Islamic University of Technology (IUT)

Electrical and Electronic Engineering Department

COMPLEX ENGINEERING PROBLEM

Course No.: EEE 4705 **Course Title:** Microcontroller Based System Design

Academic Year: 2023- 2024 **Semester:** Summer **Marks:** 30

Names of the Course Instructors:

i. Md. Arif Hossain

1. Statement of Complex Engineering Problem.[**COs:**CO4, **Inclusion:** Assignment]

A newly launched oven company called Jurgen Oven Corporation hires you to build a prototype of an oven using AT89S52/AT89C51. The concept of the oven is a new one where you can spend some time with the oven while the oven is working. You need to connect three 7SDs, 1 LCD, 1 buzzer, some LEDs and 1 keypad. The user will be allowed to give the amount of time (5 sec up to 300 sec) as input using the keypad. After giving the required number of seconds, the user will press the start button and the countdown should be displayed on the 7SDs. After the countdown stops, the buzzer should notify the user. Configure your LEDs in a way such that by looking at the LEDs one can understand if the oven is working or not. However, if the user gives more than 60 seconds, then display some facts on the LCD. The messages may be changed every 20 seconds. On the other hand, if the input is less than 60 seconds, display some messages of your own. The oven should also have an emergency stop button. Upon pressing this button the oven should be stopped irrespective of its present scenario.

[Note: 15 marks for proper configuration and connections, rest 15 for proper coding].

i. Configure the buttons on your keypad as start/stop, etc. as per your requirement.
ii. The frequency of your microcontroller should follow this formula: $11+(22-12)*(StudentId/10^9)$ Mhz
iii. Upload a small video on Google classroom containing the prototype that you built. The video should show the frequency of the microcontroller and code uploading procedure.

List Program Outcomes (POs) as well as their attributes that have been addressed in the Complex Engineering Problem.

	Statement	**Put Tick (√)**	**Different Aspects**	**Put Tick (√)**

PO1	**Engineering knowledge:** Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization to the solution of complex electrical and electronic engineering problems.			√
PO2	**Problem analysis:** Identify, formulate, research literature and analyse complex electrical and electronic engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.			√
PO3	**Design/development of solutions**: Design solutions for complex electrical and electronic engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.		Public health	√
			Safety	√
			Cultural	√
			Societal	
			Environmental	
PO4	**Investigation:** Conduct investigations of complex electrical and electronic engineering problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.		Design of experiments	
			Analysis and interpretation of data	
			Synthesis of information	
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex electrical and electronic engineering problems, with an understanding of the limitations.			√
PO6	**The engineer and society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex electrical and electronic engineering problems.		Societal	√
			Health	√
			Safety	√
			Legal	
			Cultural	
PO7	**Environment and sustainability:** Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex electrical and electronic engineering problems in societal and environmental contexts.		Societal	
			Environmental	
PO8	**Ethics:** Apply ethical principles embedded with religious values, professional ethics and responsibilities, and norms of electrical and electronic engineering practice.		Religious values	
			Professional ethics and responsibilities	
			Norms	

PO9	**Individual work and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.		Diverse teams	
			Multi-disciplinary settings	
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.		Comprehend and write effective reports	√
			Design documentation	
			Make effective presentations	
			Give and receive clear instructions	
PO11	**Project management and finance:** Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.		Engineering management principles	
			Economic decision-making	
			Manage projects	
			Multidisciplinary environments	
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the context of electrical and electronic engineering related technological change.			

Attributes of Knowledge Profile (K1 – K8) that have been addressed in the Complex Engineering Problem.

K	Knowledge Profile (Attribute)	Put Tick (√)
K1	A systematic, theory-based understanding of the natural sciences applicable to the discipline	
K2	Conceptually based mathematics, numerical analysis, statistics and the formal aspects of computer and information science to support analysis and modeling applicable to the discipline	√
K3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline	√
K4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline	√
K5	Knowledge that supports engineering design in a practice area	√
K6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline	
K7	Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the engineer's professional responsibility to public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability	
K8	Engagement with selected knowledge in the research literature of the discipline	

Attributes of ranges (P1 – P7) that have been addressed in the Complex Engineering Problem.

P	Range of Complex Engineering Problem Solving	Put Tick (√)
Attribute	Complex Engineering Problems have characteristic P1 and some or all of P2 to P7:	
Depth of knowledge required	**P1:** Cannot be resolved without in-depth engineering knowledge at the level of one or more of K3, K4, K5, K6 or K8 which allows a fundamentals-based, first principles analytical approach	√
Range of conflicting requirements	**P2:** Involve wide-ranging or conflicting technical, engineering and other issues	
Depth of analysis required	**P3:** Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models	√
Familiarity of issues	**P4:** Involve infrequently encountered issues	√
Extent of applicable codes	**P5:** Are outside problems encompassed by standards and codes of practice for professional engineering	
Extent of stakeholder involvement and conflicting requirements	**P6:** Involve diverse groups of stakeholders with widely varying needs	
Interdependence	**P7:** Are high level problems including many component parts or sub-problems	√

Attributes of ranges of Complex Engineering Activities (A1 – A5) that have been addressed in the Complex Engineering Problem.

A	Range of Complex Engineering Activities	Put Tick (√)
Attribute	Complex activities means (engineering) activities or projects that have some or all of the following characteristics:	
Range of resources	**A1:** Involve the use of diverse resources (and for this purpose resources include people, money, equipment, materials, information and technologies)	
Level of interaction	**A2:** Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues	
Innovation	**A3:** Involve creative use of engineering principles and research-based knowledge in novel ways	
Consequences for society and the environment	**A4:** Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation	
Familiarity	**A5:** Can extend beyond previous experiences by applying principles-based approaches	
Complex Engineering Activities have not been addressed		√