University of Sana'a
Faculty of Engineering
Department: Biomedical Engineering
Title of the Program: Biomedical Engineering

Course Specification of Logic System Design

Course Code (BE121)

I. Course Identification and General Information:

1	**Course Title:**	Logic System Design				
2	**Course Code & Number:**	BE121				
3	**Credit hours:**	C.H				TOTAL
		Th.	Seminar	Pr	Tr.	
		2	--	2	2	4
4	**Study level/ semester at which this course is offered:**	2nd Level / 1st Semester				
5	**Pre –requisite (if any):**	UR003 (Computer Skills)				
6	**Co –requisite (if any):**	None				
7	**Program (s) in which the course is offered:**	Biomedical Engineering Program				
8	**Language of teaching the course:**	English				
9	**Location of Teaching the Course:**	Faculty of Engineering				
10	**Prepared by:**	Assoc. Prof. Dr. Farouk Al-Fahaidy				
11	**Reviewed by:**	Assoc. Prof. Dr. Radwan AL Bouthigy				
12	**Date of Approval:**					

I. Course Description:

This course aims to provide students with concepts, theories and digital system principles & design methodologies related to the digital ICs design. Digital ICs play as the main components of all todays digital devices starting from simple timers & calculators up to the smart devices & PCs. Course

topics cover, an introduction to digital systems & Boolean algebra, logic gates & their representation tools, and combinational & sequential logic circuits design. Throughout practical, computer-based simulation and term project works, students will verify theories & their learned skill related to digital logic systems design & implementation.

III. Course Intended learning outcomes (CILOs) of the course (maximum 8CILOs)		**Referenced PILOs** (Only write code number of referenced Program Intended learning outcomes)
Knowledge and Understanding: Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		
a1	Understand basic principles, concepts and theories of the logic circuits as well as, the application of logic circuits to the design of digital ICs for biomedical instruments.	A1 Describe and explain the underlying mathematical methods and theories; life scientific-principles; and engineering core concepts related to the Biomedical Engineering context.
a2	Explain the operation and characteristics of logic gates, basic memory elements and their functionalities to the design of combinational & sequential circuits.	A2 Clarify the design principles and techniques and the engineering materials characteristics and how these are relevant to the developments and technologies in a biomedical systems context.
B. Cognitive/ Intellectual Skills: Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		
b1	Apply logic concepts, optimization techniques, methodologies, appropriate logic elements and software package to the design, modelling and constructing of	B1 Apply engineering principles; basic of life-science; mathematical theories; and modern tools professionally in modelling, analyzing, designing, and constructing physical digital systems; devices and/or processes relevant to Biomedical Engineering fields.

	physical digital systems, and ICs in relevant to Biomedical Engineering fields.	
b2	Design an innovative digital system based on combinational & sequential logic circuits within realistic constraints such as economic, environmental, social, safety, manufacturability and sustainability.	B3 Design the biomedical systems or processes within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
C. Professional and Practical Skills: Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		
c1	Practice a wide range of logic analytical methods, modern engineering software packages & tools to develop a suitable digital system for solving, modeling and implementing of Biomedical Engineering problems	C2 Use a wide range of analytical tools, techniques, IT, modern engineering tools, software packages and develop required computer programs to solve, modeling and analyzing Biomedical Engineering problems.
c2	Conduct lab & practice experiments related to digital integrated board development and implementation.	C3 Use computational facilities and techniques, measuring instruments, workshops and laboratory equipment to design and conduct experiments, collect, analyse and interpret data and present results in the biomedical systems practice.
D. Transferable Skills: Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		

d1	Function effectively while carrying out lab experiments within teams and in individual asked tasks.	D1 Lead and motivate individuals, show capability to work in stressful environments and within constraints, collaborate effectively within multidisciplinary team.
d2	Prepare lab and course project reports in written form using standard technical writing, and present & defend on.	D5 Demonstrate efficient IT capabilities and communicate effectively both orally and in writing technical reports.

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1. Understand basic principles, concepts and theories of the logic circuits as well as, the application of logic circuits to the design of digital ICs for biomedical instruments.	• Interactive lectures & examples, • Tutorials, • Interactive class discussions, • Exercises and home works.	• Written tests (mid and final terms and quizzes), • Coursework activities assessment, • Home works and assignments,
a2. Explain the operation and characteristics of logic gates, basic memory elements and their functionalities to the design of combinational & sequential circuits.	• Interactive lectures & examples, • Tutorials, • Interactive class discussions, • Exercises and home works,	• Written tests (mid and final terms and quizzes), • Coursework activities assessment, • Home works and assignments,

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1. Apply logic concepts, optimization techniques, methodologies, appropriate logic elements and software package to the design, modelling and constructing of physical digital systems, and ICs in relevant to Biomedical Engineering fields.	• Interactive lectures & examples, • Tutorials, • Interactive class discussions, • Case studies, • Exercises and home works, • Laboratory/Practical experiments based session, • Computer laboratory-based sessions, • Directed self- study,	• Written tests (mid and final terms and quizzes), • Home works and assignments, • Coursework activities assessment, • Home works and assignments, • Presentations.
b2. Design an innovative digital system based on combinational & sequential logic circuits within realistic constraints such as economic, environmental, social, safety, manufacturability and sustainability.	• Interactive class discussions, • Tutorials, • Exercises and home works, • Laboratory/Practical experiments based session, • Computer laboratory-based sessions, • Directed self- study,	• Written tests (mid and final terms and quizzes), • Lab\Project report • Practical lab performance assessment, • Coursework activities assessment, • Home works and assignments, • Presentations.

(C) Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c1. Practice a wide range of logic analytical methods, modern engineering software packages & tools to develop a suitable digital system for solving, modeling and implementing of Biomedical Engineering problems	• Interactive class discussions, • Case studies, • Laboratory/Practical experiments based session, • Computer laboratory-based sessions, • Problem based learning, • Team work (cooperative learning), • Mini/major project.	• Lab\Project report • Practical lab performance assessment, • Home works and assignments, • Presentations.
c2. Conduct lab & practice experiments related to digital integrated board development and implementation.	• Laboratory/Practical experiments based session, • Computer laboratory-based sessions, • Problem based learning, • Team work (cooperative learning), • Mini/major project.	• Lab\Project report • Practical lab performance assessment, • Coursework activities assessment, • Presentations.

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1. Function effectively while	• Laboratory/Practical	• Lab\Project report

carrying out lab experiments within teams and in individual asked tasks.	experiments based session, • Computer laboratory-based sessions, • Directed self- study, • Problem based learning, • Team work (cooperative learning), • Mini/major project.	• Practical lab performance assessment, • Coursework activities assessment, • Presentations.
d2. Prepare lab and course project reports in written form using standard technical writing, and present & defend on.	• Laboratory/Practical experiments based session, • Computer laboratory-based sessions, • Team work (cooperative learning), • Mini/major project.	• Lab\Project report • Practical lab performance assessment, • Coursework activities assessment, • Presentations.

IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	contact hours
1	**Introduction & Course Orientations**	**a1, a2**	– Course Orientations: Topics, Aims & Objectives, – Analog and Digital Systems – Binary Digits and Logic	**1**	**2**

			Levels, Digital Waveforms, Timing Diagrams, Serial and Parallel Data – Logic CAD system (VHDL) and Logic Applications.		
2	**Number systems and Codes**	**a1**	– Binary, Octal and Hex Number Systems – Number Systems Conversions. – BCD, Gray and Alphanumeric Codes. – Error Detection.	**1**	**2**
3	**Digital Numbers Representation & Arithmetic**	**a1, a2**	– Un-Signed, Signed Numbers Representations, – 1's & 2's Complements Number Representations, and Scientific Representations, – Binary addition and Subtraction: effective of 2's Complements on subtraction operation, – Binary Multiplication and Division. – BCD Addition and Hex. Arithmetic	**2**	**4**
4	**Logic Gates and Boolean Algebra**	**a1, a2, b1**	– Boolean Constants and Variables. – Truth Tables. – OR, AND, and NOT	**1**	**2**

			Operations. – Logic Algebra and Logic Implementation. – Boolean and DeMorgan's Laws.		
5	**Logic Simplification**	**a1, a2, b1**	– Universality of NAND and NOR Gates, – Alternative Representations, – Labeling Logic Signals. – SOP and POS Forms. – Simplifying Logic Circuits using algebra and K-maps.	**2**	**4**
6	**Mid-Term Theoretical Exam**	**a1, a2, b1**	ALL Previous Topics	**1**	**2**
7	**Combinational Circuits Design**	**a1, b1, b2**	– Introduction to Combinational Logic Circuits, Basic Circuits and Design Procedure, – Design of Code Converter Circuits with Displaying Devices, – Arithmetic Circuits and Comparators, – Decoders, and Encoders, – Multiplexers and Demultiplexers.	**3**	**6**
8	**Introduction to Sequential Logic Circuits & Elements**	**a1, a2, b1**	– Combinational Vs. Sequential Circuits, – Synchronous and asynchronous Sequential Circuits,	**1**	**2**

			– Basic Latch Element, SR-Latch, The D-Latch & the Clocked SR-Latch.		
9	**Flip Flops & Sequential Circuits Design Principles**	**a1, a2, b1, b2**	– The SR Flip-Flop, The JK-FF & The T-FF and Flip-Flops Applications, – State Chart & Variables, Mealy & Moore Machines, – Sequential Circuits Design Procedure.	**1**	**2**
10	**Sequential Logic Circuits Design (Counters & Registers)**	**a1, b1, b2**	– Design of Synchronous Counters, Up/Down Synchronous Counters Design, – Shift Registers, Constructions & Types, Bidirectional Shift Registers.	**2**	**4**
11	**Final Theoretical Exam**	**a1, a2, b1, b2**	ALL Topics	**1**	**2**
Number of Weeks /and Units Per Semester				**16**	**32**

B - Practical Aspect: (if any)				
Order	**Tasks/ Experiments**	**Number of Weeks**	**contact hours**	**Learning Outcomes**

1	– **Logic & Computer based Labs Orientations:** – Lab Equipment, Computer Simulation Tools Preparation & Setup	1	2	b1, c2, d1
2	– Demonstration of NOT Gate, – Demonstration of AND with 2 Inputs and 3 Inputs – Demonstration of OR with 2 Inputs and 3 Inputs	2	4	b1, c1, c2, d1
3	– Demonstration of NAND with 2 Inputs and 3 Inputs – Demonstration of NOR with 2 Inputs and 3 Inputs	1	2	b1, c1, c2, d1
4	– Demonstration of XOR and XNOR – Implementation of XOR by using NAND & NOR Gates	1	2	b1, c1, c2, d1
5	– Demonstration of Half Adder, Full Adder & 4-bit Carry-Ripple Adder	2	4	b1, b2, c1, c2, d1
6	– Demonstration of Decoder & Encoder Circuits – Decoder with 7 segments	1	2	b1, b2, c1, c2, d1
7	– **Midterm Practical Exam**	1	2	c1, c2
8	– Demonstration of Multiplexer & Demultiplexer	1	2	b1, b2, c1, c2, d1
9	– Demonstration of Latches & Flip Flops	1	2	b1, c1, c2, d1

10	– Demonstration of Counters & Registers	2	4	b1, b2, c1, c2, d1
11	– **Final Submission of Projects Reports and Presentations: Students work in groups of 2 or 3 students to solve some practical problems**	1	2	a1, a2, b1, b2, c1, c2, d1, d2
12	– **Final Practical Exam**	1	2	c1, c2
Number of Weeks /and Units Per Semester			**15**	**30**

C. Tutorial Aspect:

No.	Tutorial	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1	System Numbers & Codes	1	2	a1,
2	Digital Numbers Representations & Arithmetic	2	4	a1
3	Logic Gates & Boolean Algebra	2	4	a1, a2, b1
4	Karnaugh Maps Simplifications	1	2	a1, a2, b1
5	Design of Combinational Logic Circuits, NAND & NOR Implementations, Code Converters, Using of Input/output Devices such as Switches, LEDs, and 7-Segments, Adders & Multipliers and Comparators, Multiplexers & Decoders.	4	8	a1, a2, b1, b2, c1
6	Latches & Flip-Flops, State Machines Explanation: Mealy & Moore	3	6	a1, a2, b1, b2

C. Tutorial Aspect:

No.	Tutorial	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
	Design of Sequential Logic Circuits for Sequences Detectors Circuits, Analysis of Sequential Logic Circuits			
7	Design of Asynchronous & Synchronous Counters, Shift Register: As registers, Johnson Register, Sequence Generators and The Ring Counter	2	4	a1, a2, b1, b2,
Number of Weeks /and Units Per Semester		**15**	**30**	

V. Teaching Strategies of the Course:

- Interactive lectures & examples,
- Interactive class discussions,
- Tutorials,
- Case studies,
- Exercises and home works,
- Laboratory/Practical experiments based session,
- Computer laboratory-based sessions,
- Directed self- study,
- Problem based learning,
- Team work (cooperative learning),
- Mini/major project.

VI. Assessment Methods of the Course:

- Written tests (mid and final terms and quizzes),

VI. Assessment Methods of the Course:

- Lab\Project report
- Practical lab performance assessment,
- Coursework activities assessment,
- Home works and assignments,
- Presentations.

VII. Assignments & Reports:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	System Numbers, Codes, and Arithmetic	a1, d1	3rd to 5th	2
2	Logic Gates, Boolean Algebra & Karnaugh Maps	a1, a2, b1, d1	6th & 7th	3
3	Design of Combinational Circuits	a1, a2, b1, b2, c1, d1	9th & 10th	5
4	Design of Sequential Logic Circuits	a1, a2, b1, b2, c1, d1	11th	3
5	Counters & Registers	a1, a2, b1, b2, c1, d1	12th & 13th	5
6	Lab Reports	b1, b2, c1, d1, d2	3rd to 13th	12
Total				30

VIII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes

1	**Assignments & Reports**	3rd to 13th	30	15%	a1, a2, b1, b2, c1, d1
2	**Quizzes**	6th & 12th	20	10%	a1, a2, b1, b2, d1
3	**Midterm Theoretical**	8th	30	15%	a1, a2, b1
4	**Midterm Practical Exam**	9th	20	10%	b1, b2, c1, c2, d1
5	**Final Practical Exam (including Course Project Evaluation)**	14th & 15th	30	15%	a1, a2, b1, b2, c1, c2, d1, d2
6	**Final Theoretical Exam**	16th	70	35%	a1, a2, b1, b2
Total			200	100	

IX. Learning Resources:

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

Example

1- Niku, Saeed B., 2011, **Introduction to Robotics: Analysis, Control, Applications**, 2nd Edition, USA, Wiley.

1- Required Textbook(s) (maximum two).

1- Thomas L. Floyd, 2009, **Digital Fundamentals**, 10th Edition, Pearson Education International

2- Ronald J. Tocci, Neal S.Widmer, Gregory L. Moss, 2007, **Digital Systems : Principles and Applications**, 10th Edition,. Pearson Prentice Hall

2- Essential References.

1-Douglas L. Perry, 2002, **VHDL Programming by Example**, 4th Edition, McGraw-Hill

2- M. M. Mano, M. D. Ciletti, 2007, **Digital Design**, 4th Edition, Prentice-Hall

3- Electronic Materials and Web Sites *etc*.

Websites:

	Courses: 1- http://nptel.iitm.ac.in 2- https://ocw.mit.edu/courses. 3- Lectures that may be prepared by the lecturer **Journals** 1- http://www.scopus.com/home.url 2- http://link.springer.com/ 3- http://www.sciencedirect.com/ 4- http://dl.acm.org/dl.cfm 5- http://ieeexplore.ieee.org/Xplore/guesthome.jsp

X. Course Policies:

1	**Class Attendance:** A student should attend not less than 75 % of total hours of the subject; otherwise he/she will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring a proof statement from university Clinic. If the absent is more than 25% of a course total contact hours, student will be required to retake the entire course again.
2	**Tardy:** For late in attending the class, the student will be initially notified. If he repeated lateness in attending class, he/she will be considered as absent.
3	**Exam Attendance/Punctuality:** A student should attend the exam on time. He/she is permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam
4	**Assignments & Projects:** In general one assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time, mostly one week after given the assignment.

5	**Cheating:** For cheating in exam, a student will be considered as fail. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty.
6	**Plagiarism:** Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proofed a plagiarism of a student, he/she will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university or according to the university roles.
7	**Other policies:** - Mobile phones are not allowed to use during a class lecture. It must be closed; **otherwise** the student will be asked to leave the lecture room. - Mobile phones are not allowed in class during the examination. - Lecture notes and assignments might be given directly to students using soft or hard copy.

University of Sana'a
Faculty of Engineering
Department: Biomedical Engineering
Title of the Program: Biomedical Engineering

Template for Course Plan (Syllabus)

Logic System Design BE121

I. Course Identification and General Information:					
1	**Course Title:**	Logic System Design			
2	**Course Code & Number:**	BE121			
3	**Credit Hours:**	**Credit Hours**	**Theory Hours**		**Lab. Hours**
			Lecture	**Exercise**	
		4	2	2	2
4	**Study Level/ Semester at which this Course is offered:**	2nd Level / 1st Semester			
5	**Pre –Requisite (if any):**	UR003 (Computer Skills)			
6	**Co –Requisite (if any):**	None			
7	**Program (s) in which the Course is Offered:**	Bachelor of Biomedical Engineering			
8	**Language of Teaching the Course:**	English			
9	**Location of Teaching the Course:**	Faculty of Engineering			
10	**Prepared by:**	Assoc. Prof. Dr. Farouk Al-Fahaidy			
11	**Reviewed by:**	Assoc. Prof. Dr. Radwan AL Bouthigy			
12	**Date of Approval:**				

II. Course Description:

This course aims to provide students with concepts, theories and digital system principles & design

methodologies related to the digital ICs design. Digital ICs play as the main components of all todays digital devices starting from simple timers & calculators up to the smart devices & PCs. Course topics cover, an introduction to digital systems & Boolean algebra, logic gates & their representation tools, and combinational & sequential logic circuits design. Throughout practical, computer-based simulation and term project works, students will verify theories & their learned skill related to digital logic systems design & implementation.

III. Course Intended Learning Outcomes (CILOs): (مخرجات تعلم المقرر)

A. Knowledge and Understanding: Upon successful completion of the course, students will be able to:	
a1	Understand basic principles, concepts and theories of the logic circuits as well as, the application of logic circuits to the design of digital ICs for biomedical instruments.
a2	Explain the operation and characteristics of logic gates, basic memory elements and their functionalities to the design of combinational & sequential circuits.
B. Intellectual Skills: Upon successful completion of the course, students will be able to:	
b1	Apply logic concepts, optimization techniques, methodologies, appropriate logic elements and software package to the design, modelling and constructing of physical digital systems, and ICs in relevant to Biomedical Engineering fields.
b2	Design an innovative digital system based on combinational & sequential logic circuits within realistic constraints such as economic, environmental, social, safety, manufacturability and sustainability.
C. Professional and Practical Skills: Upon successful completion of the course, students will be able to:	
c1	Practice a wide range of logic analytical methods, modern engineering software packages & tools to develop a suitable digital system for solving, modeling and implementing of Biomedical Engineering problems

III. Course Intended Learning Outcomes (CILOs): (مخرجات تعلم المقرر)	
c2	Conduct lab & practice experiments related to digital integrated board development and implementation.
D. Transferable Skills: Upon successful completion of the course, students will be able to:	
d1	Function effectively while carrying out lab experiments within teams and in individual asked tasks.
d2	Prepare lab and course project reports in written form using standard technical writing, and present & defend on.

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
1	**Introduction & Course Orientations**	– Course Orientations: Topics, Aims & Objectives, – Analog and Digital Systems – Binary Digits and Logic Levels, Digital Waveforms, Timing Diagrams, Serial and Parallel Data – Logic CAD system (VHDL) and Logic Applications.	**1**	**2**
2	**Number systems and Codes**	– Binary, Octal and Hex Number Systems – Number Systems Conversions. – BCD, Gray and Alphanumeric Codes. – Error Detection.	**1**	**2**
3	**Digital Numbers**	– Un-Signed, Signed Numbers	**2**	**4**

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
	Representation & Arithmetic	Representations, – 1's & 2's Complements Number Representations, and Scientific Representations, – Binary addition and Subtraction: effective of 2's Complements on subtraction operation, – Binary Multiplication and Division. – BCD Addition and Hex. Arithmetic		
4	**Logic Gates and Boolean Algebra**	– Boolean Constants and Variables. – Truth Tables. – OR, AND, and NOT Operations. – Logic Algebra and Logic Implementation. – Boolean and DeMorgan's Laws.	**1**	**2**
5	**Logic Simplification**	– Universality of NAND and NOR Gates, – Alternative Representations, – Labeling Logic Signals. – SOP and POS Forms. – Simplifying Logic Circuits using algebra and K-maps.	**2**	**4**
6	**Mid-Term Theoretical Exam**	ALL Previous Topics	**1**	**2**
7	**Combinational Circuits Design**	– Introduction to Combinational Logic Circuits, Basic Circuits and	**3**	**6**

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
		Design Procedure, – Design of Code Converter Circuits with Displaying Devices, – Arithmetic Circuits and Comparators, – Decoders, and Encoders, – Multiplexers and Demultiplexers.		
8	**Introduction to Sequential Logic Circuits & Elements**	– Combinational Vs. Sequential Circuits, – Synchronous and asynchronous Sequential Circuits, – Basic Latch Element, SR-Latch, The D-Latch & the Clocked SR-Latch.	**1**	**2**
9	**Flip Flops & Sequential Circuits Design Principles**	– The SR Flip-Flop, The JK-FF & The T-FF and Flip-Flops Applications, – State Chart & Variables, Mealy & Moore Machines, – Sequential Circuits Design Procedure.	**1**	**2**
10	**Sequential Logic Circuits Design (Counters & Registers)**	– Design of Synchronous Counters, Up/Down Synchronous Counters Design, – Shift Registers, Constructions & Types, Bidirectional Shift Registers.	**2**	**4**

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
11	**Final Theoretical Exam**	ALL Topics	**1**	**2**
Number of Weeks /and Units Per Semester			**16**	**32**

B. Case Studies and Practical Aspect:

No.	Tasks/ Experiments	Number of Weeks	Contact Hours
1	– **Logic & Computer based Labs Orientations:** – Lab Equipment, Computer Simulation Tools Preparation & Setup	1	2
2	– Demonstration of NOT Gate, – Demonstration of AND with 2 Inputs and 3 Inputs – Demonstration of OR with 2 Inputs and 3 Inputs	2	4
3	– Demonstration of NAND with 2 Inputs and 3 Inputs – Demonstration of NOR with 2 Inputs and 3 Inputs	1	2
4	– Demonstration of XOR and XNOR – Implementation of XOR by using NAND & NOR Gates	1	2
5	– Demonstration of Half Adder, Full Adder & 4-bit Carry-Ripple Adder	2	4
6	– Demonstration of Decoder & Encoder Circuits – Decoder with 7 segments	1	2
7	– **Midterm Practical Exam**	1	2
8	– Demonstration of Multiplexer & Demultiplexer	1	2

B. Case Studies and Practical Aspect:			
No.	**Tasks/ Experiments**	**Number of Weeks**	**Contact Hours**
9	– Demonstration of Latches & Flip Flops	1	2
10	– Demonstration of Counters & Registers	2	4
11	– **Final Submission of Projects Reports and Presentations: Students work in groups of 2 or 3 students to solve some practical problems**	1	2
12	– **Final Practical Exam**	1	2
Number of Weeks /and Units Per Semester		**15**	**30**

C. Tutorial Aspect:			
No.	**Tutorial**	**Number of Weeks**	**Contact Hours**
1	System Numbers & Codes	1	2
2	Digital Numbers Representations & Arithmetic	2	4
3	Logic Gates & Boolean Algebra	2	4
4	Karnaugh Maps Simplifications	1	2
5	Design of Combinational Logic Circuits, NAND & NOR Implementations, Code Converters, Using of Input/output Devices such as Switches, LEDs, and 7-Segments, Adders & Multipliers and Comparators, Multiplexers & Decoders.	4	8
6	Latches & Flip-Flops, State Machines Explanation: Mealy & Moore	3	6

C. Tutorial Aspect:			
No.	**Tutorial**	**Number of Weeks**	**Contact Hours**
	Design of Sequential Logic Circuits for Sequences Detectors Circuits, Analysis of Sequential Logic Circuits		
7	Design of Asynchronous & Synchronous Counters, Shift Register: As registers, Johnson Register, Sequence Generators and The Ring Counter	2	4
Number of Weeks /and Units Per Semester		**15**	**30**

V. Teaching Strategies of the Course:

- Interactive lectures & examples,
- Interactive class discussions,
- Tutorials,
- Case studies,
- Exercises and home works,
- Laboratory/Practical experiments based session,
- Computer laboratory-based sessions,
- Directed self- study,
- Problem based learning,
- Team work (cooperative learning),
- Mini/major project.

VI. Assessment Methods of the Course:

- Written tests (mid and final terms and quizzes),
- Lab\Project report

VI. Assessment Methods of the Course:

- Practical lab performance assessment,
- Coursework activities assessment,
- Home works and assignments,
- Presentations.

VII. Assignments:

No.	Assignments	Week Due	Mark
1	System Numbers, Codes, and Arithmetic	3rd to 5th	2
2	Logic Gates, Boolean Algebra & Karnaugh Maps	6th & 7th	3
3	Design of Combinational Circuits	9th & 10th	5
4	Design of Sequential Logic Circuits	11th	3
5	Counters & Registers	12th & 13th	5
6	Lab Reports	3rd to 13th	12
Total			**30**

VIII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment
1	**Assignments & Reports**	3rd to 13th	30	15%

VIII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment
2	**Quizzes**	6th & 12th	20	10%
3	**Midterm Theoretical**	8th	30	15%
4	**Midterm Practical Exam**	9th	20	10%
5	**Final Practical Exam (including Course Project Evaluation)**	14th & 15th	30	15%
6	**Final Theoretical Exam**	16th	70	35%
Total			**200**	**100%**

IX. Learning Resources:

- *Written in the following order:*

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

Example

1- Niku, Saeed B., 2011, **Introduction to Robotics: Analysis, Control, Applications**, 2nd Edition, USA, Wiley.

1- Required Textbook(s) (maximum two):

1- Thomas L. Floyd, 2009, **Digital Fundamentals**, 10th Edition, Pearson Education International

1- Ronald J. Tocci, Neal S.Widmer, Gregory L. Moss, 2007, **Digital Systems : Principles and Applications**, 10th Edition,. Pearson Prentice Hall

2- Essential References:

1- Douglas L. Perry, 2002, **VHDL Programming by Example**, 4th Edition, McGraw-Hill

IX. Learning Resources:

2- M. M. Mano, M. D. Ciletti, 2007, **Digital Design**, 4th Edition, Prentice-Hall

3- Electronic Materials and Web Sites etc.:

Websites:

Courses:

4- http://nptel.iitm.ac.in
5- https://ocw.mit.edu/courses.
6- Lectures that may be prepared by the lecturer

Journals

6- http://www.scopus.com/home.url
7- http://link.springer.com/
8- http://www.sciencedirect.com/
9- http://dl.acm.org/dl.cfm
10- http://ieeexplore.ieee.org/Xplore/guesthome.jsp

X. Course Policies:

1	**Class Attendance:** A student should attend not less than 75 % of total hours of the subject; otherwise he/she will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring a proof statement from university Clinic. If the absent is more than 25% of a course total contact hours, student will be required to retake the entire course again.
2	**Tardy:** For late in attending the class, the student will be initially notified. If he repeated lateness in attending class, he/she will be considered as absent.
3	**Exam Attendance/Punctuality:** A student should attend the exam on time. He/she is permitted to attend an exam half one hour

	from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam
4	**Assignments & Projects**: In general one assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time, mostly one week after given the assignment.
5	**Cheating**: For cheating in exam, a student will be considered as fail. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty.
6	**Plagiarism**: Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proofed a plagiarism of a student, he/she will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university or according to the university roles.
7	**Other policies**: - Mobile phones are not allowed to use during a class lecture. It must be closed; **otherwise** the student will be asked to leave the lecture room. - Mobile phones are not allowed in class during the examination. - Lecture notes and assignments might be given directly to students using soft or hard copy.