Patuakhali Science and Technology University (PSTU)

Faculty of CSE

Laboratory Manual

Course Code: CCE 221

Sessional Primitives

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Course Number: CSE 206
Course Title: Digital Logic Design Lab
Credit Hour: 1.5
Contact Hour per Week: 3
Server Needed (If any): No
Additional Requirements (if any): No

Themes to Be Covered:

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Experiment 1:
Title: Implementing circuit with basic gates

Outline (within 50-100 words): This lab introduces students to basic logic gates and ICs. Students learn how to implement Boolean functions in a digital circuit using logic gates.

Online Task: Implementation of (some) three Boolean functions using logic gates.

Offline Task: Preparation of report (1 report/group) on the experiment performed. The report contains the followings:

- _ Problem Specification.
- _ Required Instruments.
- _ Truth Table.
- _ Circuit diagram with pin number.
- _ Overall discussion on the experiment.

Mode of Evaluation (Presentation, Quiz or Viva):

- Testing and verification of the circuit implemented by each group for the desired input/output combinations.
- Report writing.

Suggested Percentage Weight:

- For successful completion of the experiment (each group member will get): 30/Total number of experiments performed.
- For submitted report: 10/Total number of experimentsperformed.

Experiment 2:
Title: Truth tables and simplification using Boolean algebra.

Outline (within 50-100 words): In this lab students simplifies a given Boolean function and implements the simplified function in a digital circuit that results in optimum number of gate usage.

Online Task: Simplification of given Boolean functions and implementation using logic gates.

Offline Task: Preparation of report (1 report/group) on the experiment performed. The report contains the followings:

- Problem Specification.
- Required Instruments.
- Truth Table.
- Circuit diagram with pin number.
- Answer to some given questions related to the experiment.
- Overall discussion on the experiment.

Mode of Evaluation (Presentation, Quiz or Viva):

- Testing and verification of the circuit implemented by each group for the desired input/output combinations.
- Report writing

Suggested Percentage Weight:

- For successful completion of the experiment (each group member will get): 30/Total number of experiments performed.
- For submitted report: 10/Total number of experiments performed.

Experiment 3:
Title: Truth tables and K-maps.

Outline (within 50-100 words): In this lab students transform a problem description to an equivalent Boolean function, then simplify it using K-map and finally implement the function in a digital circuit.

Online Task: Find the Boolean function that corresponds to a given problem specification, simplify it using K-map and then implement using logic gates.

Offline Task: Preparation of report (1 report/group) on the experiment performed. The report contains the followings:

- Problem Specification.
- Required Instruments.
- Truth Table.
- Circuit diagram with pin number.
- Answer to some given questions related to the experiment.
- Overall discussion on the experiment.
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Mode of Evaluation (Presentation, Quiz or Viva):

- Testing and verification of the circuit implemented by each group for the desired input/output combinations.
- Report writing

Suggested Percentage Weight:

- For successful completion of the experiment (each group member will get): 30/Total number of experiments performed.
- For submitted report: 10/Total number of experiments performed.

Experiment 4:
Title: Encoder and Decoder Circuits.

Outline (within 50-100 words): This lab introduces students to some MSI circuits, namely encoder and decoder. Students learn how to implement complex Boolean functions using MSI circuits instead of using basic gates.

Online Task: Implementation of given Boolean functions using encoders and decoders.
Offline Task: Preparation of report (1 report/group) on the experiment performed. The report contains the followings:

- Problem Specification.
- Required Instruments.
- Truth Table.
- Circuit diagram with pin number.
- Answer to some given questions related to the experiment.
- Overall discussion on the experiment.

Mode of Evaluation (Presentation, Quiz or Viva):

- Testing and verification of the circuit implemented by each group for the desired input/output combinations.
- Report writing

Suggested Percentage Weight:

- For successful completion of the experiment (each group member will get): 30/Total number of experiments performed.
- For submitted report: 10/Total number of experiments performed.

Experiment 5:
Title: Design using Multiplexers.

Outline (within 50-100 words): In this lab students learn a very interesting (as well as useful) technique of implementing complex Boolean functions using multiplexers.
Online Task: Implementation of some given Boolean functions using multiplexers.
Offline Task: Preparation of report (1 report/group) on the experiment performed. The report contains the followings:

- Problem Specification.
- Required Instruments.
- Truth Table.
- Circuit diagram with pin number.
- Answer to some given questions related to the experiment.
- Overall discussion on the experiment.

Mode of Evaluation (Presentation, Quiz or Viva):

- Testing and verification of the circuit implemented by each group for the desired input/output combinations.
- Report writing

Suggested Percentage Weight:

- For successful completion of the experiment (each group member will get): 30/Total number of experiments performed.
- For submitted report: 10/Total number of experiments performed.

Experiment 6:
Title: Arithmetic circuit design.

Outline (within 50-100 words): In this lab students learn how to design a digital circuit that performs useful arithmetic operations such as addition and subtraction.

Online Task: Design and implementation of digital circuits that perform comparison and subtraction operation.

Offline Task: Preparation of report (1 report/group) on the experiment performed. The report contains the followings:

- Problem Specification.
- Required Instruments.
- Truth Table.
- Circuit diagram with pin number.
- Answer to some given questions related to the experiment.
- Overall discussion on the experiment.
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Mode of Evaluation (Presentation, Quiz or Viva):

- Testing and verification of the circuit implemented by each group for the desired input/output combinations.
- Report writing

Suggested Percentage Weight:

- For successful completion of the experiment (each group member will get): 30/Total number of experiments performed.
- For submitted report: 10/Total number of experiments performed.

Experiment 7:
Title: Circuit design using IC 7483.

Outline (within 50-100 words): In this lab students learn how to use a commercially available adder IC 7483 to perform arithmetic operations.

Online Task: Implementation of given arithmetic operations (addition and subtraction) using 7483.

Offline Task: Preparation of report (1 report/group) on the experiment performed. The report contains the followings:

- Problem Specification.
- Required Instruments.
- Truth Table.
- Circuit diagram with pin number.
- Answer to some given questions related to the experiment.

- Overall discussion on the experiment.

Mode of Evaluation (Presentation, Quiz or Viva):

- Testing and verification of the circuit implemented by each group for the desired input/output combinations.
- Report writing

Suggested Percentage Weight:

• For successful completion of the experiment (each group member will get): 30/Total number of experiments performed.

• For submitted report: 10/Total number of experiments performed.

Experiment 8:
Title: Flip-Flops.

Outline (within 50-100 words): This is the first experiment related to sequential circuits. It introduces students to the "FLIP-FLOP" – basic building block of any sequential circuit.

Online Task: Implementation of S-R and master slave J-K flip flop.

Offline Task: Preparation of report (1 report/group) on the experiment performed.
The report contains the followings:

- Problem Specification.
- Required Instruments.
- Truth Table.
- Circuit diagram with pin number.
- Answer to some given questions related to the experiment.
- Overall discussion on the experiment.

Mode of Evaluation (Presentation, Quiz or Viva):

- Testing and verification of the circuit implemented by each group for the desired input/output combinations.
- Report writing

Suggested Percentage Weight:

- For successful completion of the experiment (each group member will get): 30/Total number of experiments performed.
- For submitted report: 10/Total number of experiments performed.

Experiment 9:
Title: Registers.

Outline (within 50-100 words): Registers are integral component of any microprocessor system. Registers are used to store data for fast access. They also allow performing useful operations on the stored data such as shift and rotate.

Online Task: Design and implement a 4-bit universal shift register.

Offline Task: Preparation of report (1 report/group) on the experiment performed. The report contains the followings:

- Problem Specification.
- Required Instruments.
- Truth Table.
- Circuit diagram with pin number.
- Answer to some given questions related to the experiment.
- Overall discussion on the experiment.

Mode of Evaluation (Presentation, Quiz or Viva):

- Testing and verification of the circuit implemented by each group for the desired input/output combinations.
- Report writing

Suggested Percentage Weight:

- For successful completion of the experiment (each group member will get): 30/Total number of experiments performed.
- For submitted report: 10/Total number of experiments performed.

Experiment 10:
Title: Counters.

Outline (within 50-100 words): In this lab students learn how to design counters using flip flops

Online Task: Design and implementation of synchronous and asynchronous counters using T FLIP FLOPs.

Offline Task: Preparation of report (1 report/group) on the experiment performed. The report contains the followings:

- Problem Specification.
- Required Instruments.
- Truth Table.
- Circuit diagram with pin number.
- Answer to some given questions related to the experiment.
- Overall discussion on the experiment.

Mode of Evaluation (Presentation, Quiz or Viva):

- Testing and verification of the circuit implemented by each group for the desired input/output combinations.
- Report writing

Suggested Percentage Weight:

- For successful completion of the experiment (each group member will get): 30/Total number of experiments performed.
- For submitted report: 10/Total number of experiments performed.

Experiment 11:

Title: Sequence Detector.

Outline (within 50-100 words): A sequence detector detects a given sequence from a binary stream (sequence of 0's and 1's). Such a circuit has wide range of applications such as recognizing number in a digital telephone. In this lab students learn how to design and implement a sequence detector in digital circuit.

Online Task: Design and implementation of a digital circuit that detects a given sequence.

Offline Task: Preparation of report (1 report/group) on the experiment performed. The report contains the followings:

- Problem Specification.
- Required Instruments.
- Truth Table.
- Circuit diagram with pin number.
- Answer to some given questions related to the experiment.
- Overall discussion on the experiment.

Mode of Evaluation (Presentation, Quiz or Viva):

- Testing and verification of the circuit implemented by each group for the desired input/output combinations.
- Report writing

Suggested Percentage Weight:

- For successful completion of the experiment (each group member will get): 30/Total number of experiments performed.
- For submitted report: 10/Total number of experiments performed.

Experiment 12:

Title: BCD-to-7 Segment display.

Outline (within 50-100 words): A seven-segment display (SSD), or seven-segment indicator, is a form of electronic display device for displaying BCD numerals that is an alternative to the more complex dot matrix displays. Seven-segment displays are widely used in digital clocks, electronic meters, and other electronic devices for displaying numerical information.

Online Task: Design and implementation of a BCD-to-7 segment display circuit.

Offline Task: Preparation of report (1 report/group) on the experiment performed. The report contains the followings:

- Problem Specification.
- Required Instruments.
- Truth Table.
- Circuit diagram with pin number.
- Answer to some given questions related to the experiment.
- Overall discussion on the experiment.

Mode of Evaluation (Presentation, Quiz or Viva):

- Testing and verification of the circuit implemented by each group for the desired input/output combinations.
- Report writing

Suggested Percentage Weight:

- For successful completion of the experiment (each group member will get): 30/Total number of experiments performed.
- For submitted report: 10/Total number of experiments performed.

Semester End Assessment:

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Term Assignment: N. A
Name of the Term Assignment:
Basic Requirement of the Term Assignment:
Total Duration of the Assignment:
Presentation Requirement:
Demonstration Requirement:
Reporting Requirement:
Mark Distribution:
Mark Distribution of a Particular Deliverable:
Schedule of the Assignment:

Final Viva: Since all the experiments are performed in group, viva is necessary for individual evaluation. There are two viva's. The first viva is on Experiments 1-6 and the second one on Experiments 7-11. A total of 05% marks of complete evaluation is equally distributed to the two viva's. **Quiz:** Questions asked in the viva may not be uniform from section to section. Moreover time available for evaluating each student through viva is not sufficient. Besides some students fail to perform in viva due to time pressure. Hence a general quiz (written exam) is essential. Quiz covers all the important materials in experiments 1-11. Quiz holds 20% marks.

Reference Material:

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Books/Papers: *Digital Design*, **Morris M. Mano** (3rd edition)
Website (if any): Generally not necessary
Handout (if any): Generally not necessary
Others: Generally not necessary

Course Teacher 1:

Course Teacher 2:

Chairman: