Drives, RB-409 Robot Communications, RB-410 Special Topics in Robotics 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 Robotics and Automation curriculum satisfy the core and other all requirements.

Program	Maths & General Sciences	Engineering Topics (Electrical)	General Education (Humanities & Management Sciences)	Others (Computer Sciences)	Electives
BS Robotics and Automation	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 2nd semester and 3 credit hours subject Technical Report Writing in 3rd semester are taught to develop the oral and written communication skills of the students.

13.0 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
Location & Area	Israr Block(1 st Floor)	Israr Block(2 nd Floor)	Israr Block (1 st Floor)
Objectives	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.
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	<ol style="list-style-type: none"> 1. Introduction to Computing 2. Data Structure & Algorithm 3. Object Oriented programming 4. Computer organization & Assembly 5. Data base system 	<ol style="list-style-type: none"> 1. Computer Fundamentals 2. Engineering Workshop Lab 3. Computer Aided engineering drawing 	<ol style="list-style-type: none"> 1. Communication System 2. Robotic Machine Design 3. Robot Communication
Software Available	MS Office, Visual Studio, Turbo C, AUTOCAD, Oracle, Proteus, Emulator8086, MATLAB	MS Office, MATLAB, MS Visio, Proteus, Pspice, AutoCad, Visual Studio	MS Office, MATLAB
Major Apparatus / Equipment	<ul style="list-style-type: none"> • Computers, • Multimedia 	<ul style="list-style-type: none"> • Computers, • Multimedia 	<ul style="list-style-type: none"> • Analog and Digital Communication Trainers • Mobile Communication Trainers • Fiber Optic Trainer • Four Channel Analog TDM Trainer • DSB/SSB Transmitter and Receiver Trainer • QAM Trainer • FM Communication Trainer • Audio Input and Output Module • PAM,PPM,PWM Modulation and Demodulation Trainer • TDM Pulse Code Modulation and Demodulation Trainer • GPS Trainer • GSM Trainer

			<ul style="list-style-type: none"> • Sampling & Reconstruction Trainer • Carrier Demodulation & Data Reformatting Receiver Trainer • TDM Pulse Amplitude Demodulation Trainer • Noise Audio Amplifier Trainer • PN Sequence Generator • Digital Storage Oscilloscope • Frequency Modulation and Demodulation Trainer • Computer
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 7: Laboratories Details 1

Laboratory Title	RF & Microwave Lab	Digital Systems Lab	Electronics Workshop
Location & Area	Israr Block (1 st Floor)	Israr Block (1 st Floor)	Israr Block (1 st 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
Software Available	MS Office, MATLAB, HFSS		-

Major Apparatus / Equipment	<ul style="list-style-type: none"> • Antenna Trainers • Wave propagation trainers • Transmission line Trainer • Satellite communication Trainer • Radar Trainer • Computer 	<ul style="list-style-type: none"> • Digital Logic Trainer • Advance Digital Logic Trainer • Digital Trainer • Microprocessor Trainer 8086 Based • Micro Controller 8051 based M-51-02 • Embedded Trainer 	<ul style="list-style-type: none"> • Power Supply • Signal Generator • Oscilloscope • Multimeters • Wiring Trainer • Meggar • Soldering Iron • Project board
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
Location & Area	Israr Block (1 st Floor)	Israr Block (1 st Floor)	Israr Block (1 st Floor)
Objectives	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)
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	<ol style="list-style-type: none"> 1. Electrical Power System 2. Power Distribution & Utilization 	<ol style="list-style-type: none"> 1. Power Electronics 2. Industrial Electronics 3. Instrumentation & Measurements 4. Linear Control Systems 	<ol style="list-style-type: none"> 1. Network Analysis 2. Electronic Devices & Circuits 3. Basic Electronics 4. Electronics System Design
Software Available		MS Office, MATLAB, Proteus, Pspice	MS Office, MATLAB, Proteus, Pspice
Major Apparatus / Equipment	<ul style="list-style-type: none"> • Power Engineering Lab Unit (1&2) 	<ul style="list-style-type: none"> • Power Supply • Signal Generator • Oscilloscope • Computers • Ball & Beam • Inverted Pendulum 	<ul style="list-style-type: none"> • Workbenches • Signal Generator • Oscilloscope • Multimeters • DC Power supply • Electric city Trainer

		<ul style="list-style-type: none"> • Servo Motor Trainer • Magnetic levitation System • Traffic Signal Control • Water level Control • Temperature Control • Conveyor Control • Elevator Control Trainer • PID Trainer • PLC Trainer • Relay control Trainer • Analog Control System 	<ul style="list-style-type: none"> • Module • Computers
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 9: Laboratories Details 3

Laboratory Title	Electrical Machines Lab	Network/ DSP Lab	Project Lab
Location & Area	Israr Block (1 st Floor)	Israr Block (1 st Floor)	Israr Block (1 st Floor)
Objectives	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
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	
Courses Taught	1. Electrical Machine	1. Computer Network 2. DSP	
Software Available		MS Office, MATLAB, Proteus, Pspice	MS Office, MATLAB, Proteus, Pspice
Major Apparatus / Equipment	<ul style="list-style-type: none"> • Single Phase Transformer • DC/AC Machine • Three Phase Motor • Three Phase Transformers 	<ul style="list-style-type: none"> • Data Communication Trainer • LAN Trainers • FPGA Kits • DSP Kits 	<ul style="list-style-type: none"> • Oscilloscope • Function Generator • DMM • Power supply • Soldering Station • Drill machines • Computers

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
High Voltage Engineering Lab			

Table 10: Laboratories Details 4

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 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 also 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 enough to achieve program objectives.

14.0 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 Academic Council Meeting (ACM), 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 Electrical 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 chairperson of the department. Chairperson acts as advisor to guide students to choose appropriate courses and also 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.

15.0 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. Admissions are entertained annually in fall semester.

Students who have scored 2nd division 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 or other relevant domain diploma, are eligible for admission.

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 of 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;

Grade	Grade Point
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 Performa 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 – Annexure L) and Performa number 5 (Faculty Survey – Annexure - G) 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 8th semester which is the final semester. At the end of the 8th semester all students are required to submit their respective final year projects. Student's final 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.

16.0 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
Robotics and Automation	EE-309, EE-203, EE-206, EE-305, EE-304, RB-301, RB-302, RB-401, RB-402, RB-403, RB-404, RB-406, RB-407, RB-408, RB-409,	8	3
Total	15	8	3

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.

17.0 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

Class-rooms must be adequately equipped and offices must be adequate to enable faculty to carry out their responsibilities.

The department has sufficient number of class rooms to accommodate all sessions as per university schedule. All class rooms are equipped with air conditioners to provide a good working environment, with proper lighting and ventilation. Most class rooms 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.

18.0 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 HEC for admission in this program. Currently 2022 session is studying in 2nd semester.

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.

19.0 Conclusion

The self assessment report of the BS Robotics and Automation, 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 technologists. 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 5 teachers of the program ranged from 3.50 to 4.45. Students' course evaluation score ranged between 3.50 and 4.85 with a mean of 4.20 points in 0-5 scale.

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. However, faculty members need motivation for advanced knowledge, research and external training.

Institutional facilities were measured through Criterion 7; infrastructure, library, class room 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
- 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 Forms

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 & 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:		

HITEC UNIVERSITY TAXILA
DIRECTORATE OF QUALITY ASSURANCE & COLLABORATION

EMPLOYER FEEDBACK FORM

Name of Organization:	
Address:	
Contact No.:	
Web Address:	
Email:	

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

Name of HITEC University graduate you are evaluating:
Position of HITEC University graduate you are evaluating:

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:	

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:

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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:

Annexure B: Faculty 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, Mughal M. A. , 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.; Mughal, M.A. ; 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., Mughal, M. A. , 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, Mughal MA , 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, Mughal M.A. , and H. Ur Rahman	Volume Fraction Extraction for Binary Mixture of Ethanol and Methanol Using Optimized Microwave Microfluidic Sensor		
6	Mughal, M.A. ; Ejaz, T.; Arshad; Hussain, A.	Metaheuristic Regression Equations for Split-Ring Resonator Using Time-Varying Particle Swarm Optimization Algorithm		2.11
7	Arshad; Mughal, M.A. ; Nekahi, A.; Khan, M.; Umer, F	Influence of Single and Multiple Dry Bands on Critical Flashover Voltage of Silicone Rubber Outdoor Insulators		2.676

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

Dr. Syed Kashif Imdad				
1	Salahuddin, Humayun, Kashif Imdad , 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, Kashif Imdad , 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 Kashif Imdad	Temporal Effects of Thermal Stresses on Solid Dielectric Materials under Diverse Voltage Conditions	<i>Pakistan Journal of Engineering and Technology</i>	Y(HEC)
4	Imdad, Kashif , 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, Kashif Imdad , 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 Syed Kashif Imdad	Temperature and hydrophobicity of silicon rubber	<i>Electrical Insulations</i>	1.25
7	Imdad, Syed Kashif , and Muhammad Amin	Aging of polymeric insulator installed at colombian environment	<i>Electrical Insulations</i>	1.25
8	Kashif Imdad	Assessing Wetland ecosystem health in Sundarban Biosphere Reserve using pressure-state-response model	<i>Applied Physics</i>	2.2
9	Kashif Imdad	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	<i>Applied Mathematics</i>	0.25
10	Kashif Imdad	A passive verses active exposure of mathematical smoking model: A role for optimal and dynamical control	<i>Applied Mathematics</i>	0.25
Engr. Iftikhar Ahmed				

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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Engr. M. Shahzad				
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).	
Engr. Safee Ullah				
1	Ali, Muhammad Umair, Kamran dad kallu, Haris, Safee Ullah 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, Safee Ullah 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 & Technology</i> 41.2 (2022): 91-99.	<i>of Engineering & Technology</i>	
Engr. M. Adnan Khan				
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 D: 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 – E: Assessment Team (AT) Findings

Self Assessment Team Report Submission

01 July 2016

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. Fawad Ahmed
 - 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. Class rooms 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 class rooms have inadequate seating capacities
- b) Infrastructure not available for foundry shop
- c) Infrastructure not available for wood work 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

Annexure – F:

Rubric Report

Self Assessment Report						
Criterion 1 – Program Mission, Objectives and Outcomes			Weight = 0.20			
Factors			Score			
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
Total Encircled Value (TV)			19			
SCORE 1 (S1) = [TV/ (No. of Question * 5)] * 100 * 0.20			15.2			

Criterion 2– Curriculum Design and Organization			Weight = 0.15			
Factors			Score			
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
Total Encircled Value (TV)			31			
SCORE 1 (S1) = [TV/ (No. of Question * 5)] * 100 * 0.15			11.625			

Criterion 3– Laboratories and Computing Facilities			Weight = 0.15			
Factors			Score			
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
Total Encircled Value (TV)			12			
SCORE 1 (S1) = [TV/ (No. of Question * 5)] * 100 * 0.15			12			

Criterion 4– Student Support and Advising		Weight = 0.10				
Factors	Score					
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	
Total Encircled Value (TV)	12					
SCORE 1 (S1) = [TV/ (No. of Question * 5)] * 100 * 0.10	8					

Criterion 5– Process Control		Weight = 0.10				
Factors	Score					
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 and 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	
Total Encircled Value (TV)	43					
SCORE 1 (S1) = [TV/ (No. of Question * 5)] * 100 * 0.10	7.81					

Criterion 6– Faculty		Weight = 0.10				
Factors	Score					
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)	22				
SCORE 1 (S1) = [TV/ (No. of Question * 5)] * 100 * 0.10	6.29				

Criterion 7– Institutional Facilities		Weight = 0.10				
Factors		Score				
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)	13					
SCORE 1 (S1) = [TV/ (No. of Question * 5)] * 100 * 0.10	7.33					

Criterion 8– Institutional Support		Weight = 0.10				
Factors		Score				
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)	8					
SCORE 1 (S1) = [TV/ (No. of Question * 5)] * 100 * 0.10	8					

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