



Lesson Plan No. 01	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> a. To explain how binary sequences are used to represent digital data. b. To understand the different number systems and importance of all number system.
Teaching Aids (if any)	<ul style="list-style-type: none"> a. PPT presentation b. Chalk and Talk
Teaching Development	<p>1. Introduction (5 minutes)</p> <ul style="list-style-type: none"> - Ask questions How do we use electricity to make decisions? What is difference between Analog and Digital signals Do the students know of any other number systems? How does a computer use number systems to understand commands <p style="text-align: center;">Introduction to Digital systems(30 minutes)</p> <ul style="list-style-type: none"> a) Discussed the real examples where digital systems are applied(5 minutes) b) Introduction of binary numbers: What are binary numbers? Why do we use them? (Electric circuits) c) Remind students how to write decimal numbers in expanded form and discuss place value. Ask them if they know what base system we use? d) Binary numbers are base 2 systems: What would the place values be for a system that is base 2? e) How many different combinations are in 2 bits? 3 bits? 8 bits? Convert from Binary to Decimal using place values f) Convert from Decimal to Binary using place values g) Students will spend time practicing converting between binary and decimal and back again h) Discussion on Octal and Hexadecimal number systems. <p>Web Link: https://www.youtube.com/watch?v=2xXErGeeb_Q&pp=ygUkaW50cm9kdWN0aW9uIHRvIGRpdzZl0YWwgZWxlbGN0cm9uaWNz</p>
Activity (10 minutes)	<p>Students will spend time in groups developing an algorithm that can be used to convert between any base system and our decimal number system</p> <p>Quick Quiz: Binary/octal /Hexadecimal to Decimal conversions</p>
Closure	<p>5 minutes</p> <ul style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading : Modern Digital Electronics by R.P.Jain , McGraw-Hill 4th (2010), Pg. No 28-31



Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents
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Lesson Plan No. 02	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	<p>At the end of the lesson the student shall be able to:</p> <ol style="list-style-type: none"> a. To explain about binary numbers and other number systems that the computer may use, like Octal and Hexadecimal. b. To apply the principles of abstraction and develop an algorithm that can be used to convert any base number system to any other number system.
Teaching Aids (if any)	<ol style="list-style-type: none"> a. Chalk and Talk b. PPT presentation
Teaching Development	<ol style="list-style-type: none"> 1. Introduction (5 minutes) <ul style="list-style-type: none"> - Ask questions How do we use electricity to make decisions? What is the difference between Analog and Digital signals Do the students know of any other number systems? How does a computer use number systems to understand commands? <p style="text-align: center;">Introduction to Digital systems(30 minutes)</p> <ol style="list-style-type: none"> a) Introduce the students to the base 8 and 16 numbering system (octal/hexadecimal). b) Compare and contrast decimal and binary counting. c) Demonstrate decimal to Octal conversion d) Demonstrate decimal to Hexadecimal conversion e) Demonstrate binary to /octal and hexadecimal conversion [two methods]. f) Introduce hexadecimal/Octal to decimal conversion. g) Demonstrate hexadecimal to octal conversion. h) Demonstrate Octal to hexadecimal conversion. <p>Web Reference: https://www.youtube.com/watch?v=crSGS1uBSNQ&pp=ygUoaW50cm9kdWN0aW9uIHRvIG51bWJlciBzeXN0ZW0gaW4gZGlnaXRhbA%3D%3D </p>
Activity (10 minutes)	<p>Students will spend time in groups developing an algorithm that can be used to convert between any base system and our decimal number system</p> <p>Quick Quiz: Conversions among binary/octal /hexadecimal/decimal</p>
Closure	<p>5 minutes</p> <ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading : Modern Digital Electronics by R.P.Jain McGraw-Hill 4th (2010), Pg. No 31-37, 41-43, 48-50



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Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents
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Lesson Plan No. 03	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	<p>At the end of the lesson the student shall be able to:</p> <ol style="list-style-type: none"> a. To make the students know significance and types of binary codes, also to understand different Binary codes – weighted/Non weighted codes, alphanumeric code and the relation among them. b. Application of these codes.
Teaching Aids (if any)	<ol style="list-style-type: none"> a. PPT presentation
Teaching Development	<p>Introduction (5 minutes)</p> <ul style="list-style-type: none"> - Ask questions What is difference between LSB and MSB? What is meant by BCD code? What is the difference between binary code and BCD? <p>Introduction to Binary codes(30 minutes)</p> <ol style="list-style-type: none"> a) Define Binary Codes: Different codes are in use in digital systems for representing data such as alpha numerals and symbols. So demonstration of these codes and discuss their essentiality for the effective understanding of various digital systems including processors b) Give the types of binary codes c) Elaborate the use of binary codes d) Demonstrate Types of binary codes <ol style="list-style-type: none"> 1. Weighted codes <ul style="list-style-type: none"> Reflective Code Sequential Codes 1. Non Weighted Codes- Excess-3 code, gray code, Excess-3 codes, Gray codes 2. Explanation of Binary to gray and gray to binary conversion 3. Brief study of Error-Detecting Code
Activity (10 minutes)	<p>Open ended discussion on BCD codes and their application :</p> <ul style="list-style-type: none"> What are the advantages of gray code? <p>Practice questions :</p> <p>http://ggn.dronacharya.info/ITDept/Downloads/QuestionBank/Odd/III%20sem/Section-A/digital-electronics_5.pdf</p>
	<p>5 minutes</p> <ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Different codes are in use in digital systems for representing data such as alpha numerals and symbols. 3. So these codes are very essential for the effective understanding of various digital systems including processors. 4. Binary codes are used for unicode character encoding in MS word. It is



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	<p>also used to convert basic computer keys as binary values Suggested Reading : Modern Digital Electronics by R.P.Jain McGraw-Hill 4th (2010), Pg. No 51-53 For e-notes 5. https://faculty.atu.edu/mfinan/2033/section14.pdf</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.2. Link for the quiz using Google form3. Spend 5 minutes to evaluate student assimilation of the lesson contents



Lesson Plan No. 04	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: a. To understand the basic arithmetic operations of addition, subtraction, multiplication and division on different number systems b. To perform Basic arithmetic operations on number systems base other than 10.
Teaching Aids (if any)	a. PPT presentation b. Use of Google meet
Teaching Development	1. Introduction (5 minutes) - Ask questions Introduction to Digital systems(30 minutes) a) Introduce the students to the base 8 and 16 numbering system (octal/hexadecimal). b) Compare and contrast decimal and binary counting. c) Demonstrate decimal to Octal conversion d) Demonstrate decimal to Hexadecimal conversion e) Demonstrate binary to /octal and hexadecimal conversion [two methods]. f) Introduce hexadecimal/Octal to decimal conversion. g) Demonstrate hexadecimal to octal conversion. h) Demonstrate Octal to hexadecimal conversion. i) Practicing session
Activity (10 minutes)	Students will spend time in groups developing an algorithm that can be used to convert between any base system and our decimal number system Quick Quiz: Conversions among binary/octal /hexadecimal/decimal
Closure	5 minutes 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading : Modern Digital Electronic by R.P.Jain McGraw-Hill 4 th (2010)Pg. No 51-53 3. https://faculty.atu.edu/mfinan/2033/section14.pdf
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.



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	<p>1. Link for the quiz3 using Google form https://docs.google.com/forms/d/1duW4O-eFfdXVeHC8Q86WfMcfkoLv47AQZ59TmQAEFo/edit</p> <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>
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Lesson Plan No. 03	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> a. Understand different Binary codes – weighted/Non weighted codes, alphanumeric code b. Understand the relation among them. c. Application of these codes.
Teaching Aids (if any)	<ul style="list-style-type: none"> a. PPT presentation b. Use of Google meet
Teaching Development	<p>1. Introduction (5 minutes)</p> <ul style="list-style-type: none"> - Ask questions What are weighted and non- weighted code? What is difference between Analog and Digital signals Do the students know of any other number systems? How does a computer use number systems to understand commands <p>Introduction to BCD_ASCII_EBDIC_Gray codes_Excess-3_conversions (30 minutes)</p> <ul style="list-style-type: none"> a) Introduction: Binary Codes. b) Introduction Excess-3 code. c) Demonstrate ASCII Code and their use d) Demonstrate EBDIC Code and their use e)
Activity (10 minutes)	<p>Students will spend time in groups developing an algorithm that can be used to convert between any base system and our decimal number system</p> <p>Quick Quiz: Conversions among binary/octal /hexadecimal/decimal</p>
Closure	<p>5 minutes</p> <ul style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading : Modern Digital Electronics by R.P.Jain McGraw-Hill 4th (2010), Pg. No 31-37, 41-43, 48-50 3. NPTEL lecture https://nptel.ac.in/courses/108/105/108105132/ 4. Practice – it number conversions - http://practiceit.cs.washington.edu/ Levitin A and Levitin M. Algorithmic Puzzles, Oxford University Press, Inc, 2011
Evaluation	<ul style="list-style-type: none"> 1. Reflective Questions (What, Why, Who?). Allow students to

answer and discuss.

2. Link for the quiz using Google form

https://docs.google.com/forms/d/1OIq2xZm1-QK8Gj_E4gTdMA_cDHeULGtTQboLVs92vvU/edit

Spend 5 minutes to evaluate student assimilation of the lesson contents



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Lesson Plan No. 03	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: a. Understand different Binary codes – weighted/Non weighted codes, alphanumeric code b. Understand the relation among them. c. Application of these codes.
Teaching Aids (if any)	a. PPT presentation b. Use of Google meet
Teaching Development	1. Introduction (5 minutes) - Ask questions What are weighted and non- weighted code? What is difference between Analog and Digital signals Do the students know of any other number systems? How does a computer use number systems to understand commands Introduction to BCD_ASCII_EBDIC_Gray codes_Excess-3_conversions (30 minutes) Introduction: Binary Codes. Introduction Excess-3 code. Demonstrate ASCII Code and their use Demonstrate EBDIC Code and their use
Activity (10 minutes)	Students will spend time in groups developing an algorithm that can be used to convert between any base system and our decimal number system Quick Quiz: Conversions among binary/octal /hexadecimal/decimal
Closure	5 minutes 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading : Modern Digital Electronics by R.P.Jain McGraw-Hill 4 th (2010), Pg. No 31-37, 41-43, 48-50 3. NPTEL lecture https://nptel.ac.in/courses/108/105/108105132/ 4. Practice – it number conversions - http://practiceit.cs.washington.edu/ Levitin A and Levitin M. Algorithmic Puzzles, Oxford University Press, Inc, 2011
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Link for the quiz using Google form https://docs.google.com/forms/d/1Olq2xZm1-



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Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 03	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> a. Understand different Binary codes – weighted/Non weighted codes, alphanumeric code b. Understand the relation among them. c. Application of these codes.
Teaching Aids (if any)	<ul style="list-style-type: none"> a. PPT presentation b. Use of Google meet
Teaching Development	<p>1. Introduction (5 minutes)</p> <ul style="list-style-type: none"> - Ask questions What are weighted and non- weighted code? What is difference between Analog and Digital signals Do the students know of any other number systems? How does a computer use number systems to understand commands <p>Introduction to BCD_ASCII_EBDIC_Gray codes_Excess-3_conversions (30 minutes)</p> <ul style="list-style-type: none"> a) Introduction: Binary Codes. b) Introduction Excess-3 code. c) Demonstrate ASCII Code and their use d) Demonstrate EBDIC Code and their use e)
Activity (10 minutes)	<p>Students will spend time in groups developing an algorithm that can be used to convert between any base system and our decimal number system</p> <p>Quick Quiz: Conversions among binary/octal /hexadecimal/decimal</p>
Closure	<p>5 minutes</p> <ul style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. <u>Digital Design, by M. Morris Mano, and Michael D Ciletti Pearson, Pearson, 3rd (2012) Pg. No 73 to 91</u> <p>Nptel videos:</p> <ul style="list-style-type: none"> 3. Refer lecture 7 & 8 https://nptel.ac.in/courses/108/105/108105132/ 4. For POS and SOP https://nptel.ac.in/courses/106/105/106105185/
Evaluation	<ul style="list-style-type: none"> 1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Link for the quiz using Google form

https://docs.google.com/forms/d/1OIq2xZm1-QK8Gj_E4gTdMA_cDHeULGtTQboLVs92vvU/edit

Spend 5 minutes to evaluate student assimilation of the lesson contents



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Lesson Plan No. 03	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: a. Understand different Binary codes – weighted/Non weighted codes, alphanumeric code b. Understand the relation among them. c. Application of these codes.
Teaching Aids (if any)	a. PPT presentation b. Use of Google meet
Teaching Development	1. Introduction (5 minutes) - Ask questions What are weighted and non- weighted code? What is difference between Analog and Digital signals Do the students know of any other number systems? How does a computer use number systems to understand commands Introduction to BCD_ASCII_EBDIC_Gray codes_Excess-3_conversions (30 minutes) Introduction: Binary Codes. Introduction Excess-3 code. Demonstrate ASCII Code and their use Demonstrate EBDIC Code and their use
Activity (10 minutes)	Students will spend time in groups developing an algorithm that can be used to convert between any base system and our decimal number system Quick Quiz: Conversions among binary/octal /hexadecimal/decimal
Closure	5 minutes 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. <u>Digital Design, by M. Morris Mano, and Michael D Ciletti Pearson, Pearson, 3rd (2012) Pg. No 73 to 91</u> Nptel videos: 3. Refer lecture 7 & 8 https://nptel.ac.in/courses/108/105/108105132/ 4. For POS and SOP https://nptel.ac.in/courses/106/105/106105185/
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Link for the quiz using Google form https://docs.google.com/forms/d/1Olq2xZm1-



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Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 07	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: a. Able to derive Karnaugh maps from a given truth table - Know how to simplify Karnaugh maps
Teaching Aids (if any)	a. PPT presentation b. Use of Google meet
Teaching Development	<p>1. Introduction (5 minutes) - Ask questions What are literals and variables What are the draw backs of simplification of Boolean functions using Boolean algebra</p> <p>Introduction to K- map (30 minutes) a) Introduction Karnaugh mapping. b) Discuss Process:</p> <ul style="list-style-type: none"> • Draw the Karnaugh map • Look for octets and encircle them. • Look for quads and encircle them. Look for pairs and encircle them. • Simplify and write down the equation. <p>c) Demonstrate and practice Karnaugh maps for different Boolean functions</p>
Activity (10 minutes)	HO: Hands-On WS: Worksheet
Closure	<p>5 minutes</p> <ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. <u>Digital Design, by M. Morris Mano, and Michhael D Ciletti Pearson, Pearson, 3rd (2012)Pg. No 73 to 91</u> <p>Nptel videos:</p> <ol style="list-style-type: none"> 3. Refer lecture 7 & 8 https://nptel.ac.in/courses/108/105/108105132/ 4. For POS and SOP https://nptel.ac.in/courses/106/105/106105185/
Evaluation	<ol style="list-style-type: none"> 1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Link for the worksheet is <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



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Lesson Plan No. 07	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: a. Able to derive Karnaugh maps from a given truth table - Know how to simplify Karnaugh maps
Teaching Aids (if any)	a. PPT presentation b. Use of Google meet
Teaching Development	1. Introduction (5 minutes) - Ask questions What are literals and variables What are the draw backs of simplification of Boolean functions using Boolean algebra Introduction to K- map (30 minutes) Introduction Karnaugh mapping. Discuss Process: <ul style="list-style-type: none">• Draw the Karnaugh map• Look for octets and encircle them.• Look for quads and encircle them. Look for pairs and encircle them.• Simplify and write down the equation. Demonstrate and practice Karnaugh maps for different Boolean functions
Activity (10 minutes)	HO: Hands-On WS: Worksheet
Closure	5 minutes 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. <u>Digital Design, by M. Morris Mano, and Michael D Ciletti Pearson, Pearson, 3rd (2012)Pg. No 73 to 91</u> Nptel videos: 3. Refer lecture 7 & 8 https://nptel.ac.in/courses/108/105/108105132/ 4. For POS and SOP https://nptel.ac.in/courses/106/105/106105185/
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Link for the worksheet is Spend 5 minutes to evaluate student assimilation of the lesson contents



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Lesson Plan No. 09	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> a. Outline steps in minimisation of Boolean expressions using Q-M algorithm; b. Comparison of QM technique with k-map
Teaching Aids (if any)	<ul style="list-style-type: none"> a. PPT presentation b. Chalk and Talk
Teaching Development	<p>Introduction (5 minutes)</p> <ul style="list-style-type: none"> - Ask questions <p>Revision of Boolean expressions Brain storming (ask the class what they know about Boolean expressions, minimisation)</p> <p>Introduction to QM Method (30 minutes)</p> <ul style="list-style-type: none"> a) Explain Q-M algorithm b) Q-M software demonstration; c) Solve workout/example problem; d) Discuss the following two steps in details e) Solution for four variable function will be discussed. <ul style="list-style-type: none"> • Finding all prime implicants of the function. • Use those prime implicants in a prime implicant chart to find the essential prime implicants of the function, as well as other prime implicants that are necessary to cover the function.
Activity (15 minutes)	HO: Hands-On Worksheet Exercises (ask the class to work in pairs and solve worksheet exercises)
Closure	<p>5 minutes</p> <ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. <u>Digital Design, by M. Morris Mano, and Michhael D Ciletti Pearson, Pearson, 3rd (2012), Pg. No 112 TO 127</u> <u>Refer lecture 10 AND 11</u> 3. <u>Nptel videos:</u> <u>Refer lecture 12 https://nptel.ac.in/courses/108/105/108105132/</u> 4. <u>https://www.youtube.com/watch?v=91hV7LsRUTI</u> 5. Using c programming implementation: Sarkar, N., Petrus, K., and Hossain, H. (2001). "Software Implementation of the QuineMcCluskey Algorithm for Logic Gate Minimisation." 14th National Advisory Committee on Computing Qualifications Annual Conference, Napier.

Evaluation	<ol style="list-style-type: none"><li data-bbox="448 188 1283 264">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.<li data-bbox="448 264 820 300">2. Link for the worksheet : <p data-bbox="400 338 1315 378">Spend 5 minutes to evaluate student assimilation of the lesson contents</p>
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Lesson Plan No. 09	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: a. Outline steps in minimisation of Boolean expressions using Q-M algorithm; b. Comparison of QM technique with k-map
Teaching Aids (if any)	a. PPT presentation b. Chalk and Talk
Teaching Development	Introduction (5 minutes) - Ask questions Revision of Boolean expressions Brain storming (ask the class what they know about Boolean expressions, minimisation) Introduction to QM Method (30 minutes) Explain Q-M algorithm Q-M software demonstration; Solve workout/example problem; Discuss the following two steps in details Solution for four variable function will be discussed. <ul style="list-style-type: none">• Finding all prime implicants of the function.• Use those prime implicants in a prime implicant chart to find the essential prime implicants of the function, as well as other prime implicants that are necessary to cover the function.
Activity (15 minutes)	HO: Hands-On Worksheet Exercises (ask the class to work in pairs and solve worksheet exercises)
Closure	5 minutes <ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. <u>Digital Design, by M. Morris Mano, and Michael D Ciletti Pearson, Pearson, 3rd (2012), Pg. No 112 TO 127</u> Refer lecture 10 AND 113. <u>Nptel videos:</u> Refer lecture 12 https://nptel.ac.in/courses/108/105/108105132/4. https://www.youtube.com/watch?v=91hV7LsRUTI5. Using c programming implementation:



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	<p>Sarkar, N., Petrus, K., and Hossain, H. (2001). "Software Implementation of the QuineMcCluskey Algorithm for Logic Gate Minimisation." 14th National Advisory Committee on Computing Qualifications Annual Conference, Napier.</p>
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.2. Link for the worksheet : <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>

Lesson Plan No. 10	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> a. Outline steps in minimisation of Boolean expressions using Q-M algorithm; b. Comparison of QM technique with k-map
Teaching Aids (if any)	<ul style="list-style-type: none"> a. PPT presentation b. Chalk and Talk
Teaching Development	<p>Introduction (5 minutes)</p> <ul style="list-style-type: none"> - Ask questions <p>Revision of Boolean expressions Brain storming (ask the class what they know about Boolean expressions, minimisation)</p> <p>Introduction to Quine–McCluskey (30 minutes)</p> <ul style="list-style-type: none"> a) Explain Q-M algorithm b) Briefing why QM technique used for solving Boolean functions c) Q-M techniques solution demonstration; d) Solve workout/example problem; <ul style="list-style-type: none"> • Solution for 5 variable • Solution for 4 variable with don't care e) Discuss the following two steps in details <ul style="list-style-type: none"> • Finding all prime implicants of the function. • Use those prime implicants in a prime implicant chart to find the essential prime implicants of the function, as well as other prime implicants that are necessary to cover the function.
Activity (15 minutes)	HO: Hands-On Worksheet Exercises (ask the class to work in pairs and solve worksheet exercises)
Closure	5 minutes <ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. <u>Digital Design, by M. Morris Mano, and Michael D Ciletti Pearson, Pearson, 3rd (2012), Pg. No 112 TO 127</u> <u>Refer lecture 10 AND 11</u> 3. <u>Nptel videos:</u> <u>Refer lecture 12 https://nptel.ac.in/courses/108/105/108105132/</u> 4. https://www.youtube.com/watch?v=91hV7LsRUTI 5. Using c programming implementation: Sarkar, N., Petrus, K., and Hossain, H. (2001). “Software Implementation of the QuineMcCluskey Algorithm for Logic Gate

	Minimisation.” 14th National Advisory Committee on Computing Qualifications Annual Conference, Napier.
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.2. Link for the worksheet : <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 10	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: a. Outline steps in minimisation of Boolean expressions using Q-M algorithm; b. Comparison of QM technique with k-map
Teaching Aids (if any)	a. PPT presentation b. Chalk and Talk
Teaching Development	Introduction (5 minutes) - Ask questions Revision of Boolean expressions Brain storming (ask the class what they know about Boolean expressions, minimisation) Introduction to Quine–McCluskey (30 minutes) Explain Q-M algorithm Briefing why QM technique used for solving Boolean functions Q-M techniques solution demonstration; Solve workout/example problem; <ul style="list-style-type: none">• Solution for 5 variable• Solution for 4 variable with don't care Discuss the following two steps in details <ul style="list-style-type: none">• Finding all prime implicants of the function.• Use those prime implicants in a prime implicant chart to find the essential prime implicants of the function, as well as other prime implicants that are necessary to cover the function.
Activity (15 minutes)	HO: Hands-On Worksheet Exercises (ask the class to work in pairs and solve worksheet exercises)
Closure	5 minutes 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. <u>Digital Design, by M. Morris Mano, and Michael D Ciletti Pearson, Pearson, 3rd (2012), Pg. No 112 TO 127</u> <u>Refer lecture 10 AND 11</u> 3. <u>Nptel videos:</u> <u>Refer lecture 12 https://nptel.ac.in/courses/108/105/108105132/</u>



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	<ol style="list-style-type: none">4. https://www.youtube.com/watch?v=91hV7LsRUTI5. Using c programming implementation: Sarkar, N., Petrus, K., and Hossain, H. (2001). "Software Implementation of the QuineMcCluskey Algorithm for Logic Gate Minimisation." 14th National Advisory Committee on Computing Qualifications Annual Conference, Napier.
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.2. Link for the worksheet : <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>

Lesson Plan No. 11	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> a. To exposure students to operational basics and the use of Encoders b. To be familiar with the use and applications of encoders
Teaching Aids (if any)	<ul style="list-style-type: none"> a. PPT presentation b. Chalk and Talk c. Use of Google meet if online
Teaching Development	<p>1. EVOCATION: (10 minutes)</p> <ul style="list-style-type: none"> a. Combinational Circuits b. Boolean functions and their gate implementation c. Difference between Combinational Circuits and sequential Circuits d. Need of combinational circuits e. Fundamental circuits that are the base building blocks of most larger digital circuits f. They are reusable and are common to many systems Types of combinational circuits. g. Implementation Using Combinational Circuits The implementation using combinational circuits can be formulated by following steps Specification for the Circuits <p style="text-align: center;">Introduction to Digital systems(30 minutes)</p> <ul style="list-style-type: none"> a) Discuss the examples of combinational circuits b) <i>Introduction to encoder</i> c) Describe the basic concept of encoders d) Explain the types of encoders and implement their design using the basic logic e) Implement any one of the encoder circuit with necessary diagrams wherever necessary. f) List the types of encoder g) An encoder is the inverse operation of a decoder (ie) contains m inputs and convert it into to n outputs h) If two inputs are active simultaneously, the output produces an undefined combination. We can establish an input priority to ensure that only one input is encoded. i) Another ambiguity in the octal-to-binary encoder is that an output with all 0's is generated when all the inputs are 0; the output is the same as when D0 is equal to 1. j) Types of Encoder 4to2 encoder, 8to3 encoder,16to4 encoder, Priority encoder and so on k) Implementation of encoder circuit 8 to 3 encoder

Activity (10 minutes)	Students will spend time in practicing to design and implement encoder.
Closure	<p>5 minutes</p> <ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading : <u>Digital Design, by M. Morris Mano, and Michael D Ciletti Pearson, Pearson, 3rd (2012)</u> Pg. No 176 TO 179 3. Nptel video lecture link : https://www.youtube.com/watch?v=RZQTTfU9TNA
Evaluation	<ol style="list-style-type: none"> 1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Link for the quiz using Google form <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 11	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: <ul style="list-style-type: none">a. To exposure students to operational basics and the use of Encodersb. To be familiar with the use and applications of encoders
Teaching Aids (if any)	<ul style="list-style-type: none">a. PPT presentationb. Chalk and Talkc. Use of Google meet if online
Teaching Development	<p>1. EVOCATION: (10 minutes)</p> <ul style="list-style-type: none">a. Combinational Circuitsb. Boolean functions and their gate implementationc. Difference between Combinational Circuits and sequential Circuitsd. Need of combinational circuitse. Fundamental circuits that are the base building blocks of most larger digital circuitsf. They are reusable and are common to many systems Types of combinational circuits.g. Implementation Using Combinational Circuits The implementation using combinational circuits can be formulated by following steps Specification for the Circuits <p>Introduction to Digital systems(30 minutes)</p> <p>Discuss the examples of combinational circuits</p> <p>Introduction to encoder</p> <p>Describe the basic concept of encoders</p> <p>Explain the types of encoders and implement their design using the basic</p> <p>Implement any one of the encoder circuit with necessary diagrams necessary.</p> <p>e types of encoder</p> <p>An encoder is the inverse operation of a decoder (ie) contains m inputs t it into to n outputs</p> <p>If two inputs are active simultaneously, the output produces an undefined n. We can establish an input priority to ensure that only one input is</p> <p>er ambiguity in the octal-to-binary encoder is that an output with all 0's is</p>



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	<p>when all the inputs are 0; the output is the same as when D0 is equal to 1. of Encoder 4to2 encoder, 8to3 encoder,16to4 encoder, Priority encoder</p> <p>Implementation of encoder circuit 8 to 3 encoder</p>
Activity (10 minutes)	Students will spend time in practicing to design and implement encoder.
Closure	<p>5 minutes</p> <ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Suggested Reading : <u>Digital Design, by M. Morris Mano, and Michael D Ciletti Pearson, Pearson, 3rd (2012)</u> Pg. No 176 TO 1793. Nptel video lecture link : https://www.youtube.com/watch?v=RZQTTfU9TNA
Evaluation	<ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.2. Link for the quiz using Google form <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>

Lesson Plan No. 11	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> a. To make the students know the basic concept of decoders and implement their types using the basic logic b. Describe the basic concept of decoders c. Explain the types of decoders and implement their design using the basic logic
Teaching Aids (if any)	<ul style="list-style-type: none"> a. PPT presentation b. Chalk and Talk c. Use of Google meet if online
Teaching Development	<ol style="list-style-type: none"> 1. EVOCATION: (10 minutes) <ul style="list-style-type: none"> a. What is the decoder? b. How it is different from encoder c. How these two are used in communication and other discuss few examples 2. Introduction to Decoders(30 minutes) <ul style="list-style-type: none"> a) Describe the basic concept of decoders b) Explain the types of decoders and implement their design using the basic logic c) Implement any one of the encoder circuit with necessary diagrams wherever necessary. d) List the types of decoder 2to4 decoder 3to8 decoder 4to16 decoder and so on. e) Implementation of decoder circuit 3 to 8 decoder f) Discuss Decoder Examples. g) Discuss the applications like the Decoders are used to analyze data streams for a certain data code and give an output if the data is present like an address to a peripheral unit that needs service.
Activity (10 minutes)	Students will spend time in practicing to design and implement decoder.
Closure	<p>5 minutes</p> <ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading : <u>Digital Design, by M. Morris Mano, and Michhael D Ciletti Pearson, Pearson, 3rd (2012)</u> <u>Pg. No 171 TO 175</u> 3. Nptel video lecture link : https://www.youtube.com/watch?v=RZQTTfU9TNA

Evaluation	<ol style="list-style-type: none"><li data-bbox="448 188 1283 264">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.<li data-bbox="448 264 975 304">2. Link for the quiz using Google form <p data-bbox="400 338 1315 378">Spend 5 minutes to evaluate student assimilation of the lesson contents</p>
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Lesson Plan No. 11	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: a. To make the students know the basic concept of decoders and implement their types using the basic logic b. Describe the basic concept of decoders c. Explain the types of decoders and implement their design using the basic logic
Teaching Aids (if any)	a. PPT presentation b. Chalk and Talk c. Use of Google meet if online
Teaching Development	1. EVOCATION: (10 minutes) a. What is the decoder? b. How it is different from encoder c. How these two are used in communication and other discuss few examples 2. Introduction to Decoders (30 minutes) Describe the basic concept of decoders Explain the types of decoders and implement their design using the basic Implement any one of the encoder circuit with necessary diagrams necessary. List the types of decoder 2to4 decoder 3to8 decoder 4to16 decoder and Implementation of decoder circuit 3 to 8 decoder s Decoder Examples. Discuss the applications like the Decoders are used to analyze data a certain data code and give an output if the data is present like an a peripheral unit that needs service.
Activity (10 minutes)	Students will spend time in practicing to design and implement decoder.
Closure	5 minutes 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading : <u>Digital Design, by M. Morris Mano, and Michael D Ciletti Pearson, Pearson, 3rd (2012)</u> <u>Pg. No 171 TO 175</u>



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	<p>3. Nptel video lecture link : https://www.youtube.com/watch?v=RZQTTfU9TNA</p>
Evaluation	<p>1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Link for the quiz using Google form</p> <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>

Lesson Plan No. 14	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: To make the students know the basic concept of Multiplexers and implement their types using the basic logic
Outcomes	Describe the basic concept of Multiplexers Explain the types of Multiplexers and implement their design using the basic logic
Teaching Aids (if any)	<ul style="list-style-type: none"> a. PPT presentation b. Chalk and Talk c. Use of Google meet if online
Teaching Development	<ol style="list-style-type: none"> 1. EVOCATION: (10 minutes) <ul style="list-style-type: none"> a. What is the decoder/encoder? b. How many input are required for 4 outputs 2. Introduction to Decoders(30 minutes) <ul style="list-style-type: none"> a) In electronics, a multiplexer (or mux) is a device that selects one of several analog or digital input signals and forwards the selected input into a single line. b) A multiplexer of 2^n inputs has n select lines, which are used to select which input line to send to the output. c) Multiplexers are mainly used to increase the amount of data that can be sent over the network within a certain amount of time and bandwidth. d) Multiplexing examples e) A multiplexer is also called a data selector. Types of Multiplexer 2 to 1 MUX 4 to 1 MUX 16 to 1 MUX and so on f) Implementation of MUX circuit 2 to 1 MUX $S = 0, Y = I_0$ Truth Table $S \ Y \ S = 1, Y = I_1 \ 0 \ I_0 \ Y = S'I_0 + SI_1 \ 1 \ I_1$ g) 4 to 1 MUX h) Boolean function implementation i) A more efficient method for implementing a Boolean function of n variables with a multiplexer that has $n-1$ selection inputs. $F(x, y, z) = (1,2,6,7)$
Activity (10 minutes)	Students will spend time in practicing to design and implement Multiplexer.
Closure	<p>5 minutes</p> <ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. <u>Digital Design, by M. Morris Mano, and Michael D Ciletti Pearson, Pearson, 3rd (2012), Pg. No 178-180</u> 3. Video lecture https://nptel.ac.in/courses/108/105/108105132/ Multiplexer

Evaluation**Open ended questions**

1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.
2. What is the Multiplexers and write the other name for Multiplexers?
3. Implement any one of the Multiplexers circuit with necessary diagrams wherever necessary.
4. List the types of Multiplexers
5. Implement the Boolean function using any one of the multiplexer circuit

Spend 5 minutes to evaluate student assimilation of the lesson contents



Lesson Plan No. 14	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: To make the students know the basic concept of Multiplexers and implement their types using the basic logic
Outcomes	Describe the basic concept of Multiplexers Explain the types of Multiplexers and implement their design using the basic logic
Teaching Aids (if any)	<ul style="list-style-type: none"> a. PPT presentation b. Chalk and Talk c. Use of Google meet if online
Teaching Development	<ol style="list-style-type: none"> 1. EVOCATION: (10 minutes) <ul style="list-style-type: none"> a. What is the decoder/encoder? b. How many input are required for 4 outputs 2. Introduction to Decoders(30 minutes) In electronics, a multiplexer (or mux) is a device that selects one of log or digital input signals and forwards the selected input into a single A multiplexer of 2n inputs has n select lines, which are used to select line to send to the output. Multiplexers are mainly used to increase the amount of data that can be the network within a certain amount of time and bandwidth. Multiplexing examples A multiplexer is also called a data selector. Types of Mux 2 to 1 MUX 16 to 1 MUX and so on Implementation of MUX circuit 2 to 1 MUX $S = 0, Y = I_0$ Truth Table $S = 1, Y = I_1$ $Y = I_0 + S I_1$ 4 to 1 MUX Boolean function implementation An efficient method for implementing a Boolean function of n variables with er that has n-1 selection inputs. $F(x, y, z) = (1,2,6,7)$
Activity (10 minutes)	Students will spend time in practicing to design and implement Multiplexer.
Closure	5 minutes <ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. <u>Digital Design, by M. Morris Mano, and Michael D Ciletti Pearson,</u>



	<p><u>Pearson, 3rd (2012), Pg. No 178-180</u></p> <p>3. <u>Video lecture https://nptel.ac.in/courses/108/105/108105132/Multiplexer</u></p>
Evaluation	<p>Open ended questions</p> <ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.2. What is the Multiplexers and write the other name for Multiplexers?3. Implement any one of the Multiplexers circuit with necessary diagrams wherever necessary.4. List the types of Multiplexers5. Implement the Boolean function using any one of the multiplexer circuit <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>

Lesson Plan No. 15	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: To make the students know the basic concept of DeMultiplexers and implement different logic functions using the demux
Outcomes	Describe the basic concept of Demultiplexers Explain the types of Demultiplexers and implement their design using the basic logic
Teaching Aids (if any)	<ul style="list-style-type: none"> a. PPT presentation b. Chalk and Talk c. Use of Google meet if online
Teaching Development	<ol style="list-style-type: none"> 1. EVOCAATION: (10 minutes) Ask questions <ul style="list-style-type: none"> a. What is the MUX b. How many select lines are required for 4:1 Mux 2. Introduction to Demultiplexer(30 minutes) <ul style="list-style-type: none"> a) Demultiplexer (or demux) is a device taking a single input signal and selecting one of many data-output-lines, which is connected to the single b) Demonstrate that demux is otherwise known as data distributor. A decoder with an enable input is referred to as a decoder/demultiplexer. The truth table of demultiplexer is the same with decoder. c) Explain types of Demultiplexer 1 to 2 DEMUX,1 to 4 DEMUX,1 to 16 DeMUX and so on d) Demultiplexing examples e) Implementation of DEMUX circuit 1-to-4 De-multiplexer f) The Boolean expression for this 1-to-4 Demultiplexer above with outputs A to D and data select lines a, b is given as: $F = abA + abB + abC + abD$
Activity (10 minutes)	Students will spend time in practicing to design and implement Multiplexer.
Closure	<p>5 minutes</p> <ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Discuss applications of Demultiplexer is used to connect a single source to multiple destinations. It is used in ALU circuit. The second use of the Demultiplexer is the reconstruction of Parallel Data from the incoming serial data stream.

	<ol style="list-style-type: none"> 3. <u>Digital Design, by M. Morris Mano, and Michael D Ciletti Pearson, Pearson, 3rd (2012), Pg. No 178-180</u> 4. Video lecture https://nptel.ac.in/courses/108/105/108105132/ Multiplexer
Evaluation	<p>Open ended questions</p> <ol style="list-style-type: none"> 1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. What is the Demultiplexers and write the other name for Demultiplexers? 3. Implement any one of the Demultiplexers circuit with necessary diagrams wherever necessary. 4. List the types of Demultiplexers <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 15	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: To make the students know the basic concept of DeMultiplexers and implement different logic functions using the demux
Outcomes	Describe the basic concept of Demultiplexers Explain the types of Demultiplexers and implement their design using the basic logic
Teaching Aids (if any)	a. PPT presentation b. Chalk and Talk c. Use of Google meet if online
Teaching Development	<p>1. EVOCATION: (10 minutes) Ask questions</p> <ol style="list-style-type: none">What is the MUXHow many select lines are required for 4:1 Mux <p>2. Introduction to Demultiplexer(30 minutes)</p> <p>Demultiplexer (or demux) is a device taking a single input signal and producing one of many data-output-lines, which is connected to the single input line.</p> <p>Demonstrate that demux is otherwise known as data distributor. A demultiplexer with an enable input is referred to as a decoder/demultiplexer. The truth table of a demultiplexer is the same with decoder.</p> <p>Explain types of Demultiplexer</p> <p>1 to 2 DEMUX, 1 to 4 DEMUX, 1 to 16 DeMUX and so on</p> <p>Demultiplexing examples</p> <p>Implementation of DEMUX circuit 1-to-4 De-multiplexer</p> <p>Boolean expression for this 1-to-4 Demultiplexer above with outputs A to D and select lines a, b is given as: $F = abA + abB + abC + abD$</p>
Activity (10 minutes)	Students will spend time in practicing to design and implement Multiplexer.
Closure	5 minutes
	<ol style="list-style-type: none">Summarize the Lesson Learning Outcomes and get affirmation from students on these.Discuss applications of Demultiplexer is used to connect a single source to multiple destinations. It is used in ALU circuit. The second use of the Demultiplexer is the reconstruction of Parallel



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	<p>Data from the incoming serial data stream.</p> <ol style="list-style-type: none">3. <u>Digital Design, by M. Morris Mano, and Michael D Ciletti Pearson, Pearson, 3rd (2012), Pg. No 178-180</u>4. Video lecture https://nptel.ac.in/courses/108/105/108105132/Multiplexer
Evaluation	<p>Open ended questions</p> <ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.2. What is the Demultiplexers and write the other name for Demultiplexers?3. Implement any one of the Demultiplexers circuit with necessary diagrams wherever necessary.4. List the types of Demultiplexers <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>

Lesson Plan No. 16	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: i. Deduce the Principle of code conversion ii. Describe the various code conversion methods using the principle
Outcomes	What is the principle of code conversion? List the types of code conversion circuits Design any one of the code conversion circuit by the principle used.
Teaching Aids (if any)	a. PPT presentation b. Chalk and Talk c. Use of Google meet if online
Teaching Development	<p>1. EVOCATION: (5 minutes) Ask questions</p> <ol style="list-style-type: none"> Convert $(1056)_{16}$ to $(?)_8$ What are Ex-3 Code Convert $(15)_{16}$ into equivalent Ex-3 code. <p>2. Introduction to Code Conversion (30 minutes)</p> <ol style="list-style-type: none"> Conversion of signals, or groups of signals, in one code into corresponding signals, or groups of signals, in another code. Principle of Code Conversion A process for converting a code of some predetermined bit structure, such as 5, 7, or 14 bits per character interval, to another code with the same or a different number of bits per character interval. Types of codeconversion BCD to Gray code. and viceversa. BCD to excess3 code and viceversa. Binary to gray code and viceversa Implementation of code conversion circuit BCD and Excess-3 codes Truth Table Code Conversion Examples Kmap and Boolean Expression For each symbol of the Excess-3 code, we use 1's to draw the map for simplifying Boolean function. $z = D'$; $y = CD + C'D' = CD + (C + D)'$ $x = B'C + B'D + BC'D' = B'(C + D) + B(C + D)'$ $w = A + BC + BD = A + B(C + D)$ BCD – Excess3 circuit
Activity (10 minutes)	Students will spend time in practicing to design and implement Gray to Binary code converter.

Closure	<p>5 minutes</p> <ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Discuss applications of Demultiplexer is used to connect a single source to multiple destinations. It is used in ALU circuit. The second use of the Demultiplexer is the reconstruction of Parallel Data from the incoming serial data stream. 3. Reading : <u>Modern Digital Electronics</u> by R.P.Jain , McGraw-Hill 4th (2010) <u>Pg. No 258 to 271</u> 4.
Evaluation	<p>Open ended questions</p> <ol style="list-style-type: none"> 1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Link of google quiz : <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 16	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: i. Deduce the Principle of code conversion ii. Describe the various code conversion methods using the principle
Outcomes	What is the principle of code conversion? List the types of code conversion circuits Design any one of the code conversion circuit by the principle used.
Teaching Aids (if any)	a. PPT presentation b. Chalk and Talk c. Use of Google meet if online
Teaching Development	<p>1. EVOCATION: (5 minutes) Ask questions</p> <p>a. Convert $(1056)_{16}$ to $(?)_8$ b. What are Ex-3 Code c. Convert $(15)_{16}$ into equivalent Ex-3 code.</p> <p>2. Introduction to Code Conversion (30 minutes)</p> <p>Conversion of signals, or groups of signals, in one code into ing signals, or groups of signals, in another code.</p> <p>Principle of Code Conversion A process for converting a code of etermined bit structure, such as 5, 7, or 14 bits per character interval, to de with the same or a different number of bits per character interval. Types ersion</p> <p>BCD to Gray code. and viceversa. BCD to excess3 code and inary to gray code and viceversa</p> <p>Implementation of code conversion circuit BCD and Excess-3</p> <p>Table</p> <p>Code Conversion Examples</p> <p>Kmap and Boolean Expression For each symbol of the Excess-3 se 1's to draw the map for simplifying Boolean function.</p> <p>$z = D'$; $y = CD + C'D' = CD + (C + D)'$ $x = B'C + B'D + BC'D' = B'(C + D)$ $w = A + BC + BD = A + B(C + D)$ BCD – Excess3 circuit</p>
Activity (10 minutes)	Students will spend time in practicing to design and implement Gray to Binary code converter.



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Closure	5 minutes <ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Discuss applications of Demultiplexer is used to connect a single source to multiple destinations. It is used in ALU circuit. The second use of the Demultiplexer is the reconstruction of Parallel Data from the incoming serial data stream.3. Reading : <u>Modern Digital Electronics by R.P.Jain , McGraw-Hill 4th (2010)</u> <u>Pg. No 258 to 271</u>4.
Evaluation	Open ended questions <ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.2. Link of google quiz : Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 17	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: i. Deduce the Principle of code conversion ii. Describe the various code conversion methods using the principle
Outcomes	What is the principle of code conversion? List the types of code conversion circuits Design any one of the code conversion circuit by the principle used.
Teaching Aids (if any)	a. PPT presentation b. Chalk and Talk c. Use of Google meet if online
Teaching Development	1. EVOCATION: (5 minutes) Ask questions a. Convert $(1056)_{16}$ to $(?)_8$ b. What are Ex-3 Code c. Convert $(15)_{16}$ into equivalent Ex-3 code. 2. Introduction to Code Conversion (30 minutes) a) Conversion of signals, or groups of signals, in one code into corresponding signals, or groups of signals, in another code. b) Principle of Code Conversion A process for converting a code of some predetermined bit structure, such as 5, 7, or 14 bits per character interval, to another code with the same or a different number of bits per character interval. Types of codeconversion c) Binary to gray code and viceversa d) Implementation of code conversion circuit BCD and Gray codes Truth Table e) Code Conversion Examples f) Kmap and Boolean Expression For each symbol of the binary to gray code, we use 1's to draw the map for simplifying Boolean function. g) Binary – Gray Code converter
Activity (10 minutes)	Students will spend time in practicing to design and implement Binary to gray code converter.
Closure	5 minutes 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Discuss applications of gray code and coverters.

	<p>3. Reading : <u>Modern Digital Electronics</u> by R.P.Jain <u>McGraw-Hill 4th (2010)</u> <u>Pg. No 258 to 271</u></p> <p>4. https://www.youtube.com/watch?v=R7uuIACpdGQ</p>
Evaluation	<p>Open ended questions</p> <ol style="list-style-type: none"> 1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. What are the primary uses of Gray code? 3. Convert binary number into gray code: 100101. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>



Lesson Plan No. 17	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: i. Deduce the Principle of code conversion ii. Describe the various code conversion methods using the principle
Outcomes	What is the principle of code conversion? List the types of code conversion circuits Design any one of the code conversion circuit by the principle used.
Teaching Aids (if any)	a. PPT presentation b. Chalk and Talk c. Use of Google meet if online
Teaching Development	<p>1. EVOCATION: (5 minutes) Ask questions</p> <ol style="list-style-type: none">Convert $(1056)_{16}$ to $(?)_8$What are Ex-3 CodeConvert $(15)_{16}$ into equivalent Ex-3 code. <p>2. Introduction to Code Conversion (30 minutes)</p> <p>Conversion of signals, or groups of signals, in one code into ing signals, or groups of signals, in another code.</p> <p>Principle of Code Conversion A process for converting a code of etermined bit structure, such as 5, 7, or 14 bits per character interval, to de with the same or a different number of bits per character interval. Types version</p> <p>Binary to gray code and viceversa Implementation of code conversion circuit BCD and Gray codes</p> <p>Code Conversion Examples Kmap and Boolean Expression For each symbol of the binary to we use 1's to draw the map for simplifying Boolean function. Binary – Gray Code converter</p>
Activity (10 minutes)	Students will spend time in practicing to design and implement Binary to gray code converter.
Closure	5 minutes 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Discuss applications of gray code and coverters.



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	<p>3. Reading : <u>Modern Digital Electronics by R.P.Jain</u> <u>McGraw-Hill 4th (2010)</u> <u>Pg. No 258 to 271</u></p> <p>4. https://www.youtube.com/watch?v=R7uuIACpdGQ</p>
Evaluation	<p>Open ended questions</p> <ol style="list-style-type: none">1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.2. What are the primary uses of Gray code?3. Convert binary number into gray code: 100101. <p>Spend 5 minutes to evaluate student assimilation of the lesson contents</p>

Lesson Plan No. 18	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: lesson learners will be introduced to main memory, RAM and ROM, as well as cache
Outcomes	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> • Describe the characteristics of RAM ,Cache , EPROM and ROM etc • Explain the role of main memory as part of a computer system
Teaching Aids (if any)	a. PPT presentation b. Chalk and Talk c. Use of Google meet if online d. Explanatory video
Teaching Development	<ol style="list-style-type: none"> 1. EVOCATION: (5 minutes) <ul style="list-style-type: none"> • Meaning of computer memory and storage device • Their types • How the type of memory effects on the system performance? 2. Introduction to Code Conversion (30 minutes) <ol style="list-style-type: none"> a) Start by explaining the memory device and meaning of storage devices and discuss how the information are stored in them. b) Discuss internal and external storage devices. c) Explaining the difference between volatile and non-volatile memory. d) The difference between RAM and ROM Binary to gray code and vice versa. e) RAM – Static and dynamic RAM f) Discuss different types of memory devices like RAM, ROM, EPROM, EEROM and their applications g) Explain the features of the storage devices by giving an example.
Activity (10 minutes)	<p>Discussion</p> <p>Split the class into small groups and challenge them to create a revision resource on different types of memory and A description of each of the following:</p> <ol style="list-style-type: none"> a. RAM b. ROM c. Flash Memory d. Virtual Memory <p>Include in your description:</p>

	<ul style="list-style-type: none"> a) What it's used for b) What it stores c) What happens when it loses power
Closure	<p>5 minutes</p> <ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Watch you tube video http://www.youtube.com/watch?v=URYPErhTkMY 3. Digital Design, by M. Morris Mano, and Michhael D Ciletti Pearson, Pearson, 3rd (2012), Pg. No 335 and 350
Evaluation	<p>Spend 5 minutes to evaluate student assimilation of the lesson contents Quiz will be shared with the students.</p>



Lesson Plan No. 18	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	At the end of the lesson the student shall be able to: lesson learners will be introduced to main memory, RAM and ROM, as well as cache
Outcomes	At the end of the lesson the student shall be able to: <ul style="list-style-type: none">• Describe the characteristics of RAM ,Cache , EPROM and ROM etc• Explain the role of main memory as part of a computer system
Teaching Aids (if any)	a. PPT presentation b. Chalk and Talk c. Use of Google meet if online d. Explanatory video
Teaching Development	<ol style="list-style-type: none">1. EVOCATION: (5 minutes)<ul style="list-style-type: none">• Meaning of computer memory and storage device• Their types• How the type of memory effects on the system performance?2. Introduction to Code Conversion (30 minutes) Start by explaining the memory device and meaning of storage discuss how the information are stored in them. Discuss internal and external storage devices. Explaining the difference between volatile and non-volatile The difference between RAM and ROM Binary to gray code and RAM – Static and dynamic RAM Discuss different types of memory devices like RAM, ROM, ROM and their applications Explain the features of the storage devices by giving an example.
Activity (10 minutes)	Discussion Split the class into small groups and challenge them to create a revision resource on different types of memory and A description of each of the following: <ol style="list-style-type: none">a. RAMb. ROMc. Flash Memoryd. Virtual Memory



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	<p>Include in your description:</p> <ol style="list-style-type: none">What it's used forWhat it storesWhat happens when it loses power
Closure	<p>5 minutes</p> <ol style="list-style-type: none">Summarize the Lesson Learning Outcomes and get affirmation from students on these.Watch you tube video http://www.youtube.com/watch?v=URYPErhTkMYDigital Design, by M. Morris Mano, and Michael D Ciletti Pearson, Pearson, 3rd (2012), Pg. No 335 and 350
Evaluation	<p>Spend 5 minutes to evaluate student assimilation of the lesson contents Quiz will be shared with the students.</p>

Lesson Plan No. 20	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	Design and Implement Combinational circuits using programmable logic devices.
Outcomes	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> • Understand the concepts of programmable logic devices. • Realize of Switching Functions using ROM
Teaching Aids (if any)	<ol style="list-style-type: none"> a. PPT presentation b. Chalk and Talk c. Use of Google meet if online d. Explanatory video
Teaching Development	<ol style="list-style-type: none"> 1. Ask questions: (5 minutes) <ul style="list-style-type: none"> • Meaning of computer memory and storage device • Their types • How the type of memory effects on the system performance? 2. Introduction to Code Conversion (30 minutes) <ol style="list-style-type: none"> a) Start by explaining the – Programmable Logic Devices b) Classification of PLD <ul style="list-style-type: none"> • –ROM • – Programmable Logic Array (PLA) • - Programmable Array Logic (PAL) • – Field Programmable Gate Arrays (FPGA) - c) Implementation of combinational logic circuits using ROM d) Discuss the example: Combinational-circuit implementation with a 4 X 2 ROM e) ROM Realization of Logic Functions <ul style="list-style-type: none"> • ROM consists of a decoder and a memory array. • When a particular input sequence is applied to the n decoder inputs, exactly one of the 2n outputs is set to 1. • This output line selects one of the words in the memory array.
Activity (10 minutes)	<p>Discussion</p> <p>Split the class into small groups and challenge them to create and implement the following SOP functions of 4 variables Using the ROM.</p> $X0 = A \cdot C \cdot D + A \cdot B \cdot D + A \cdot B \cdot C \cdot D + A \cdot C \cdot D$ $X1 = A \cdot B \cdot C \cdot D \quad X2 = A + C \cdot D + A \cdot C$ $X3 = B \cdot C + A \cdot B + A \cdot D + B \cdot D$

Closure	<p>5 minutes</p> <ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. With the advent of Programmable Logic Array the designing of circuit is changing and now the scenario is moving towards micro processors. 3. Reading Material http://www.nou.ac.in/econtent/BCA%20Part%20I/Paper%207/BCA%20Paper-VII%20Block-1%20Unit-2.pdf 4. Digital Design, by M. Morris Mano, and Michael D Ciletti Pearson, Pearson, 3rd (2012) Pg. No 350 to 363
Evaluation	<p>Spend 5 minutes to evaluate student assimilation of the lesson contents Quiz will be shared with the students.</p>



Lesson Plan No. 20	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	Design and Implement Combinational circuits using programmable logic devices.
Outcomes	At the end of the lesson the student shall be able to: <ul style="list-style-type: none">• Understand the concepts of programmable logic devices.• Realize of Switching Functions using ROM
Teaching Aids (if any)	a. PPT presentation b. Chalk and Talk c. Use of Google meet if online d. Explanatory video
Teaching Development	<ol style="list-style-type: none">1. Ask questions: (5 minutes)<ul style="list-style-type: none">• Meaning of computer memory and storage device• Their types• How the type of memory effects on the system performance?2. Introduction to Code Conversion (30 minutes) Start by explaining the – Programmable Logic Devices Classification of PLD<ul style="list-style-type: none">• –ROM• – Programmable Logic Array (PLA)• - Programmable Array Logic (PAL)• – Field Programmable Gate Arrays (FPGA) -Implementation of combinational logic circuits using ROM Discuss the example: Combinational-circuit implementation with a 4 ROM Realization of Logic Functions<ul style="list-style-type: none">• ROM consists of a decoder and a memory array.• When a particular input sequence is applied to the n decoder inputs, exactly one of the 2ⁿ outputs is set to 1.• This output line selects one of the words in the memory array.
Activity (10 minutes)	Discussion Split the class into small groups and challenge them to create and implement the following SOP functions of 4 variables Using the ROM. $X_0 = A \cdot C \cdot D + A \cdot B \cdot D + A \cdot B \cdot C \cdot D + A \cdot C \cdot D$ $X_1 = A \cdot B \cdot C \cdot D$ $X_2 = A + C \cdot D + A \cdot C$ $X_3 = B \cdot C + A \cdot B + A \cdot D + B \cdot D$



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Closure	5 minutes <ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. With the advent of Programmable Logic Array the designing of circuit is changing and now the scenario is moving towards micro processors.3. Reading Material http://www.nou.ac.in/econtent/BCA%20Part%20I/Paper%207/BCA%20Paper-VII%20Block-1%20Unit-2.pdf4. Digital Design, by M. Morris Mano, and Michhael D Ciletti Pearson, Pearson, 3rd (2012) Pg. No 350 to 363
Evaluation	Spend 5 minutes to evaluate student assimilation of the lesson contents Quiz will be shared with the students.

Lesson Plan No. 21	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	Design and Implement Combinational circuits using programmable logic devices.
Outcomes	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> • Understand the concepts of programmable logic Array • Realize of Switching Functions using PLA
Teaching Aids (if any)	<ol style="list-style-type: none"> PPT presentation Chalk and Talk Use of Google meet if online Explanatory video
Teaching Development	<ol style="list-style-type: none"> Ask questions: (5 minutes) What is full form of PLD And PLA refers to ? Introduction to – Programmable Logic Array(PLA) (30 minutes) <ol style="list-style-type: none"> Start by explaining the – Programmable Logic Array(PLA) is a fixed architecture logic device with programmable AND gates followed by programmable OR gates –ROM Comparison with other Programmable Logic Devices: Explain Basic block diagram for PLA Input buffer -AND matrix Output buffer –OR matrix For the realization of the above function for the following expression : $F1 = AB + AC'$ $F2 = A'BC + AB'C + ABC$ Discuss Applications such as <ul style="list-style-type: none"> • PLA is used to provide control over data path. • PLA is used as a decoder. • PLA is used as a BUS interface in programmed I/O
Activity (10 minutes)	Discussion/Break out room to implement the given function using PLA.
Closure	<p>5 minutes</p> <ol style="list-style-type: none"> Summarize the Lesson Learning Outcomes and get affirmation from students on these. With the advent of Programmable Logic Array the designing of circuit is changing and now the scenario is moving towards micro processors. Reading Material http://www.nou.ac.in/econtent/BCA%20Part%20I/Paper%207/BCA%20Paper-VII%20Block-1%20Unit-2.pdf Digital Design, by M. Morris Mano, and Michael D Ciletti Pearson, Pearson, 3rd (2012), Pg. No 350 to 363

Evaluation	Spend 5 minutes to evaluate student assimilation of the lesson contents Quiz will be shared with the students. Ask questions The inputs in the PLD is given through _____ PLA contains _____ PLA is used to implement _____
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Lesson Plan No. 21	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	Design and Implement Combinational circuits using programmable logic devices.
Outcomes	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> • Understand the concepts of programmable logic Array • Realize of Switching Functions using PLA
Teaching Aids (if any)	<ul style="list-style-type: none"> a. PPT presentation b. Chalk and Talk c. Use of Google meet if online d. Explanatory video
Teaching Development	<p>1. Ask questions: (5 minutes) What is full form of PLD And PLA refers to ?</p> <p>2. Introduction to – Programmable Logic Array(PLA) (30 minutes)</p> <ul style="list-style-type: none"> • Start by explaining the – Programmable Logic Array(PLA) is a fixed architecture logic device with programmable AND gates followed by programmable OR gates –ROM • Comparison with other Programmable Logic Devices: • Explain Basic block diagram for PLA <p>Input buffer -AND matrix Output buffer –OR matrix</p> <ul style="list-style-type: none"> • For the realization of the above function for the following expression : $F1 = AB + AC'$ $F2 = A'BC + AB'C + ABC$ • Discuss Applications such as <ul style="list-style-type: none"> • PLA is used to provide control over data path. • PLA is used as a decoder. • PLA is used as a BUS interface in programmed I/O
Activity (10 minutes)	Discussion/Break out room to implement the given function using PLA.



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Closure	5 minutes <ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. With the advent of Programmable Logic Array the designing of circuit is changing and now the scenario is moving towards micro processors.3. Reading Material http://www.nou.ac.in/econtent/BCA%20Part%20I/Paper%207/BCA%20Paper-VII%20Block-1%20Unit-2.pdf4. Digital Design, by M. Morris Mano, and Michhael D Ciletti Pearson, Pearson, 3rd (2012), Pg. No 350 to 363
Evaluation	Spend 5 minutes to evaluate student assimilation of the lesson contents Quiz will be shared with the students. Ask questions The inputs in the PLD is given through _____ PLA contains _____ PLA is used to implement ____

Lesson Plan No. 22	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	Design and Implement Combinational circuits using programmable Array logic.
Outcomes	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> • Understand the concepts of programmable Array Logic • Realize of Switching Functions using PAL
Teaching Aids (if any)	<ol style="list-style-type: none"> PPT presentation Chalk and Talk Use of Google meet if online Explanatory video
Teaching Development	<ol style="list-style-type: none"> Ask questions: (5 minutes) <ul style="list-style-type: none"> What is full form of PLD And PLA refers to ? What PAL refers to? Introduction to – Programmable Logic Array(PAL) (30 minutes) <ol style="list-style-type: none"> Start by explaining the – Programmable Array Logic(PAL) Comparison with other Programmable Logic Devices: Explain Basic block diagram for PAL For the realization of the above function for the following expression : $F1 = AB + AC'$ $F2 = A'BC + AB'C + ABC$ Discuss combinational PALs , Registered PALs and configurable PALs Discuss how to program AND array. Difference between PAL and PLA
Activity (10 minutes)	Implement the following Boolean expression with the help of programmable array logic (PAL) $X = AB + AC'$ $Y = AB' + BC'$
Closure	5 minutes <ol style="list-style-type: none"> Summarize the Lesson Learning Outcomes and get affirmation from students on these. With the advent of Programmable Logic Array the designing of circuit is changing and now the scenario is moving towards micro processors. Reading Material http://www.nou.ac.in/econtent/BCA%20Part%20I/Paper%207/BCA%20Paper-VII%20Block-1%20Unit-2.pdf Digital Design, by M. Morris Mano, and Michael D Ciletti Pearson, Pearson, 3rd (2012), Pg. No 350 to 363
Evaluation	Spend 5 minutes to evaluate student assimilation of the lesson contents Quiz will be shared with the students. Ask questions The difference between a PAL & a PLA is _____ What will be scenario if a PAL has been programmed once ? Discuss



Lesson Plan No. 22	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	Design and Implement Combinational circuits using programmable Array logic.
Outcomes	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> • Understand the concepts of programmable Array Logic • Realize of Switching Functions using PAL
Teaching Aids (if any)	<ol style="list-style-type: none"> PPT presentation Chalk and Talk Use of Google meet if online Explanatory video
Teaching Development	<ol style="list-style-type: none"> Ask questions: (5 minutes) <ul style="list-style-type: none"> What is full form of PLD And PLA refers to ? What PAL refers to? Introduction to – Programmable Logic Array(PAL) (30 minutes) <ul style="list-style-type: none"> • Start by explaining the – Programmable Array Logic(PAL) • Comparison with other Programmable Logic Devices: • Explain Basic block diagram for PAL • For the realization of the above function for the following expression : $F1 = AB + AC'$ $F2 = A'BC + AB'C + ABC$ Discuss combinational PALs , Registered PALs and configurable PALs Discuss how to program AND array. <ul style="list-style-type: none"> • Difference between PAL and PLA
Activity (10 minutes)	Implement the following Boolean expression with the help of programmable array logic (PAL) $X = AB + AC'$ $Y = AB' + BC'$
Closure	5 minutes <ol style="list-style-type: none"> Summarize the Lesson Learning Outcomes and get affirmation from students on these. With the advent of Programmable Logic Array the designing of circuit is changing and now the scenario is moving towards micro processors. Reading Material http://www.nou.ac.in/econtent/BCA%20Part%20I/Paper%207/BCA%20Paper-VII%20Block-1%20Unit-2.pdf Digital Design, by M. Morris Mano, and Michael D Ciletti Pearson,



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	Pearson, 3 rd (2012), Pg. No 350 to 363
Evaluation	Spend 5 minutes to evaluate student assimilation of the lesson contents Quiz will be shared with the students. Ask questions The difference between a PAL & a PLA is _____ What will be scenario if a PAL has been programmed once ? Discuss



Lesson Plan No. 23	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	To learn the fundamentals of Digital systems and principle of operation of Logic families
Outcomes	At the end of the lesson the student shall be able to: <ul style="list-style-type: none">• List the different logic family• Differentiate between RTL and DTL logic families
Teaching Aids (if any)	a. PPT presentation b. Chalk and Talk c. Use of Google meet if online d. Explanatory video
Teaching Development	1. Evocation: (5 minutes) Integrated circuits, VLSI 2. Introduction to – TTL logic families (30 minutes) <ol style="list-style-type: none">1. Start by explaining the – In Digital Designs, our primary aim is to create an Integrated Circuit (IC). A Circuit configuration or arrangement of the circuit elements in a special manner will result in a particular Logic Family2. The basic Classification of the Logic Families are as follows: A) Bipolar Families B) MOS Families C) Hybrid Devices3. Explain RTL (resistor transistor logic) where all the logic are implemented using resistors and transistors. Also discuss advantage and disadvantages of RTL4. Explain Diode Transistor Logic, where all the logic is implemented using diodes and transistors. Also discuss advantage and disadvantages of DTL
Activity (10 minutes)	Prepare a table of differences of RTL and DTL
Closure	5 minutes <ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.2. Modern Digital Electronics by R.P.Jain McGraw-Hill 4th (2010), Pg. No 120 to 1253. Video lecture: https://www.youtube.com/watch?v=PM-4emVKbQg
Evaluation	Spend 5 minutes to evaluate student assimilation of the lesson contents Quiz will be shared with the students. Ask questions The difference between a PAL & a PLA is _____ What will be scenario if a PAL has been programmed once ? Discuss



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Lesson Plan No. 24	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	To learn the fundamentals of Digital systems and principle of operation of Logic families
Outcomes	At the end of the lesson the student shall be able to: <ul style="list-style-type: none">• Understand the concepts of TTL and ECL logic families• Explain TTL NAND gate and ECL NAND gate• Differentiate between TTL and ECL logic families.
Teaching Aids (if any)	a. PPT presentation b. Chalk and Talk c. Use of Google meet if online d. Explanatory video
Teaching Development	<ol style="list-style-type: none">1. Ask questions: (5 minutes) What is full form of RTL And DL refers to ?<ul style="list-style-type: none">• The very large scale integration (VLSI) technology integrates _____ transistors(ans: 10000–1 million)2. Introduction to – TTL logic families (30 minutes)<ol style="list-style-type: none">1. Start by explaining the – In Digital Designs, our primary aim is to create an Integrated Circuit (IC). A Circuit configuration or arrangement of the circuit elements in a special manner will result in a particular Logic Family2. The basic Classification of the Logic Families are as follows: A) Bipolar Families B) MOS Families C) Hybrid Devices3. Explain TTL (transistor transistor logic) where all the logic are implemented using transistors.4. Further TTL is classified as TTL Logic has the following sub-families: Standard TTL. , High Speed TTL.... etcAlso discuss advantage and disadvantages of TTL Explain Emitter Coupled Logic, and about the main specialty of ECL that it is operating in Active Region than the Saturation Region. That is the reason for its high speed operation. Also discuss advantage and disadvantages of ECL
Activity (10 minutes)	Prepare a table of differences of TTL and ECL



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Closure	5 minutes 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Modern Digital Electronics by R.P.Jain McGraw-Hill 4 th (2010), Pg. No 120 to 125 for TTL Modern Digital Electronics by R.P.Jain McGraw-Hill 4 th (2010), Pg. No 128-131 for ECL 3. Video lecture: https://www.youtube.com/watch?v=PM-4emVKbQg
Evaluation	Spend 5 minutes to evaluate student assimilation of the lesson contents Quiz will be shared with the students. Ask questions <ul style="list-style-type: none">• A TTL circuit acts as a current sink in the _____• The logic family that has the fastest switching action is _____ (TTL, ECL, CMOS, DTL)• Resistors and transistors are used to represent _____ (TTL, ECL, RTL, DTL)



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Lesson Plan No. 25	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	To learn the fundamentals of Digital systems and principle of operation of Logic families
Outcomes	At the end of the lesson the student shall be able to: <ul style="list-style-type: none">• Understand the concepts of TTL and ECL logic families• Explain TTL NAND gate and ECL NAND gate• . Differentiate between TTL and ECL logic families.
Teaching Aids (if any)	a. PPT presentation b. Chalk and Talk c. Use of Google meet if online d. Explanatory video
Teaching Development	<ol style="list-style-type: none">1. Ask questions: (5 minutes) What is full form of RTL And DL refers to ?<ul style="list-style-type: none">• The very large scale integration (VLSI) technology integrates _____ transistors(ans: 10000–1 million)2. Introduction to – TTL logic families (30 minutes)<ol style="list-style-type: none">1. Start by explaining the – In Digital Designs, our primary aim is to create an Integrated Circuit (IC). A Circuit configuration or arrangement of the circuit elements in a special manner will result in a particular Logic Family2. The basic Classification of the Logic Families are as follows: A) Bipolar Families B) MOS Families C) Hybrid Devices3. Explain TTL (transistor transistor logic) where all the logic are implemented using transistors.4. Further TTL is classified as TTL Logic has the following sub-families: Standard TTL. , High Speed TTL.... etcAlso discuss advantage and disadvantages of TTL Explain Emitter Coupled Logic, and about the main specialty of ECL that it is operating in Active Region than the Saturation Region. That is the reason for its high speed operation. Also discuss advantage and disadvantages of ECL
Activity (10 minutes)	Prepare a table of differences of TTL and ECL



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Closure	5 minutes 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Modern Digital Electronics by R.P.Jain McGraw-Hill 4 th (2010), Pg. No 120 to 125 for TTL Modern Digital Electronics by R.P.Jain McGraw-Hill 4 th (2010), Pg. No 128-131 for ECL 3. Video lecture: https://www.youtube.com/watch?v=PM-4emVKbQg
Evaluation	Spend 5 minutes to evaluate student assimilation of the lesson contents Quiz will be shared with the students. Ask questions <ul style="list-style-type: none">• A TTL circuit acts as a current sink in the _____• The logic family that has the fastest switching action is _____ (TTL, ECL, CMOS, DTL)• Resistors and transistors are used to represent _____ (TTL, ECL, RTL, DTL)



Lesson Plan No. 25	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	To learn the fundamentals of Digital systems and principle of operation of Logic families
Outcomes	At the end of the lesson the student shall be able to: <ul style="list-style-type: none">• Understand the concepts of MOS and CMOS logic families• Differentiate between MOS and CMOS logic families.
Teaching Aids (if any)	a. PPT presentation b. Chalk and Talk c. Use of Google meet if online d. Explanatory video
Teaching Development	<ol style="list-style-type: none">1. Evocation: (5 minutes) The main characteristics of Logic families include: Speed, Fan-in, Fan-out, Noise Immunity, Power Dissipation2. Introduction to – MOS logic families (30 minutes)<ol style="list-style-type: none">1. Start by explaining the –2. The basic Classification of the Logic Families are as follows: A) Bipolar Families B) MOS Families C) Hybrid Devices3. Explain MOS logic families, where all the logic are implemented using transistors. Also discuss advantage and disadvantages of MOS logic families4. Explain Complementary Metal Oxide Semiconductor Logic, (CMOS logic): CMOS has complementary and symmetrical NMOS and PMOS transistors5. Draw and explain two input CMOS NAND gate
Activity (10 minutes)	Prepare a table of differences of MOS and CMOS
Closure	5 minutes <ol style="list-style-type: none">1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. Modern Digital Electronics by R.P.Jain McGraw-Hill 4th (2010), Pg. No 128-131 for MOS and CMOS2. Video lecture: https://www.youtube.com/watch?v=PM-4emVKbQg
Evaluation	Spend 5 minutes to evaluate student assimilation of the lesson contents Quiz will be shared with the students.



	<p>Ask questions</p> <ul style="list-style-type: none">• A TTL circuit acts as a current sink in the _____• The logic family that has the fastest switching action is _____ (TTL, ECL, CMOS, DTL)• Resistors and transistors are used to represent _____ (TTL, ECL, RTL, DTL)
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Lesson Plan No. 26	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	To explore the basic units the latches and flip-flops that are used to design advanced and complicated sequential circuits
Outcomes	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> • Understand the Flip-Flop principle <ul style="list-style-type: none"> - Know the basic Flip-Flops (RS) - Able to analyze timing diagrams.
Teaching Aids (if any)	<ol style="list-style-type: none"> PPT presentation Chalk and Talk Use of Google meet if online Explanatory video
Teaching Development	<ol style="list-style-type: none"> Evocation: (5 minutes) Discuss the difference between combinational and sequential circuits Introduction of RS Flip-Flops (30 minutes) <ul style="list-style-type: none"> • A Flip-Flop is a bistable electronic circuit that has two stable states. • Create a RS Flip-Flop with NAND gates. • Explain RS Flip-Flop, logic circuit and device symbol. • Discuss the truth table for the RS Flip-Flop • If both inputs (R, S) are high at once, the output cannot be determined before; therefore, it is a forbidden state. Clocked RS-FF Flip-Flop can be enabled or disabled. ENABLE low: R and S will have no effect on the output ENABLE high: R and S inputs will be directly transmitted to the output Timing diagram A timing diagram is a drawing to determine the time dependent actions of logic devices.
Activity (10 minutes)	Ask students to built a truth table for a Digital circuits for a RS flip flop using NOR gates as done using u NAND gates
Closure	5 minutes <ol style="list-style-type: none"> Summarize the Lesson Learning Outcomes and get affirmation from students on these. Modern Digital Electronics by R.P.Jain McGraw-Hill 4th (2010), Pg. No 279 to 295 Video lecture: youtube.com/watch?v=Ot3GlduZn74
Evaluation	Spend 5 minutes to evaluate student assimilation of the lesson contents

Quiz will be shared with the students.

Ask questions

Latches constructed with NOR and NAND gates tend to remain in the latched condition due to which configuration feature?

- a) Low input voltages
- b) Synchronous operation
- c) Gate impedance
- d) **Cross coupling**

A basic S-R flip-flop can be constructed by cross-coupling of which basic logic gates?

- a) AND or OR gates
- b) XOR or XNOR gates
- c) **NOR or NAND gates**
- d) AND or NOR gates

Lesson Plan No. 27	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	To explore the basic units the latches and flip-flops that are used to design advanced and complicated sequential circuits
Outcomes	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> • Understand the Flip-Flop principle <ul style="list-style-type: none"> - Know the basic Flip-Flops (JK) - Able to analyze timing diagrams.
Teaching Aids (if any)	<ol style="list-style-type: none"> a. PPT presentation b. Chalk and Talk c. Use of Google meet if online d. Explanatory video
Teaching Development	<ol style="list-style-type: none"> 1. Evocation: (5 minutes) What is difference between RS latch and flipflop 2. Introduction of JK Flip-Flops (30 minutes) <ul style="list-style-type: none"> • A Flip-Flop is a bistable electronic circuit that has two stable states. • Create a JK Flip-Flop with NAND gates. • Explain JK Flip-Flop, logic circuit and device symbol. • Discuss the truth table for the JK Flip-Flop • If both inputs (J, K) are high at once, the output cannot be determined before; therefore, it is a forbidden state. 3. Clocked JK-FF Flip-Flop can be enabled or disabled. ENABLE low: J and K will have no effect on the output ENABLE high: J and K inputs will be directly transmitted to the output 4. Timing diagram A timing diagram is a drawing to determine the time dependent actions of logic devices. 5. Discuss the race around condition in JK flipflop
Activity (10 minutes)	Ask students to built a truth table for a Digital circuits for a JK flip flop using RS flipflop
Closure	5 minutes <ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. Modern Digital Electronics by R.P.Jain McGraw-Hill 4th (2010), Pg. No 279 to 295 2. Video lecture: youtube.com/watch?v=Ot3GlduZn74
Evaluation	Spend 5 minutes to evaluate student assimilation of the lesson contents Quiz will be shared with the students.

Ask questions

The logic circuits whose outputs at any instant of time depends only on the present input but also on the past outputs are called _____

a) Combinational circuits

b) Sequential circuits

c) Latches

When both inputs of a J-K flip-flop cycle, the output will _____

a) Be invalid

b) Change

c) Not change

d) Toggle

Lesson Plan No. 28	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	To explore the basic units the latches and flip-flops that are used to design advanced and complicated sequential circuits
Outcomes	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> • Understand the Flip-Flop principle <ul style="list-style-type: none"> - Know the basic Flip-Flops (T and D) - Able to analyze timing diagrams.
Teaching Aids (if any)	<ol style="list-style-type: none"> a. PPT presentation b. Chalk and Talk c. Use of Google meet if online d. Explanatory video
Teaching Development	<ol style="list-style-type: none"> 1. Evocation: (5 minutes) Race around condition and remedy required. 2. Introduction of D Flip-Flop (15 minutes) <ul style="list-style-type: none"> • The generation of two signals to drive a Flip-Flop is a disadvantage in many applications. This has led to the D-FF, a circuit that needs only a single data input. • Construct D flip flop using SR flip flop and AND gates 3. Construct <i>D Flip-Flop, logic circuit and truth table</i> 4. Timing diagram A timing diagram is a drawing to determine the time dependent actions of logic devices. 5. Introduction of T Flip-Flop (15 minutes) <ul style="list-style-type: none"> • For both inputs (S=0, R=0 and S=1, R=1) do not lead to unallowed states, we can use another type of gated latch called the T-latch. The T-latch is a JK-latch where both data inputs, J and K, are connected. • Construct T flip flop using JK flip flop and NOT gate 6. Construct <i>T Flip-Flop, logic circuit and truth table</i> 7. Timing diagram A timing diagram is a drawing to determine the time dependent actions of logic devices.
Activity (10 minutes)	Create a 4 bit data memory with D-latches (D-FF).

Closure	<p>5 minutes</p> <ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. Modern Digital Electronics by R.P.Jain McGraw-Hill 4th (2010), Pg. No 279 to 295 2. Video lecture: youtube.com/watch?v=Ot3GlduZn74 3. Link for PLC (ladder programming to implement t flipflop https://www.sanfoundry.com/plc-program-implement-t-flip-flop/
Evaluation	<p>Spend 5 minutes to evaluate student assimilation of the lesson contents Quiz will be shared with the students. Ask questions In D flip-flop, D stands for what? Which statement describes the BEST operation of a negative-edge-triggered D flip-flop?</p> <ol style="list-style-type: none"> a) The logic level at the D input is transferred to Q on NGT of CLK b) The Q output is ALWAYS identical to the CLK input if the D input is HIGH c) The Q output is ALWAYS identical to the D input when CLK = PGT d) The Q output is ALWAYS identical to the D input

Lesson Plan No. 29	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	To explore the basic units the latches and flip-flops that are used to design advanced and complicated sequential circuits
Outcomes	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> • Understand the Flip-Flop principle <ul style="list-style-type: none"> - Know the Master slave flipflop - Able to analyze timing diagrams.
Teaching Aids (if any)	<ol style="list-style-type: none"> a. PPT presentation b. Chalk and Talk c. Use of Google meet if online d. Explanatory video
Teaching Development	<ol style="list-style-type: none"> 1. Evocation: (5 minutes) Race around condition and remedy required. 2. Introduction of Master slave JK Flip-Flop (25 minutes) Regardless what the master does, the slave copies it. The slave copies the master on the negative clock edge. This circuit provides a way to avoid racing. 3. Construct <i>JK master slave Flip-Flop, logic circuit and truth table</i> 4. Timing diagram A timing diagram is a drawing to determine the time dependent actions of logic devices. 5. Discuss Preset (PR) and Clear (CLR) are input signals to get a definite start point. 6. Discuss applications JK master Slave Flip - Flops can be used to build counters, JK-FF are the ideal elements for that purpose 7. Discuss the edge triggered flipflops
Activity (10 minutes)	Write Comparison chart for all the flip flops Take a quiz using google form
Closure	5 minutes <ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. Modern Digital Electronics by R.P.Jain McGraw-Hill 4th (2010), Pg. No 279 to 295 2. Video lecture: youtube.com/watch?v=Ot3GlduZn74 3. Link for PLC (ladder programming to implement t flipflop https://www.sanfoundry.com/plc-program-implement-t-flip-flop/
Evaluation	Spend 5 minutes to evaluate student assimilation of the lesson contents Quiz will be shared with the students. Ask questions

In D flip-flop, D stands for what?

Which statement describes the BEST operation of a negative-edge-triggered D flip-flop?

- a) **The logic level at the D input is transferred to Q on NGT of CLK**
- b) The Q output is ALWAYS identical to the CLK input if the D input is HIGH
- c) The Q output is ALWAYS identical to the D input when CLK = PGT
- d) The Q output is ALWAYS identical to the D input

Which flipflop is used eliminate race around condition.

Lesson Plan No. 30	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	To understand the basic functions of registers and shift registers
Outcomes	At the end of the lesson the student shall be able to: <ul style="list-style-type: none"> • Understand different types of registers, • Understand their operations, and learn about their various applications..
Teaching Aids (if any)	<ol style="list-style-type: none"> a. PPT presentation b. Chalk and Talk c. Use of Google meet if online d. Explanatory video
Teaching Development	<ol style="list-style-type: none"> 1. Evocation: (5 minutes) Sequential circuits and flip flop 2. Introduction of Registers and shift registers(25 minutes) A register is basically a storage space for units of memory that are used to transfer data for immediate use by the CPU. A register is a generalization of a flip-flop. Where a flipflop stores one bit, a register stores several bits 3. Elaborate the four different modes in which shift registers operate <ul style="list-style-type: none"> • serial in-serial out • serial in-parallel out • parallel in-serial out <p style="padding-left: 40px;">Each bit is shifted on its own clock pulse</p> 4. A timing diagram all the register and shift register types. 5. Control Signals ☐ When they are asserted, they initiate an action in the register ☐ Asynchronous Control Signals cause the action to take place immediately ☐ Synchronous Control Signals must be asserted during a clock assertion to have an effect ☐ Example 6. Applications of registers
Activity (10 minutes)	Register as a storage elements Take a quiz using google form

Closure	5 minutes 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. Digital Design, by M. Morris Mano, and Michael D Ciletti Pearson, Pearson, 3 rd (2012), Pg. No 276-291 Lecture no 36 https://nptel.ac.in/courses/108/105/108105132/
Evaluation	Spend 5 minutes to evaluate student assimilation of the lesson contents Quiz will be shared with the students.

Lesson Plan No. 30	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	To explore the basic units the latches and flip-flops that are used to design advanced and complicated sequential circuits
Outcomes	At the end of the lesson the student shall be able to: This section deals with some simple and useful sequential circuits. Its objectives are to: <input type="checkbox"/> Introduce registers as multi-bit storage devices. <input type="checkbox"/> Introduce counters by adding logic to registers implementing the functional capability to increment and/or decrement their contents. <input type="checkbox"/> Define shift registers and show how they can be used to implement counters that use the one-hot code.
Teaching Aids (if any)	<ol style="list-style-type: none"> a. PPT presentation b. Chalk and Talk c. Use of Google meet if online d. Explanatory video
Teaching Development	<ol style="list-style-type: none"> 1. Evocation: (5 minutes) Race around condition and remedy required. 2. Introduction of Master slave JK Flip-Flop (25 minutes) Regardless what the master does, the slave copies it. The slave copies the master on the negative clock edge. This circuit provides a way to avoid racing. 3. Construct <i>JK mater slave Flip-Flop, logic circuit and truth table</i> 4. Timing diagram A timing diagram is a drawing to determine the time dependent actions of logic devices. 5. Discuss Preset (PR) and Clear (CLR) are input signals to get a definite start point. 6. Discuss applications JK master Slave Flip - Flops can be used to build counters, JK-FF are the ideal elements for that purpose 7. Discuss the edge triggered flipflops
Activity (10 minutes)	Write Comparison chart for all the flip flops Take a quiz using google form
Closure	<p>5 minutes</p> <ol style="list-style-type: none"> 1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. Modern Digital Electronics by R.P.Jain McGraw-Hill 4th (2010), Pg. No 279 to 295 2. Video lecture: youtube.com/watch?v=Ot3GlduZn74 3. Link for PLC (ladder programming to implement t flipflop https://www.sanfoundry.com/plc-program-implement-t-flip-flop/

Evaluation

Spend 5 minutes to evaluate student assimilation of the lesson contents
Quiz will be shared with the students.

Ask questions

In D flip-flop, D stands for what?

Which statement describes the BEST operation of a negative-edge-triggered D flip-flop?

- a) **The logic level at the D input is transferred to Q on NGT of CLK**
- b) The Q output is ALWAYS identical to the CLK input if the D input is HIGH
- c) The Q output is ALWAYS identical to the D input when CLK = PGT
- d) The Q output is ALWAYS identical to the D input

Which flipflop is used eliminate race around condition.

Lesson Plan No. 32	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	To explore counters by adding logic to registers implementing the functional capability to increment and/or decrement their contents. □ Define shift registers and show how they can be used to implement counters that use the one-hot
Outcomes	At the end of the lesson the student shall be able to: Understand the principle of asynchronous and synchronous counter - Able to design synchronous counter
Teaching Aids (if any)	<ol style="list-style-type: none"> a. PPT presentation b. Chalk and Talk c. Use of Google meet if online d. Explanatory video
Teaching Development	<ol style="list-style-type: none"> 1. Evocation: (5 minutes) Main difference between synchronous and asynchronous counters Why counters are needed? Their applications. 2. Introduction of Synchronous Counters (30 minutes) A counter is a register capable of incrementing and/or decrementing its contents $Q \leftarrow Q \text{ plus } n$ $Q \leftarrow Q \text{ minus } n$. 3. Construct a 3-bit binary synchronous counter and explain its working. 4. Draw the state diagram 5. Timing diagram of a 3-bit binary counter A timing diagram is a drawing to determine the time dependent actions of logic devices. 6. Discuss Preset (PR) and Clear (CLR) are input signals to get a definite start point and using these pins design mod 5 counter 7. Discuss 3-bit binary up/down counter
Activity (10 minutes)	Ask students to design Binary mod 6 counter
Closure	<p>5 minutes Summarize the Lesson Learning Outcomes and get affirmation from students on these.</p> <p>Digital Design, by M. Morris Mano, and Michael D Ciletti Pearson, Pearson, 3rd (2012), Pg. No 307 to 317</p> <p>Nptel video Lecture no 41 and 43 https://nptel.ac.in/courses/108/105/108105132/</p>

Evaluation	Spend 5 minutes to evaluate student assimilation of the lesson contents Quiz will be shared with the students using Google form.

Lesson Plan No. 33	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	To explore counters by adding logic to registers implementing the functional capability to increment and/or decrement their contents. □ Define shift registers and show how they can be used to implement counters that use the one-hot
Outcomes	At the end of the lesson the student shall be able to: Understand the principle of asynchronous and synchronous counter - Able to design asynchronous counter
Teaching Aids (if any)	a. PPT presentation b. Chalk and Talk c. Use of Google meet if online d. Explanatory video
Teaching Development	<ol style="list-style-type: none"> 1. Evocation: (5 minutes) Main difference between synchronous and asynchronous counters Why counters are needed? Their applications. 2. Introduction of Counters (30 minutes) A counter is a register capable of incrementing and/or decrementing its contents $Q \leftarrow Q \text{ plus } n$ $Q \leftarrow Q \text{ minus } n$. 3. Construct a 4-bit binary asynchronous counter and explain its working. 4. Draw the state diagram 5. Timing diagram of a 4-bit binary asynchronous counter A timing diagram is a drawing to determine the time dependent actions of logic devices. 6. Discuss Preset (PR) and Clear (CLR) are input signals to get a definite start point and using these pins design mod 5 counter 7. Discuss 3-bit binary up/down counter
Activity (10 minutes)	Ask students to design Binary mod 10 asynchronous counter
Closure	<p>5 minutes Summarize the Lesson Learning Outcomes and get affirmation from students on these.</p> <p>Digital Design, by M. Morris Mano, and Michael D Ciletti Pearson, Pearson, 3rd (2012), Pg. No 307 to 317</p> <p>Nptel video Lecture no 41 and 43</p>

	https://nptel.ac.in/courses/108/105/108105132/
Evaluation	Spend 5 minutes to evaluate student assimilation of the lesson contents Quiz will be shared with the students using Google form.

Lesson Plan No. 34	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	Identify the behaviour of a system through finite state machine.
Outcomes	At the end of the lesson the student shall be able to: Articulate the Mealy and Moore machines Comparison of the two machine types 3. Timing diagram and state machines
Teaching Aids (if any)	<ol style="list-style-type: none"> PPT presentation Chalk and Talk Use of Google meet if online Explanatory video
Teaching Development	<p>Sequential Design Review(5 minutes): - A binary number can represent 2^n states, where n is the number of bits. - The number of bits required is determined by the number of states. Ex. 4 states requires 2 bits ($2^2 = 4$ possible states) Ex. 19 states requires 5 bits ($2^5 = 32$ possible states) - One flip-flop is required per state bit.</p> <p>Introduction to Designing of Sequential Circuits: (35 minutes)</p> <ol style="list-style-type: none"> Define synchronous sequential circuit. Define state. Define finite state machine. Draw the Moore and Mealy FSM models Compare and contrast the Mealy and Moore models. Compare and contrast current and next state. Define state diagram. Draw the state diagram for a Moore FSM to be designed. Convert the design state diagram into a design state table. Convert the design state table into a truth table using standard binary encoding. Derive the next state and output equations from the design truth table. Draw the state machine schematic using logic symbols on paper.
Activity (10 minutes)	Mealy Machine Vs. Moore Machine: Explore What is the Difference Between Mealy Machine and Moore Machine?
Closure	<p>5 minutes Summarize the Lesson Learning Outcomes and get affirmation from students on these.</p> <p>Nptel video Lecture no 46 https://nptel.ac.in/courses/108/105/108105132/</p>

	https://www.youtube.com/watch?v=fH4zUvUVXn8&t=954s
Evaluation	Spend 5 minutes to evaluate student assimilation of the lesson contents Quiz will be shared with the students using Google form.

Lesson Plan No. 35	Course Name: Digital Electronics	Course No.: ECE-302
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Objectives	Identify the behaviour of a system through finite state machine.
Outcomes	At the end of the lesson the student shall be able to: Articulate the Mealy and Moore machines Comparison of the two machine types 3. Timing diagram and state machines
Teaching Aids (if any)	<ol style="list-style-type: none"> PPT presentation Chalk and Talk Use of Google meet if online Explanatory video
Teaching Development	<p>Sequential Design Review(5 minutes): - A binary number can represent 2^n states, where n is the number of bits. - The number of bits required is determined by the number of states. Ex. 4 states requires 2 bits ($2^2 = 4$ possible states) Ex. 19 states requires 5 bits ($2^5 = 32$ possible states) - One flip-flop is required per state bit.</p> <p>Introduction to Designing of Sequential Circuits: (35 minutes)</p> <ol style="list-style-type: none"> Define synchronous sequential circuit. Define state. Define finite state machine. Draw the state diagram for a Moore FSM to be designed. Convert the design state diagram into a design state table. Convert the design state table into a truth table using standard binary encoding. Derive the next state and output equations from the design truth table. Draw the state machine schematic using logic symbols on paper. Draw a timing diagram that illustrates asynchronous reset followed by operational FSM behavior as inputs change.
Activity (10 minutes)	Mealy Machine Vs. Moore Machine: Explore What is the Difference Between Mealy Machine and Moore Machine?
Closure	<p>5 minutes Summarize the Lesson Learning Outcomes and get affirmation from students on these.</p> <p>Nptel video Lecture no 46 https://nptel.ac.in/courses/108/105/108105132/ https://www.youtube.com/watch?v=fH4zUvUVXn8&t=954s https://byjus.com/gate/difference-between-mealy-machine-and-moore-machine/</p>

Evaluation	Spend 5 minutes to evaluate student assimilation of the lesson contents Quiz will be shared with the students using Google form.
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