Computer Engineering Department
University of Engineering and Technology, Taxila.

COMPLEX ENGINEERING PROBLEMS

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BASIC ELECTRICAL ENGINEERING

INSTRUCTOR: **Engr. Asim Raza**

COURSE CODE: **EE-102 L**

SEMESTER: **1st (Fall-2020)**

ENTRY: **20-CP**

Credit Hours: **3 (Theory)+1 (Lab)**

Semester project is designed in a way to able students to solve the complex engineering problem. Following characteristics of complex engineering problem are targeted in this semester project of Electronic Circuits:

WP 1	Depth of Knowledge Required
WP 2	Range of Conflicting Requirements
WP 3	Depth of Analysis Required

CEP statement:

Design and implement an electronic circuit comprising semiconductor device to solve a real-life issue.

Project is carried out in four phases:

1. **Problem Identification:**

In the first phase, students are asked to bring the problems they intend to work on. Counselling is given to students in lab and contact hours for finalizing their ideas and preparing a proposal. Students must explore the problems/issues around us, which they can solve using electronic circuits techniques. If the problem brought by the students are irrelevant to the course or not feasible at this level, they are asked to bring some other problem. Once ideas are finalized, constant counselling is provided by the Lab Engr. and Course Instructor for requirements, issues, components, and possible circuitry of each idea.

Following is the list of projects approved after discussion:

2. **Project Proposal:**

In initial study phase, students must explore the literature or existing solutions for their selected project idea. In this phase, students are also encouraged to have a detailed analysis of the problem to solve it in a better way. Each group's project is unique, may have many possible solutions as well as may be explored and developed in a different way. After discussion, students are asked to submit a proposal on one idea approved by the Instructor/Lab Engr. A sample of Project Proposal is also attached in the course folder.

3. **Project Progress Report**

Students are asked to submit a short report on progress/status regarding prototyping the project idea, successes, failures, troubleshooting, and objectives. Responses are received on one page including current image of hardware equipment.

4. Simulation of Project

Every student must submit a printout of simulation (CCT diagram) and expected output of the project.

As Electronic Circuit projects are having many real-time constraints as well as there is no fixed solution for any problem. Each problem may be solved in many possible ways. Students have tried to apply the in-depth engineering knowledge (WP1) to complete each project. During the initial study and formulation of proposed solution, they focused on the detailed requirements (WP2), real-time constraints (WP2) and performed in-depth analysis (WP3). Projects were evaluated on the following criteria:

Idea/Initial Study (WP2)	20%
Project Proposal (WP1, WP3)	20%
Project Progress (WP3)	10%
Simulation	10%
Demo/Report	40%

Complete assessment of each student is presented in the result. Sample project reports are also attached in the course folder.

Summary:

Following are salient outcome of the semester project in terms of complex engineering problem:

- Brainstorming exercise forced them to explore the surrounding environment to sort out the problems to be solved using image processing.
- Problem formulation enhances their ability to gather real-time requirements and address conflicts/constraints.
- Design/Simulation/Implementation gave them a chance to go through the in-depth engineering knowledge to solve the problem and analyze in an effective way.

CIRCUIT ANALYSIS

INSTRUCTOR: **Asim Raza**

COURSE CODE: **EE-108 L**

SEMESTER: **3rd (Spring-2021)**

ENTRY: **20-CP**

Credit Hours: **3 (Theory)+1 (Lab)**

Semester project is designed in a way to able students to solve the complex engineering problem. Following characteristics of complex engineering problem are targeted in this semester project of Electronic Circuits:

WP 1	Depth of Knowledge Required
WP 2	Range of Conflicting Requirements
WP 3	Depth of Analysis Required

CEP statement:

Design and implement an electronic circuit comprising semiconductor device to solve a real-life issue.

Project is carried out in four phases:

1. **Problem Identification:**

In the first phase, students are asked to bring the problems they intend to work on. Counselling is given to students in lab and contact hours for finalizing their ideas and preparing a proposal. Students must explore the problems/issues around us, which they can solve using electronic circuits techniques. If the problem brought by the students are irrelevant to the course or not feasible at this level, they are asked to bring some other problem. Once ideas are finalized, constant counselling is provided by the Lab Engr. and Course Instructor for requirements, issues, components, and possible circuitry of each idea.

Following is the list of projects approved after discussion:

CA Project list Spring 2021 (20-CP)			
Sr. #	**Reg #**	**Name**	**Project Name**
1	20-CP-01	Khadija Bibi	Audio generator
2	20-CP-02	Ahmad Murtaz	Toy Piano
3	20-CP-04	Muhammad Jawad Asghar	Screaming Siren Lights
4	20-CP-05	Kanwar Muhammad Umar	Amplifier
5	20-CP-06	Muhammad Rizwan Iftikhar Ali	
6	20-CP-07	Hamza Sardar	Water Level Indicator

7	20-CP-08	Hassam Qaisar	40 W inverter
8	20-CP-09	Muhammad Ubaid Ashraf Chaudhary	Faulty Car Alarm Indicator
9	20-CP-10	Ch Sufyan Zafar	Puff to off Led
10	20-CP-11	Maryam Seemab	Clap based fan switch
11	20-CP-12	Eman Tariq Awan	Brake Failure indicator
12	20-CP-13	Laiba Kanwal	Mobile Phone Charger Circuit
13	20-CP-14	Hassan Raza	variable voltage supply from fixed voltage regulator
14	20-CP-15	Sibgha Sohail	Crystal tester
15	20-CP-16	Aiman Malik	Battery level indicator
16	20-CP-17	Abdul Wahab	Audio Amplifier
17	20-CP-18	Muhammad Jabir Ali	Obstacles Avoiding Robot without using Microcontrollers
18	20-CP-19	Abdul Hannan Tahir	Earthquake Detector
19	20-CP-20	Uzair Akbar Malik	Automatic parking light
20	20-CP-21	Abeeha Fatima	Fire Detector
21	20-CP-22	Usama Shoukat	FM radio
22	20-CP-23	Aqsa Aziz	Thermal Touch switch
23	20-CP-24	Muhammad Azam Rajpoot	Automatic Temperature Sensor Circuit with Alarm
24	20-CP-25	Alisha Tabassum	Metal Detector using 555 IC timer
25	20-CP-26	Aimen Atif	12V to 220V Step Up Inverter using transformer in Proteus
26	20-CP-27	Adiba Muqadas	Traffic Light
27	20-CP-28	Salman Ahmad	Electronic circuit breaker with high/low voltage protection
28	20-CP-29	Aqsa Sher	Automated smoking zone Monitoring & Alerting system
29	20-CP-30	Moez Ahsan Azam	over heat detector
30	20-CP-31	Muhammad Zulqarnain	ELECTRONIC LED DICE
31	20-CP-32	Basit Mujtaba	USB LED light And Emergency LED light circuit
32	20-CP-33	Muhammad Omar Farooq	Joule Thief Circuit
33	20-CP-34	Atiqa Qayyum	Automatic Doorbell

34	20-CP-35	Wahab Kazim	Automatic Light Detector9
35	20-CP-37	SaifUr Rehman	
36	20-CP-38	Itaat Ullah Khan	Super Sensitive intruder alarm
37	20-CP-39	Zafar Iqbal	Mosquito Repellent Circuit
38	20-CP-40	Muhammad Sarmad Qadir	Sun tracking solar panel
39	20-CP-42	Ali Raza Amir	Light sensor
40	20-CP-43	Muhammad Zia Ullah	AC to DC Adapter with 220V AC input and 5V DC output
41	20-CP-44	Maria Aftab	Hearing Aids project
42	20-CP-45	Hammad Maqsood	Laser Security System
43	20-CP-46	Ali Hassan	Air flow detector
44	20-CP-47	Umair Aziz	Automatic Door Bell Ringer
45	20-CP-48	Kamran khan	220 V AC to 12 V DC
46	20-CP-49	Muhammad Jahangir	HEAT SENSOR
47	20-CP-50	Shaher Bano Sani	Electronic Eye
48	20-CP-51	Muhammad Hammad Farooq	circuit breaker
49	20-CP-52	Muhammad Faaz Qadeer	AC to DC Charger
50	20-CP-53	Muddasir Ali Haider	Automatic Night Lamp
51	20-CP-54	Hareem Shahzad	Simple Function Generator
52	20-CP-56	Faria Raghib	Peak Detector
53	20-CP-57	Ehsan Ullah	Audio Equalizer
54	20-CP-58	Daud Khalid	Incoming call inductor
55	20-CP-60	Muhammad Junaid	Bike Turning Signal Circuit
56	20-CP-61	Abdul Moiz Zagham	
57	20-CP-62	Muhammad Zubair Zafar	Mosquito Repellent Project
58	20-CP-63	Tooba Ijaz	Automatic Fence lightning Circuit with alarm
59	20-CP-64	Ali Raza	Touch Sensor
60	20-CP-65	Hammad Ansar	Electronic Letter Box
61	20-CP-66	Muhammad Daniyal Naeem	
62	20-CP-67	Syeda Irram Hassan	Automatic Fan controller
63	20-CP-68	Shahid Amin	
64	20-CP-69	Salman Shahid	

65	20-CP-70	Awais Ali	Security Alarm using diodes and transistors
66	20-CP-71	Abdullah	Digital stethoscope
67	20-CP-73	Muhammad Hussnain	DC power supply
68	20-CP-74	Muhammad Yazdan Afzal	Green House Monitoring & control
69	20-CP-75	Hussam Ather	Stress Meter
70	20-CP-76	Hashir Awan	Water detection system
71	20-CP-77	Muhammad Subhan	Automatic street light
72	20-CP-78	Muhammad Umer	Remote control switch
73	20-CP-79	Muhammad Shoaib	Heartbeat sensor
74	20-CP-80	Muhammad Sufian Iqbal	Thermometer using op amplifier
75	20-CP-81	Bakhtawar Attiq	People Counter
76	20-CP-82	Muhammad Zain-ul-abideen	police light repeater circuit
77	20-CP-83	Mahnoor	lead acid battery charger
78	20-CP-84	Noor Ullah	10-Watt Audio Amplifier
79	20-CP-85	Husnain Firdous	Infrared motion detector
80	20-CP-86	Musa Faisal	
81	20-CP-87	Hussnain Ashraf	motion detector
82	20-CP-88	NaeemUllah	
83	20-CP-89	Haider Akash	Touch Sensor
84	20-CP-90	Aleena Shafiq	Vehicle Indicator
85	20-CP-91	Ali Babar	Aids for hearing impaired
86	20-CP-92	Arooj	Ding Dong Door Bell
87	20-CP-93	Ali Sher Baz	AUTOMATIC BATTERY CHARGER
88	20-CP-94	Muhammad Asim	WIRELESS VOLTAGE DETECTOR
89	20-CP-95	ZabiUllah	Building a Wailing Siren Circuit using a 555 Timer IC

2. Project Proposal:

In initial study phase, students must explore the literature or existing solutions for their selected project idea. In this phase, students are also encouraged to have a detailed analysis of the problem to solve it in a better way. Each group's project is unique, may have many possible solutions as well as may be explored and developed in a different

way. After discussion, students are asked to submit a proposal on one idea approved by the Instructor/Lab Engr. A sample of Project Proposal is also attached in the course folder.

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4. Simulation of Project

Every student must submit a printout of simulation (CCT diagram) and expected output of the project.

As Electronic Circuit projects are having many real-time constraints as well as there is no fixed solution for any problem. Each problem may be solved in many possible ways. Students have tried to apply the in-depth engineering knowledge (WP1) to complete each project. During the initial study and formulation of proposed solution, they focused on the detailed requirements (WP2), real-time constraints (WP2) and performed in-depth analysis (WP3). Projects were evaluated on the following criteria:

Idea/Initial Study (WP2)	20%
Project Proposal (WP1, WP3)	20%
Project Progress (WP3)	10%
Simulation	10%
Demo/Report	40%

Complete assessment of each student is presented in the result. Sample project reports are also attached in the course folder.

Summary:

Following are salient outcome of the semester project in terms of complex engineering problem:

- Brainstorming exercise forced them to explore the surrounding environment to sort out the problems to be solved using image processing.
- Problem formulation enhances their ability to gather real-time requirements and address conflicts/constraints.
- Design/Simulation/Implementation gave them a chance to go through the in-depth engineering knowledge to solve the problem and analyze in an effective way.

ENGINEERING WORKSHOP

COURSE TITLE: **Engineering Workshop**

INSTRUCTOR: **TBA**

SEMESTER: **1st (Fall-2021)**

ENTRY: **21-CP**

Credit Hours: **1 (Lab)**

Semester project is designed in a way to able students to solve the complex engineering problem. Following characteristics of complex engineering problem are targeted in this semester project of Engineering Workshop.

WP 1	Depth of Knowledge Required
WP 2	Range of Conflicting Requirements
WP 3	Depth of Analysis Required
WP4	Involve infrequently encountered issues

Example CEP Statement:

Design and implement a digital system's prototype using Arduino IDE and MIT app inventor to exercise and apply the concepts and hands on experiences learned in the course. The project should relate to some real-life issue. An example project's statement is shown below:

"In this complex engineering problem, students as a group will investigate and design a simple voice-controlled robot. Such a system can be incorporated with a 4-wheel robot car kit to make it voice controlled and thus enables a physically handicapped person to move freely without the help of a constant care-giver. Moreover, the ability to give commands in MIT app inventor will make the system more user-friendly. Students are required to explore different methodologies to investigate the problem through design of experiment and data analysis and select or develop an optimal methodology for design of the system"

Project is carried out in four phases:

1. **Problem Identification:**

In the first phase, students are asked to bring the problems they intend to work on. Counselling is given to students in lab and contact hours for finalizing their ideas and preparing a proposal. Students must explore the problems/issues around them, which they can propose a digital system to solve the issue. If the problem brought by the students are irrelevant to the course or not feasible at this level, they are asked to bring some other

problem. Once ideas are finalized, they would identify the requirements, issues, components, algorithm, and circuit of their idea.

2. **Project Proposal:**

In this phase, students are asked to propose their intended project in the form of a formal project proposal. Each group's project can be unique or they can apply different approaches to solve a similar problem.

3. **Project Progress:**

In this phase, students would be asked to demonstrate the progress of their project to show what they have done so far, identify the problems, discuss possible solutions and demonstrate their workplan with timeline to complete the project.

4. **Project Demonstration:**

In this phase, students would show the final demo of their project and the present the project report. They would discuss the problems faced during the project and their solutions to resolve these problems.

Students would try to apply the in-depth engineering knowledge (WP1) to complete each project. During the initial study and formulation of proposed solution, they would focus on the detailed requirements (WP2), real-time constraints (WP2), performed in-depth analysis (WP3) and solved infrequently occurring issues (WP4). Projects would be evaluated on the following criteria: -

Idea/Initial Study (WP2) 15%

Project Proposal (WP1, WP3) 15%

Project Progress (WP3,WP4) 20% Final Demo (WP3,WP4) 35%

Final Report (WP3,WP4) 15%

Summary:

Following are salient outcome of the semester project in terms of complex engineering problem:

- Brainstorming exercise forced them to explore the surrounding environment to sort out the problems.
- Problem formulation enhances their ability to gather real-time requirements and address conflicts/constraints.
- Design/Simulation/Implementation gave them a chance to go through the in-depth engineering knowledge to solve the problem and analyze in an effective way.

DIGITAL LOGIC DESIGN

INSTRUCTOR: **NOSHINA SHAMIR**

COURSE CODE: **CP-106**

SEMESTER: **2nd**

ENTRY: **20-CP**

CREDIT HOUR: **3+1**

A number of teaching paradigms have been utilized to increase the student learning effectiveness for advanced and complex engineering problems. The studies have indicated that student learning experience can be improved when it is supported with hands-on laboratory components, practical applications and theoretical concepts covered in classrooms.

A semester project in digital logic design (DLD) course is designed in this way that will improve the effectiveness of education quality. The key aim of this project to design and develop an effective solution of a targeted daily life problem. This project covers following complexity levels.

WP1	Depth of knowledge Required
WP2	Range of conflicting Requirements
WP3	Depth of Analysis Required

CEP Statement:

Consider a daily life problem, design and implement its proposed solution by using digital logic design techniques.

Semester project has three phases:

I. **Problem identification and Project selection:**

In this phase, students can choose any one daily life problem and propose its multiple solution. Once student listed their projects, instructor discuss with students about the requirements, issues and technical strength of each idea. After discussion, students are allowed to work on one idea recommended by the instructor.

Following is this list of projects in the course of digital logic design, covering CEP:

Group Member	Project Title
20-CP-05 20-CP-31 20-CP-37 20-CP-53	Door Lock

20-CP-69	
20-CP-85	Air Flow Detector
20-CP-94	Password Security System
20-CP-35 20-CP-45	3 to 8 Decoder Circuit
20-CP-74, 20-CP-66	Battery Charger
20-CP-33 20-CP-77 20-CP-52 20-CP-47	Calculator
20-CP-01 20-CP-26 20-CP-16 20-CP-57	Car Parking Counter
20-CP-07 20-CP-09 20-CP-53 20-CP-24	Digital Clock
20-CP-34 20-CP-54 20-CP-23 20-CP-80	battery level indicator
20-CP-60 20-CP-82 20-CP-32	Digital Counter Using IC's
20-CP-20 20-CP-8	Power supply
20-CP-39 20-CP-49 20-CP-79 20-CP-42	Mosquito Repellent System
20-CP-86 20-CP-25 20-CP-71	Electronic Eye controlled LED Security system

20-CP-29	
20-CP-84 20-CP-38 20-CP-30	Line Follower Robot
20-CP-27 20-CP-21 20-CP-81 20-CP-13	Major voting using 7-segment common cathode
20-CP-22 20-CP-61 20-CP-17 20-CP-76	Stop watch
20-CP-70 20-CP-48 20-CP-58 20-CP-14	Car Parking System
20-CP-11 20-CP-83	Thermometer
20-CP-40 20-CP-93 20-CP-78 20-CP-10	People counter
20-CP-28 20-CP-90	Clap Switch
20-CP-87 20-CP-63 20-CP-73 20-CP-15	Smart Room
20-CP-95 20-CP-43	TIC TOC TOE 4 x 4
20-CP-89 20-CP-65 20-CP-75	Touch on-off circuit
20-CP-91	Traffic light control system

20-CP-92 20-CP-12 20-CP-56 20-CP-44 20-CP-50	
20-CP-04 20-CP-02 20-CP-18 20-CP-19 20-CP-57	Water Level Controller

II. Initial study of the project:

In this phase, students have to explore existing solution for the selected project. They have to come up with single solution. Then, they have to write a report detailing all the circuits with connections with every module/IC. No control or input/output should be left open without stating the reason. Make reasonable assumptions.

Each project is unique, may have many possible solutions.

III. Project Presentation:

In this phase project is evaluated based on following assessment criteria:

Idea / initial study (WP2)	20%
Implementation/ Demo (WP1, WP3)	40%
Presentation	10%
Report	10%

Following are the outcomes of CEP:

Brainstorming**,** a group creativity by which efforts are made to find a conclusion for a specific problem by gathering a list of ideas spontaneously contributed by its members. This activity encourages the students to explore the problems and to solve them by using Digital logic techniques. After the completion of second phase, they improve their ability to formulate the problem. After Implementation, they realize an application, or execution of a plan, idea, design, specification, or policy.

COMPUTER PROGRAMMING

INSTRUCTOR: **Dr. Afshan Jamil**

COURSE CODE: **CP-107**

SEMESTER: **2nd (Spring-2021)**

ENTRY: **20-CP**

Credit Hours: **2 (Theory)+1 (Lab)**

Following characteristics of complex engineering problem are targeted in this programming assignment of computer programming course.

WP 1	Depth of Knowledge Required
WP 2	Range of Conflicting Requirements
WP 3	Depth of Analysis Required

I. CEP statement:

As children, we loved word games. So, let's do those interesting things again. In this assignment, you'll **implement** a word game. While doing this implementation you will **use** all programming constructs learned in the class till now.

II. Problem definition:

This game is just like a scrabble game.

- First, user is asked to enter number of letters allowed to make word e.g., ***n***
- Then user will be prompted to enter ***n*** different letters along with score (1-9) assigned to each letter.
- User will construct one word out of these letters. Each valid word receives a score.
- Score for a word is the sum of the points for letters in the word, plus 50 points if all ***n*** letters are used on the first go.

Program must have following checks:

- Number of allowed letters should not exceed 15 and should not be less than 3.
- Score assigned to each letter should not be negative or zero and should be less than 10.
- Program should display zero score if word constructed by user has any letter other than allowed list.
- User should be asked if he/she wants to play game again.

- If user enters a number in place of allowed letter loop should immediately terminate with the message "invalid letter".

III. Analysis of the problem:

This whole task can be divided into many small sub tasks:

- ***Setting letter tiles and scores:***

  In this task user will not only define range of allowed letters to make word but he/she will also enter random letters and their scores. After this task initial grid of letters is available to user and now, he/she can make words.

- ***Constructing word:***

  User will use allowed letter grid to make meaningful words. While constructing words user will have to keep all game rules in mind.

- ***Checking validity of word:***

  In this phase program will check for validity of word by checking all set constraints. Program will display a message to user after check and will prompt user to play more.

IV. Evaluation:

Students will be evaluated on the following criteria:

- Implementation: 70%
- Output/result achieved: 30%

Summary:

Following are salient outcomes of this assignment in terms of complex engineering problem:

- Brainstorming exercise forced them to explore the surrounding environment to sort out the problems using programming constructs.
- Implementation gave them a chance to go through the in-depth engineering knowledge to solve the problem and analyze in an effective way.

COMPUTER PROGRAMMING (LAB)

INSTRUCTOR: **Dr. Afshan Jamil**

COURSE CODE: **CP-107**

SEMESTER: **2nd (Spring 2021)**

ENTRY: **20-CP**

Credit Hours: **3 (Theory)+1 (Lab)**

Semester project is designed in a way to able students to solve the complex engineering problem. Following characteristics of complex engineering problem are targeted in this semester project of Computer Programming:

WP 1	Depth of Knowledge Required
WP 2	Range of Conflicting Requirements
WP 3	Depth of Analysis Required

CEP statement:

Design and implement a complex problem using object-oriented programming constructs to solve a real-life issue.

Project is carried out in four phases:

1. **Problem Identification:**

In the first phase, students are asked to bring the problems they intend to work on. Counselling is given to students in lab and contact hours for finalizing their ideas and preparing a proposal. Students have to explore the problems/issues around us, which they can solve using programming constructs. If the problem brought by the students are irrelevant to the course or not feasible at this level, they are asked to bring some other problem. Once ideas are finalized, constant counselling is provided by the Lab Engr. and Course Instructor for requirements and coding issues. Following is the list of projects approved after discussion:

Sr. No	Project Name
1	Birthday game
2	Restaurant table reservation system
3	Petrol pump system
4	Student data storage system
6	Cricket matches management
7	Gym management system
8	Student record system

9	Pacman game
10	Parking management system
11	Vote management system
12	Prison management system
13	Player management system
14	Canteen management system
15	Quiz project
16	Car rental system
17	Math's game
18	Mobile game
19	Registration and login system
20	Patient management system
21	Car parking system
22	Coffee shop billing system
23	Hospital management system
24	Airline reservation system
25	Student report card system project in C++
26	School fee inquiry system
27	Console based game collection
28	Blood bank management system
29	Matrix calculator
30	Digital ballot program
31	Medical store management and employee's salary
32	Simple command line in c++
33	Employee management system
34	General knowledge quiz game
35	Doctor appointment
36	E-commerce
37	Telephone billing system
38	File tracking system
39	Book shop project
40	Phone book application
41	Online payment system
42	Snake game
43	Contact management system
44	Library management system

45	Movie theater
46	Shop billing system
47	Tourism management system
48	Restaurant menu system
49	School admin system
50	Almeida pizza hut management
51	University management system
52	Digital clock
53	Railway reservation system
54	Casino number guessing game
55	Calculator in C++
56	Semester GPA calculator
57	Complaint management system
58	Book shop management system
59	Hangman game
60	Betting game
61	Job advertisement
62	Ticket booking system
63	It club management system
64	Car workshop
65	Credit card validator
66	Football team record management in C++
67	Supermarket billing system
68	Sanitary and paint shop management system
69	Sudoku game
70	Chat box
71	Online shopping management system
72	Casino bet and win
73	Console base car game
74	Food ordering system
75	Bus reservation system
76	Android battery saver system
77	Pia flight tracking and reserving system
78	Supermarket
79	Police station management system
80	Salary slip

81	Tic-tac-toe game
82	Payroll management system
83	University admission on the basis of student marks
84	Atm code
85	Bank management system
86	Hotel management system

2. **Project Proposal:**

In initial study phase, students have to explore the literature or existing solutions for their selected project idea. In this phase, students are also encouraged to have a detailed analysis of the problem to solve it in a better way. Each student's project is unique, may have many possible solutions as well as may be explored and developed in a different way. After discussion, students are asked to submit a proposal on one idea approved by the Instructor/Lab Engr. A sample of Project Proposal is also attached in the course folder.

3. **Simulation of Project**

Every project is checked by running and observing the output. Students had option of using any programming tool of C++ to develop a project. Students have tried to apply the in-depth engineering knowledge (WP1) to complete each project. During the initial study and formulation of proposed solution, they focused on the detailed requirements (WP2), real-time constraints (WP2) and performed in-depth analysis (WP3). Projects were evaluated on the following criteria:

Idea/Initial Study (WP2)	20%
Project Proposal (WP1, WP3)	20%
Project Progress (WP3)	10%
Simulation	10%
Demo/Report	40%

Complete assessment of each student is presented in the result. Sample project reports are also attached in the course folder.

Summary:

Following are salient outcome of the semester project in terms of complex engineering problem:

- Brainstorming exercise forced them to explore the surrounding environment to sort out the problems to be solved using image processing.
- Problem formulation enhances their ability to gather real-time requirements and address conflicts/constraints.

Complex Engineering Problems

- Design/Implementation gave them a chance to go through the in-depth engineering knowledge to solve the problem and analyze in an effective way.

CONTROL ENGINEERING

Instructor: Dr Muhammad Asif Khan

Course Code: CP-405

Credit Hours: 3(Theory) + 1 (Lab)

CEP Statement:

Experiment 4.2

Objective To evaluate the effect of additional poles and zeros upon the time response of second-order systems.

Minimum Required Software Packages MATLAB, Simulink, and the Control System Toolbox

Prelab

1. **a.** Given the transfer function $G(s) = \dfrac{25}{s^2 + 4s + 25}$, evaluate the percent overshoot, settling time, peak time, and rise time. Also, plot the poles.
   b. Add a pole at -200 to the system of Prelab 1**a**. Estimate whether the transient response in Prelab 1**a** will be appreciably affected.
   c. Repeat Prelab 1**b** with the pole successively placed at -20, -10, and -2.
2. A zero is added to the system of Prelab 1**a** at -200 and then moved to -50, -20, -10, -5, and -2. List the values of zero location in the order of the greatest to the least effect upon the pure second-order transient response.
3. Given the transfer function $G(s) = \dfrac{(25b/a)(s + a)}{(s + b)(s^2 + 4s + 25)}$, let $a = 3$ and $b = 3.01$, 3.1, 3.3, 3.5, and 4.0. Which values of b will have minimal effect upon the pure second-order transient response?
4. Given the transfer function $G(s) = \dfrac{(2500b/a)(s + a)}{(s + b)(s^2 + 40s + 2500)}$, let $a = 30$ and $b = 30.01$, 30.1, 30.5, 31, 35, and 40. Which values of b will have minimal effect upon the pure second-order transient response?

Lab

1. Using Simulink, add a pole to the second-order system of Prelab 1**a** and plot the step responses of the system when the higher-order pole is nonexistent, at -200, -20, -10, and -2. Make your plots on a single graph, using the Simulink LTI Viewer. Normalize all plots to a steady-state value of unity. Record percent overshoot, settling time, peak time, and rise time for each response.
2. Using Simulink, add a zero to the second-order system of Prelab 1**a** and plot the step responses of the system when the zero is nonexistent, at -200, -50, -20, -10, -5, and -2. Make your plots on a single graph, using the Simulink LTI Viewer. Normalize all plots to a steady-state value of unity. Record percent overshoot, settling time, peak time, and rise time for each response.
3. Using Simulink and the transfer function of Prelab 3 with $a = 3$, plot the step responses of the system when the value of b is 3, 3.01, 3.1, 3.3, 3.5, and 4.0. Make your plots on a single graph using the Simulink LTI Viewer. Record percent overshoot, settling time, peak time, and rise time for each response.
4. Using Simulink and the transfer function of Prelab 4 with $a = 30$, plot the step responses of the system when the value of b is 30, 30.01, 30.1, 30.5, 31, 35, and 40. Make your plots on a single graph, using the Simulink LTI Viewer. Record percent overshoot, settling time, peak time, and rise time for each response.

Postlab

1. Discuss the effect upon the transient response of the proximity of a higher-order pole to the dominant second-order pole pair.
2. Discuss the effect upon the transient response of the proximity of a zero to the dominant second-order pole pair. Explore the relationship between the length of the vector from the zero to the dominant pole and the zero's effect upon the pure second-order step response.
3. Discuss the effect of pole-zero cancellation upon the transient response of a dominant second-order pole pair. Allude to how close the canceling pole and zero should be and the relationships of (1) the distance between them and (2) the distance between the zero and the dominant second-order poles.

Course	WK	PLO (WA)	WP	Bloom's Learning Level
Control Engineering	WK3, WK4	5 (modern tools)	WP1, WP2, WP3, WP4	4

MOBILE APPLICATION DEVELOPMENT

Subject: Mobile Applications Development

Total Marks: 20

Subject Code: CP-309

Semester: BS-CP (Semester 6th)

Important Instructions:

- Every student will submit his/her projects individually and within due date.
- All the projects submitted after the due date will be marked as zero.
- Copied projects will be marked as zero.

Project Deployment Platform Languages:

- Java, HTML 5 and CSS-3

Q1. Design and develop a mobile app that can take pictures from a mobile camera and set it as wallpaper of the mobile screen. This app should be capable to take/select wallpaper stored on mobile storage (e.g., gallery, etc.) and set it as wallpaper of mobile screen. (CLO-2)

Software Tools

- Android studio and Kotlin
- WAMP Server
- XAMPP Server

Project Evaluation

- Project report
- Viva of the project.

WIRELESS AND MOBILE NETWORKS

INSTRUCTOR: Dr. Farhan Qamar

SEMESTER: 6th

ENTRY: 18-CP

Credit Hours: 3 (Theory) + 1 (Lab)

Wireless and mobile networks (6th Semester)

Free space optical transmission systems reduce the cost, save the optical fiber resources, and offer efficient utilization of transmission bandwidth. These systems can provide extremely large bandwidths in unidirectional as well as in bi-directional transmission systems. The performance of these system depends upon several factors such as,

- Modulation schemes
- Transmission Power
- Channel selection
- Amplifiers
- Environmental attenuation etc.

CEP Statement

Design and optimize free space wireless communication system to increase the overall data rates while maintaining long distance to meet the key objectives of next generation wireless networks. Greater the data rates achieved better will be the system to satisfy on-growing demand of data rates.

In the design stage, integrate different components of communication system to achieve the goal. Set parameters values of communication components for optimized results. Use multiple available analyzers at different points to study wireless signal both in time domain and frequency domain. Analyze the Q-factors of received signals to prove the effectiveness of your system design.

Course	**WK**	**PLO (WA)**	**WP**	**Bloom's Learning Level**
Wireless & mobile networks	WK5, WK6	3 (Design) 5 (Modern Tool usage)	WP1, WP3, WP4, EP2	C6

Complex Engineering Problems

Deliverables:

An optimized free space wireless optical communication system for next generation wireless networks.

Pre-Requisites:

To solve the complex engineering problem, students should have the knowledge and understanding of

- Wireless propagation models
- Free space optical communication system
- Requirements of NGNs
- Optisystem (Tool)
- MATLAB (Tool)

Data Given:

Pseudorandom data for wireless propagation.

ARTIFICIAL INTELLEGENCE

INSTRUCTOR: **Dr. Afshan Jamil**

COURSE CODE: **CP-310**

SEMESTER: **6th (Spring 2021)**

ENTRY: **16-CP**

Credit Hours: **03 (Theory)+ 0 (Lab)**

Semester project is designed in a way to able students to solve the complex engineering problem. Following characteristics of complex engineering problem are targeted in this semester project of Artificial Intelligence:

WP 1	Depth of Knowledge Required
WP 2	Range of Conflicting Requirements
WP 3	Depth of Analysis Required

CEP statement:

Game playing is a popular application area for artificial intelligence. There are several reasons for this popularity, but probably the most import reason is that games are suitable for evaluating some of the central techniques of artificial intelligence, such as search and use of heuristic knowledge. Normally, a game is based on a few, simple rules, and it is easy to measure success and failure. The purpose of this assignment is to submit a detailed proposal of artificially intelligent system which can play a given game. While selecting game consider the following two properties.

- It must be a single person or a two-person game
- Environment of the game should be fully observable, i.e., a game where both players know the current state of the game (nothing is hidden to the players).

Students can also bring project idea other than game.

Project is carried out in four phases:

4. **Problem Identification:**

In the first phase, students are asked to bring the problems they intend to work on. Counselling is given to students for finalizing their ideas and preparing a proposal. Students must explore the problems/issues around us, which they can solve using artificial intelligence models. If the problem brought by the students are irrelevant to the course or not feasible at this level, they are asked to bring some other problem.

5. **Project Proposal:**

In initial study phase, students must explore the literature or existing solutions for their selected project idea. In this phase, students are also encouraged to have a detailed analysis of the problem to solve it in a better way. Each

student's project is unique, may have many possible solutions as well as may be explored and developed in a different way. After discussion, students are asked to submit a proposal on one idea approved by the Instructor. A sample of Project Proposal is also attached in the course folder.

6. Simulation of Project

Every project is checked by running and observing the output. Students had option of using any software development tool for the project . Students have tried to apply the in-depth engineering knowledge (WP1) to complete each project. During the initial study and formulation of proposed solution, they focused on the detailed requirements (WP2), real-time constraints (WP2) and performed in-depth analysis (WP3). Projects were evaluated on the following criteria:

Idea/Initial Study (WP2)	20%
Project Proposal (WP1, WP3)	20%
Project Progress (WP3)	10%
Simulation	10%
Demo/Report	40%

Complete assessment of each student is presented in the result. Sample project reports are also attached in the course folder.

Summary:

Following is salient outcome of the semester project in terms of complex engineering problem:

- Brainstorming exercise forced them to explore the surrounding environment to sort out the problems to be solved using image processing.
- Problem formulation enhances their ability to gather real-time requirements and address conflicts/constraints.
- Design/Implementation gave them a chance to go through the in-depth engineering knowledge to solve the problem and analyze in an effective way.

DIGITAL SIGNAL PROCESSING

INSTRUCTOR: **Dr. Muhammad Majid**

COURSE CODE: **CP-309**

SEMESTER: **5th (Fall-2019)**

ENTRY: **17-CP**

Credit Hours: **3 (Theory)+1(Lab)**

Filtering is one of the most common applications in digital signal processing. Filters attenuate some of the undesired aspects of the signal partially or completely or enhance some of the desired aspect of the signal. In context of speech and audio signal processing, the undesired aspect is generally the noise coupled with the signal due to external and internal noise inducing factors and corrupts the useful information. Therefore, the goal of the filter in this scenario is to remove the frequencies related to noise from audio signal.

CEP Statement:

Design a digital signal processing-based system, which is capable to enhance the speech signal quality by modifying its spectrum.

In the planning stage, select the signal processing blocks to enhance the speech signal quality and justify your selection. In the implementation stage specify the parameters of each block and justify why these parameters are chosen. Also analyze the noisy speech signal and enhanced speech signal after noise removal.

Course	WK	PLO (WA)	WP	Bloom's Learning Level
Digital Signal Processing	WK3, WK4	3 (Design)	WP1, WP2, WP3, WP4, EP2	C6

Deliverables:

- Enhanced speech signal without noise in .wav format
- Complete working MATLAB code
- Project report addressing all requirements **Pre-Requisite:**

To carry out the complex engineering problem you should have the knowledge and understanding of

- Sampling
- Frequency domain analysis (DFT and FFT)
- Digital filter design (FIR and IIR)
- MATLAB digital signal processing toolbox
- **Data Given:** Noisy speech signal in .wav format.

SYSTEM PROGRAMMING

Subject: System Programming

Total Marks: 20

Subject Code: CP-403

Semester: BS-CP (Semester 7th)

Important Instructions:

- Every student will submit his/her projects individually and within due date.
- All the projects submitted after due date will be marked as zero.
- Copied projects will be marked as zero.

Projects Deployment Platforms:

- RedHat Enterprise LINUX/CENTOS LINUX 6.4 or 5.4 Platforms

Q1. You need to deploy the Open LDAP Server on Redhat Enterprise LINUX platform. (10) (CLO-5)

Q2. You need to deploy different backup tools available for Microsoft Windows 7/XP and Centos LINUX, also deploy VPN (Virtual Private Network) between Windows 7/XP and Centos LINUX platforms and vice versa. (10) (CLO-5)

Software Tools

- Centos Linux 7.0/6.4/5.4
- Fedora Linux 20
- Microsoft Windows Server 2008 R2/Microsoft Windows Server 2012

Project Evaluation

- Project report
- Viva of the project.

BLOCKCHAIN AND APPLICATIONS

Credit Hours: 3 (Theory)

Instructor: Muhammad Asif Khan

Motivation:

Although smart contract programming in many ways resembles traditional programming, it raises important new security challenges. Contracts are “play-for-keeps”, since virtual currencies have real value. If you load money into a buggy smart contract, you will likely lose it. Further, smart contract programming requires an “economic thinking” perspective that traditional programmers may not have acquired. Contracts must be written to ensure fairness even when counterparties may attempt to cheat in arbitrary ways that maximize their economic gains.

CEP Statement:

In contrast to traditional software development where bugs such as buffer overflows are typical, we observed bugs and pitfalls that arise due to the unique nature of smart contract programs.

Most often very simple smart contracts (e.g., a “Rock, Paper, Scissors” game), designing and implementing them correctly was highly non-trivial. This suggests that extra precautions and scrutiny are necessary when programming smart contracts.

Course	WK	PLO (WA)	WP	Bloom’s Learning Level
Complex Engineering Problem	WK3, WK4	3 (Design), 4 (Investigate)	WP1, WP2, WP3 ,WP4, EP2	4

Deliverables:

This design problem is proceeded in two phases.

Creation phase. The first phase is a creation phase where each group will create a smart contract application of their own choice. The students created a variety of applications, including games (e.g., Rock-Paper-Scissors, Russian Roulette, custom-designed games), escrow services, auctions (e.g., sealed auctions, silent auctions), a parking meter service, and stock market applications. At the end of the first phase, each group will make a short presentation of their contract application in class. I myself, TAs, and students jointly observe numerous issues with the programs that students will create.

Amendment phase. The goal of this phase is students related to critique their programs, find bugs, and amend their designs. The instructor and TAs had in-person meetings with each project group to help them amend their smart contract programs. Students also formed pair groups to critique and help the other group. At the end of the first phase, each group will make a short presentation of their design issues and suggested amendments.

CRYPTOGRAPHY AND NETWORK SECURITY

COURSE CODE: CP-310

SEMESTER: 8th

ENTRY: 17-CP

CREDIT HOUR: 3 (Theory)

Cryptography and Network Security (8th semester)

IPsec (Internet Protocol Security) is a suite of protocols and algorithms for securing data transmitted over the internet or any public network. IPsec originally defined two protocols for securing IP packets: Authentication Header (AH) and Encapsulating Security Payload (ESP). The former provides data integrity and anti-replay services, and the latter encrypts and authenticates data. IPsec is used for protecting sensitive data, such as financial transactions, medical records and corporate communications, as it's transmitted across the network. It's also used to secure virtual private networks (VPNs), where IPsec tunneling encrypts all data sent between two endpoints.

CEP Statement:

Configure IPSEC in windows Operating System for implementing a secure tunnel between two systems that can be operating on Ethernet LAN or WLAN. Transfer a 100KB file between the systems using SMTP and FTP protocols both with IPsec on and off. Capture the packets through any packet analyzer tool, such as Ethereal or packet tracer and evaluate the overheads that act as cost for implementing security through IPsec.

Course	**WK**	**PLO(WA)**	**WP**	**Blooms learning Level**
Cryptography and Network Security	Wk5, WK6	3 (Design) 5 (Modern Tool Usage)	WP1, WP3	C6

Tools:

a. MMC (Microsoft Management Console)

b. Wireshark (Packet Capture)

c. Command Prompt

Complex Engineering Problems

Deliverables: Configuration of IPSEC in windows operating System and evaluation of the overheads that act as cost for implementing security through IPsec.

Pre-Requisite: To solve the complex engineering problems, student should have knowledge and understanding of

- IPSEC protocol
- Modes of IPSEC protocol
- Packet Analyzer Tools (i.e MMC, Wireshark, cmd)

Data given: 100KB text file for transmission between systems.