B.Sc. Engg. (CSE)/HDCSE, 4th Sem. Date: October 28, 2016 (Morning)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Semester Final Examination Summer Semester, A. Y. 2015-2016
Course No.: EEE 4435 Time: 3 Hours
Course Title: Digital Electronics and Pulse Techniques Full Marks: 150

*There are **8 (eight)** questions.* Answer **any 6 (six)** questions. All questions carry equal marks. Marks in the margin indicate full marks. Programmable calculators are not allowed. Do not write on this question paper. All symbols bear their usual meanings. Make reasonable approximation(s) for missing information.

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1. a) Reference voltage of a 3-bit flash ADC is +8V. When will this circuit generate binary output of 101 and 011? Explain by drawing the circuit diagram. 10

   b) Why is 44.1 kHz chosen as audio CD sampling frequency? 4

   c) Explain the step-by-step conversion (4-bit) of a constant input voltage of 7.04 V for the successive approximation type ADC. Compare the conversion time of this type of ADC with others. Does it have a fixed conversion time? 8+3

2. a) Mention the performance characteristics of a Digital to Analog Converter (DAC). 6

   b) What is the disadvantage of binary-weighted input DAC? Resolution of an n-bit DAC is 0.392%. Find out the value of n. 3+4

   c) Determine the outputs of a 4-bit R/2R ladder DAC circuit for inputs: 0100 and 0001. 6+6

3. a) What does it mean to program a programmable logic array (PLA)? Explain the operating principle of a PLA. 3+7

   b) Explain the terms 'power dissipation' and 'fan-out' of a logic gate. 3+5

   c) What are the typical applications of a pulse generator? Briefly explain the functionality of a blocking oscillator. 3+4

4. a) Show a single transistor NOR gate implementation. Implement two input NAND logic using dual transistors. 5+5

   b) Show inverter, two input NAND and NOR gate implementation using CMOS logic. 2+3+3

   c) Using diode logic, implement the output $X = (A+D).(B+C)$. 7

5. a) Clarify the 'virtual ground' concept in an OP-AMP circuit. Derive the expression of output voltage for an inverting amplifier circuit 5+10

   b) Show a quantitative approach to calculate the value of common mode rejection ratio (CMRR) of an OP-AMP circuit. 10

6. a) Define retriggerable and non-retriggerable monostable multivibrator. Show that the period of oscillation of an OPAMP based one-shot circuit is T = 0.69RC. 3+11

b) Explain the circuit operation of basic BJT bistable multivibrator. 7

c) Explain electroluminescence and color of the light emitted by an LED. 4

7. a) What is the purpose of precision rectifier? Design and verify a precision full wave rectifier where output will be the absolute value of the input. 2+10

b) Design a 1 kHz unipolar triangular waveshape generator circuit with V_{UT} = 4.7V, $-V_{sat}$ = -13.8V. 10

c) Define tri-state logic. 3

8. a) Explain transistor operation for switch condition in both cut-off and saturation states. 7

b) Design a dual OP-AMP voltage subtractor circuit where output V_0 = -20 (V_2-V_1); V_1 and V_2 are the inputs given from first and second OP-AMP respectively. Then design a single OP-AMP voltage subrtactor circuit with unity gain. 7+5

c) Briefly explain the important parameters of an analog switch. 6