B.Sc. Engg. (EE)/HDEE, 3rd Sem. Date: March 04, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination — Winter Semester, A. Y. 2018-2019
Course No.: EEE 4307 — Time: 90 Minutes
Course Title: Digital Electronics — Full Marks: 75

There are **4 (four)** questions. Answer **any 3 (three)** 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.

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1. Assume an aribirtary number system 'Base 32' having 32 bases. The symbols of 'Base 32' number system and their equivalent decimal values are shown in Table I.

Base 32	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Decimal	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Base 32	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
Decimal	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

Table I

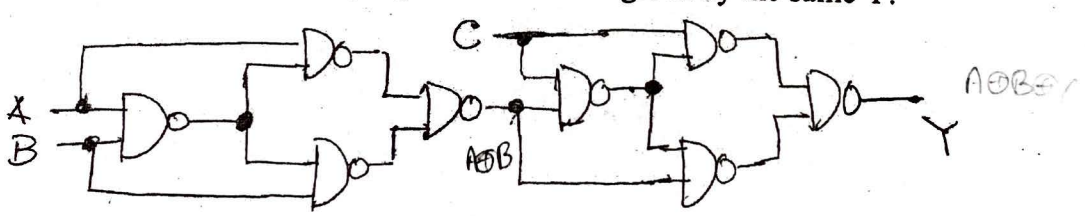
a) Find the value of X. 12
(i) $(MNOP\ .\ 9A)_{32} = (X)_{10}$
(ii) $(667154271276727\ .\ 45735)_8 = (X)_{32}$
(iii) $(16QP32\ .\ DE)_{32} = (X)_{16}$

b) (i) Determine the value of base x if $(225525)_x = (IUT)_{32}$. 10
(ii) Use 31's complement to perform the following subtraction operation.
$(IVDK24M5)_{32} - (G1NDKV)_{32}$

c) (i) Find the decimal number of the 4221 BCD code: 1001 0101. 3
(ii) Find the Gray code for the binary number: 11011.

2. a) Design a full-subtractor. Show the truth table and construct Boolean expression for all possible inputs. Draw the logic diagram. Realize this using half-subtractor and other necessary gates. Implement it by 4 × 1 MUX. 10

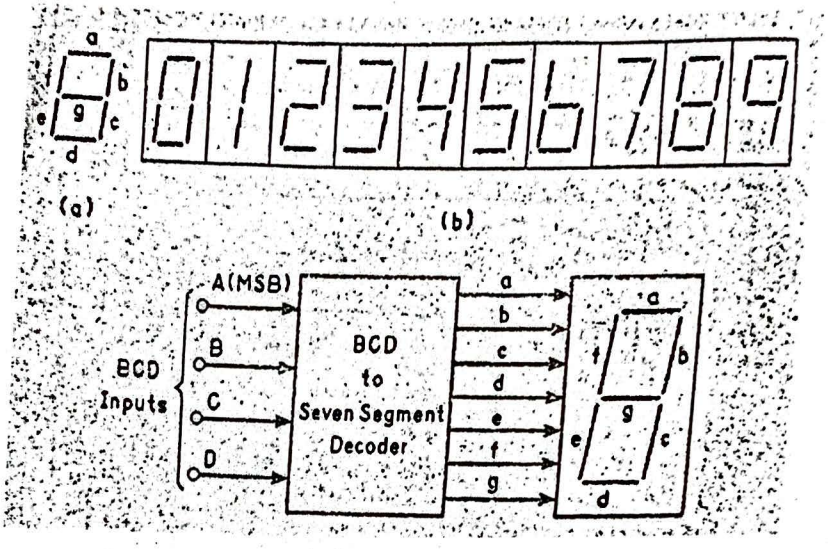
b) Find the truth table for the function 6
$Y = A \ominus B \ominus C$.
Show the output of the following logic circuit is also given by the same Y.



c) Implement the following function with 8 × 1 MUX. Choose the select line w, y , z as S_2, S_1, and S_0 and x in the input line. 9
$F(w, x, y, z) = \Pi\ (2, 5, 6, 7, 10, 11, 12, 13, 14)$

1100
10010

3. A digital display that consists of seven LED segments is commonly used to display decimal numerals in digital systems. For using this display device, the data has to be converted from some binary code to the code required for the display. Usually the binary code used is natural BCD. The following figures show the display device and the segments which must be illumanted for each of the numerals and the display system.



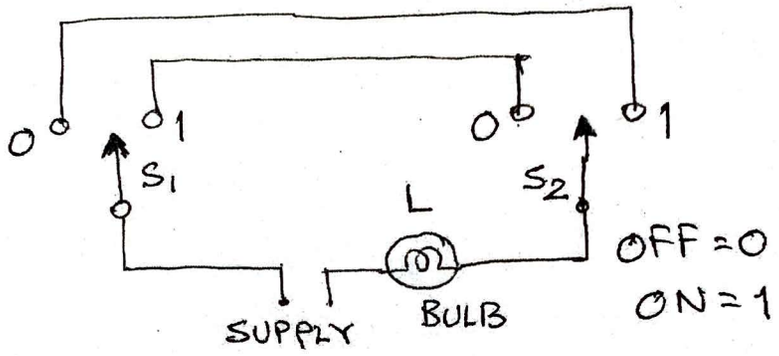
Design a BCD to Seven Segment Decoder using minimum number of SSI gates.

4 a) The control unit for a chemical process is to be designed. Temperature and pressure are the two variables to be controlled. The control is exercised by switching a heater on or off and by opening or closing a valve. The control scheme is shown below where the central square represents normal operation. 10

Pressure \ Temperature	01	11	10
10	Heater off Valve open Alarm off	Heater off Valve open Alarm off	Heater off Valve open Alarm on
11	Heater on Valve closed Alarm off	Heater off Valve closed Alarm off	Heater off Valve closed Alarm off
01	Heater off Valve open Alarm on	Heater off Valve closed Alarm off	Heater off Valve closed Alarm off

Assign suitable binary variables and construct the K-maps for the two outputs controlling the heater and the valve, as well as for the alarm. Obtain expressions for the three outputs in the minimal sum of products and in the minimal product of sums form.

b) A staircase light shown in the following figure is controlled by two switches, one at the top of the stairs and other at the bottom of the stairs. 6



EX-~~NOT~~OR

(i) Make a truth table for this system.

(ii) Write the logic equation in SOP and POS form.

(iii) Realize the circuit by only X-OR gate.

(iv) Implement the same circuit using two input NAND gate only.

c) For the given K-Map, make the truth table for the 4-variable (A, B, C, D) where A is the MSB and D is LSB. 9

(i) Find the SOP and POS.

(ii) Implement the logic functions by using X-OR gates only.

AB \ CD	00	01	11	10
00		1		1
01	1		1	
11		1		1
10	1		1	

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
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DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4303
Course Title: Electronics II

Winter Semester, A.Y. 2018-2019
Time: 90 Minutes
Full Marks: 75

There are **4 (four)** questions. Answer **any 3 (three)**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. Symbols carry their usual meanings.

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1. a) What are the advantages and disadvantages of active and passive filters? 7

   b) What are the types of active filter? Draw their corresponding circuit diagrams and write transfer functions. 8

   c) Derive the voltage transfer function of a first order active low pass filter and design it, such that the input resistance is 20 kΩ, the low-frequency gain is −15, and the −3 dB frequency is 5 kHz. 10

2. a) Design a summing op-amp to produce the output $v_0 = -10v_{I1} - 4v_{I2} + 5v_{I3} + 2v_{I4}$. The smallest resistor value allowable is 20 kΩ. 15

   b) Consider the voltage-to-current converter shown in Fig. 2(b). The load impedance is Z_L = 200 Ω and the input voltage is $v_i = -3$ V. Determine the load current i_L and the output voltage v_o if R_1 = 10 kΩ, R_2 = 1.5 kΩ, R_3 = 3 kΩ and R_F = 20 kΩ. 10

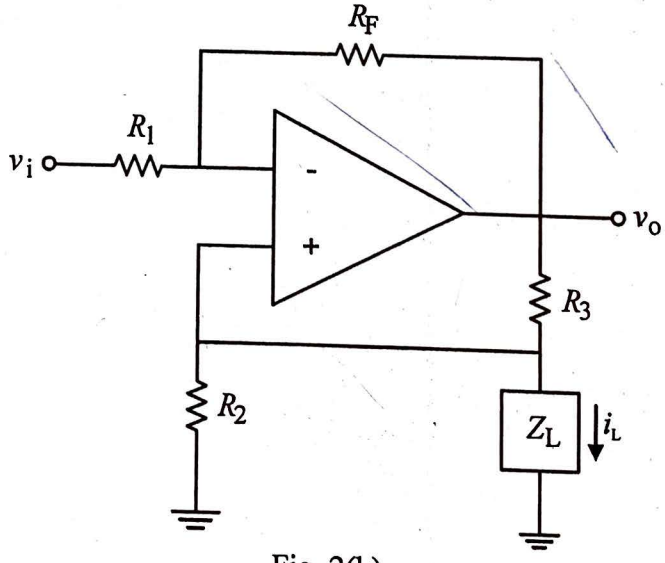

Fig. 2(b)

3. a) Briefly explain a precision half-wave rectifier circuit using an op-amp and a diode. 7

   b) Draw the bode plots for the transfer function $H(s) = \frac{5(s+2)}{s(s+10)}$. 8

   c) Design an amplifier system with three inverting op-amps circuits in cascade such that the overall closed-loop voltage gain is $A_v = \frac{v_0}{v_i} = -300$. The maximum resistance is limited to 200 kΩ and the minimum resistance is limited to 20 kΩ. In addition, the maximum current in any resistor is to be limited to 60 μA, when v_0 = 6 V. 10

4. a) Briefly explain the bandwidth extension and show that the gain-bandwidth product of a feedback amplifier is a constant.

b) Derive the ideal form of the general feedback transfer function and define the loop gain factor.

c) The open-loop gain of an amplifier is $A = 5 \times 10^4$. If the open-loop gain decreases by 10 percent, the closed-loop gain must not change by more than 0.1 percent. Determine the required value of the feedback transfer function β and the closed-loop gain A_f.

B.Sc. Engg.(EE) 3rd Sem.
BScTE (2Yr) 1st Sem.

Date: March 07, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: Math 4321/Math 4529
Course Title: Transform Techniques and Linear Algebra

Winter Semester, A.Y. 2018-2019
Time: 90 Minutes
Full Marks: 75

There are **4 (four)** questions. Answer **any 3 (three)** 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. Symbols carry their usual meanings.

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1. a) Find $L\{e^{-2t}t\sin t\cos^2 t\}$ and hence evaluate $\int_0^\infty e^{-2t}t\sin t\cos^2 t\,dt$. 12

b) If $L\{F(t)\}=f(s)$, then show that $\left\{\frac{F(t)}{t}\right\}=\int_s^\infty f(u)\,du$ and use this to find 13

$$L\left\{\frac{e^{-at}-e^{-bt}}{t}\right\}.$$

2. Evaluate the following:

(i) $L^{-1}\left\{\frac{5s-2}{3s^2+4s+8}\right\}$, 8

(ii) $L^{-1}\left\{\frac{6s^2+22s+18}{s^3+6s^2+11s+6}\right\}$ and 8

(iii) $L^{-1}\left\{\frac{1}{s^2(s^2+4)}\right\}$ by using convolution theorem. 9

3. a) Let $\mathbf{u}=(1,-1,3,5)$, $\mathbf{v}=(2,1,0,-3)$ and $\mathbf{w}=(1,-4,9,18)$. Find scalars a and b so that $a\mathbf{u}+b\mathbf{v}=\mathbf{w}$. 12

b) Find two vectors of norm 1 that are orthogonal to the three vectors $\mathbf{u}=(2,1,-4,0)$, $\mathbf{v}=(-1,-1,2,2)$ and $\mathbf{w}=(3,2,5,4)$. 13

4. a) Write down the definition of vector space including 10 axioms. Give an example of vector space and show that it satisfies axioms 1, 6 and 4 (closed under vector addition and scalar multiplication and axiom about zero element). 15

b) What is subspace? Determine which of the following are subspaces of $\mathbf{R}^3$. 10
(i) Set of all vectors of the form (a, 0, b), where a, b are any real numbers.
(ii) Set of all vectors of the form (a, b, c), where $b=a+c+1$ and a, b, c are any real numbers.

B.Sc. Engg. (EE) / HDEE, 3rd Sem.
DTE 1st Sem.

Date: March 8, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid Semester Examination
Course No.: EEE 4301 / EEE 4395
Course Title: Power System I

Winter Semester, A.Y. 2018-2019
Time: 90 Minutes
Full Marks: 75

There are **4 (four)** questions. Answer **any 3 (three)** questions. All questions carry equal marks. Marks in the right margin indicate full marks. Programmable calculators are not allowed. Do not write on this question paper. Symbol(s) preserve their usual meanings. Assume reasonable value if necessary.

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1. a) A string of suspension insulators consists of three units. The capacitance between each link pin and earth is one-sixth of the self-capacitance of each unit. If the maximum voltage per unit is not to exceed 35 kV, 12
   (i) determine the maximum voltage that the string can withstand,
   (ii) calculate the string efficiency.

   b) Each line of a 3-phase system is suspended by a string of 3 identical insulators of self-capacitance C farad. The shunt capacitance of connecting metal work of each insulator is 0·2C to earth and 0·1 C to line. Find the string efficiency of the system if a guard ring increases the capacitance to the line of metal work of the lowest insulator to 0·3 C. 13

2. a) Single phase ring distributor ABC is fed at A. The loads at B and C are 40 A at 0·8 p.f. lagging and 60 A at 0·6 p.f. lagging, respectively. Both power factors expressed are referred to the voltage at point A. 09
   The total impedance of sections AB, BC and CA are 2 + j1, 2 + j3 and 1 + j2 ohms, respectively. Determine the current in each section.

   b) 3-phase ring main ABCD fed at A at 11 kV supplies balanced loads of 50 A at 0.8 p.f. lagging at B, 120 A at unity p.f. at C and 70 A at 0·866 lagging at D, the load currents being referred to the supply voltage at A. The impedances of the various sections are: Section AB = (1 + j 0·6) Ω ; Section BC = (1·2 + j 0·9) Ω ; Section CD = (0·8 + j 0·5) Ω ; Section DA = (3 + j 2) Ω. Calculate the currents in various sections and station bus-bar voltages at B, C and D. 16

3. a) Electric power of 50 MW is to be transmitted over a 132 KV, 3-phase, 3-wire transmission line. The length of the line is 300 km and the efficiency of transmission is 85%. Aluminium is used for conductor material which has resistivity of 3×10^{-9} Ωm. Calculate the volume of conductor material required for a power factor of 0·8 lagging. 12

   b) A sub-station supplies power at 11 kV, 0·8 p.f. lagging to a consumer through a single phase transmission line having total resistance (both go and return) of 0.15 Ω. The voltage drop in the line is 15%. If the same power is to be supplied to the same consumer by two wire d.c. system by a new line having a total resistance of 0·05 Ω and if the allowable voltage drop is 25%, calculate the d.c. supply voltage. 13

4. a) The terminals of a single phase a.c. generator which has an internal resistance of 2 Ω and an equivalent internal inductive reactance of 6 Ω are connected to a particular RLC series branch, the R of which is 10 Ω, ωL of which is 20 Ω and 1/ωC of which is 40 Ω. If the magnitude of the internally generated emf is 500 V, find the current that flows in the series circuit and the terminal voltage of the generator. Also draw the phasor diagram illustrating necessary voltages and currents. 15

b) A 110 kV, 50 Hz, 175 km long three phase transmission line consists of three 1.2 cm diameter stranded copper conductors spaced in a 2 m delta arrangement. Assume that temperature is 25° C and barometric pressure 74 cm. Assume surface irregularity factor m = 0.85 (roughness factor), m_v for local corona = 0.72 and m_v for general corona = 0.82. Find: 10

i) Disruptive critical voltage.
ii) Visual corona voltage for local corona.
iii) Visual corona voltage for general corona.
iv) Power loss due to corona using Peek's formula under fair weather and wet weather.

B.Sc. Eng. (EEE) 3rd Semester — 12 March 2019 (Afternoon)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF MECHANICAL AND CHEMICAL ENGINEERING

Mid Semester Examination — Summer Semester, A.Y. 2018-2019
Course Code: MCE 4391 — Time : 1.5 hours
Course Title: Basic Mechanical Engineering — Full Marks : 75

There are **4 (four)** Questions. Answer any **Three**.
Marks in the Margin indicate the full marks. Programmable calculators are not allowed.

1	a)	What is fuel? Write down the requirements of a good fuel?	7
	b)	What are the intensive and extensive properties of sytem? What is quasi-equilibrium process?	8
	c)	A Carnot heat engine receives 750 kJ of heat from a high-temperature source at 685°C and rejects heat to a low-temperature sink at 35°C. Determine the (i) thermal efficiency of this heat engine and (ii) amount of heat rejected from the sink per cycle.	10
2	a)	What are the boiler mountings and accessories? What are the differences between fire tube and water tube boiler?	7
	b)	Why is the Carnot cycle not a practically viable cycle? What are the differences between Otto cycle and Diesel cycle?	7
	c)	In a Diesel cycle, the compression ratio is 16. Compression begins at 0.15 MPa, 45°C. The heat added is 1500 MJ/kg. Find (i) the maximum temperature in the cycle, (ii) work doen per kg of air (iii) the cycle efficiency, (d) the temperature at the end of the isentropic expansion, (iv) the cut-off ratio and (v) the MEP of the cycle.	11
3	a)	Draw the schematic of Francis Turbine. Label the important components of it.	8
	b)	What is the function of the guide vane of a Francis turbine?	4
	c)	Mention the differences between the Francis and Kaplan turbine.	6
	d)	In kaptai hydroelecetic dam, there are five turbines (2 x 40 MW and 3 x 50 MW). The average height of the dam is 30 m. The turbines are rotating 150 rpm. Find the specific speed of the turbine. Based on specific speed, comment which types of turbines is running in Kaptai dam.	7
4	a)	What are the differences among fan, blower and compressor?	6
	b)	What does a spear valve in Pelton wheel do? With a schematic show how it works.	7
	c)	A Pelton turbine rotates at an angular speed of 400rpm, developing 67.5 kW under a head of 60 m of Water. The inlet pipe diameter at the base of the single nozzle is 200 mm. The operating conditions are velocity coefficient, $C_v = 0.97$; speed factor, $\varphi = 0.46$, and efficiency $nT = 0.83$. Determine (i) The volumetric Flow rate, (ii) The diameter of the jet, (iii) the wheel diameter, and (iv) the pressure in the inlet pipe at the nozzle base.	12