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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4101
Course Title: Electrical Circuit I

Summer 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 for parts of the questions are indicated in the right margin. Programmable calculators are not allowed. Do not write on this question paper. Symbols carry their usual meanings.

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1. a) The charge entering the upper terminal of the BOX in Figure 1(a) is shown below. How much energy is absorbed by the BOX between 0 and 9 seconds? 13

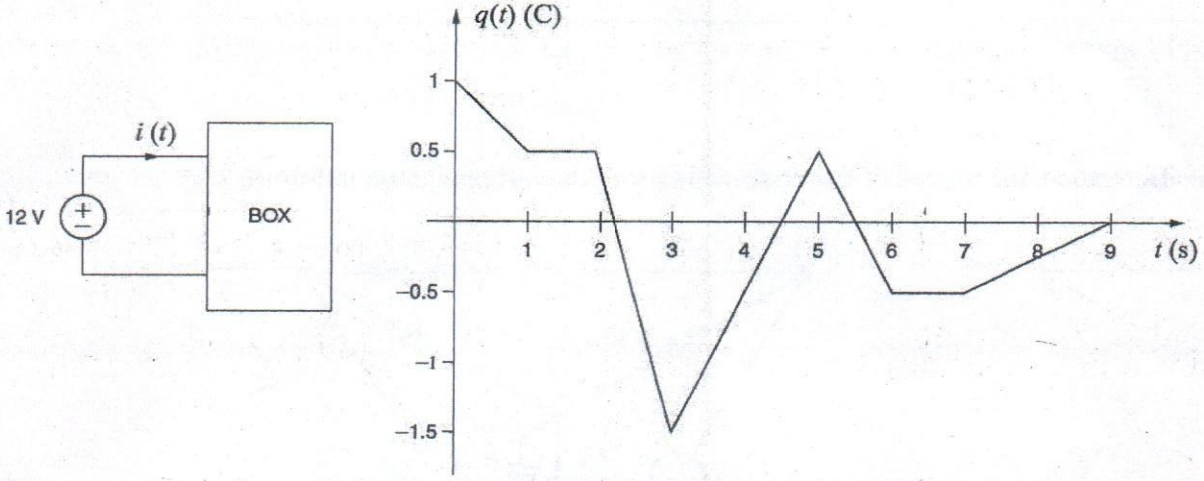

Figure 1(a)

b) Find the power absorbed/supplied by the dependent source shown in Figure 1(b). 12

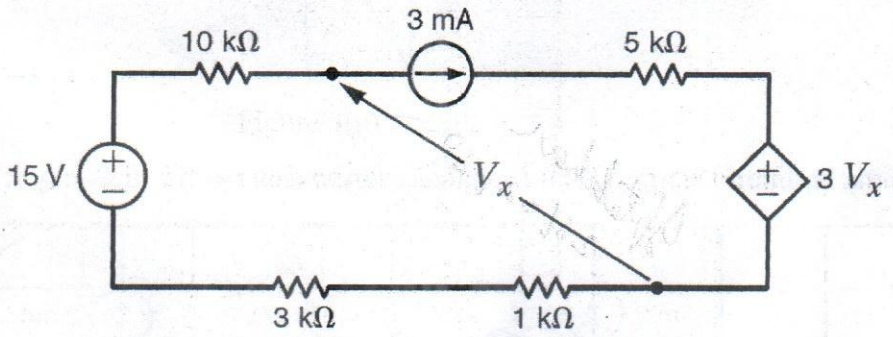

Figure 1(b)

2. a) An element is represented by the relation between current and voltage as 13

$$v = 3i + 5.$$

Determine whether the element is linear or not.

b) Calculate the node voltages v_1, v_2 and v_3 in the circuit of Figure 2(b). 12

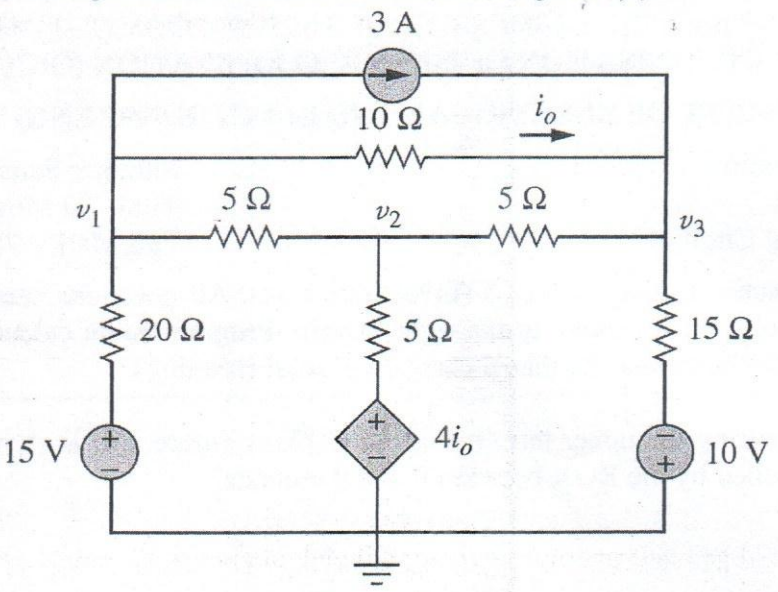

Figure 2(b)

3. a) Determine the values of the node voltages of the circuit shown in Figure 3(a). 13

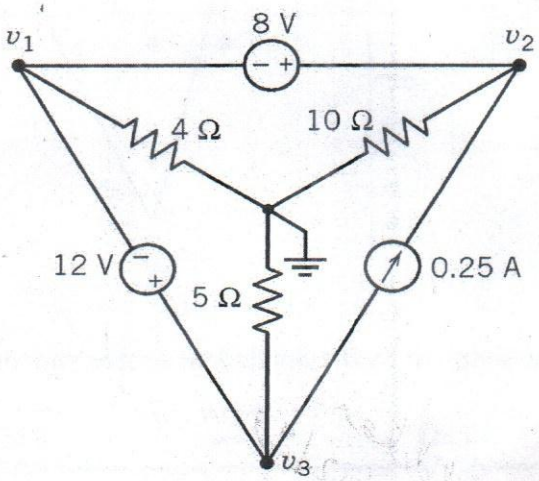

Figure 3(a)

b) Find *Vo* in the circuit of Figure 3(b) using mesh current analysis. 12

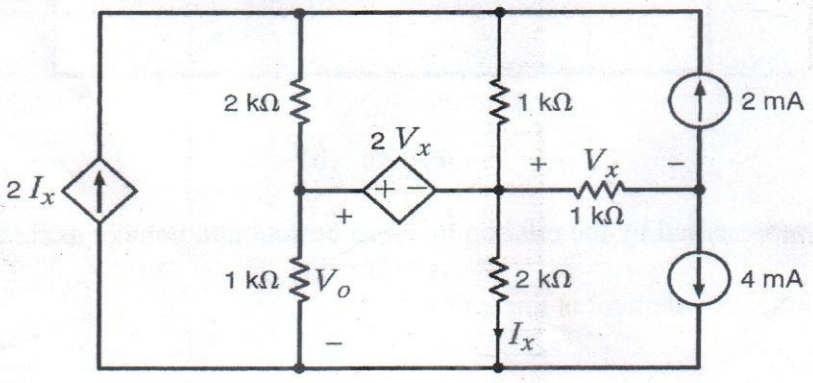

Figure 3(b)

4. a) Find I_o in the circuit of Figure 4(a) using superposition. 13

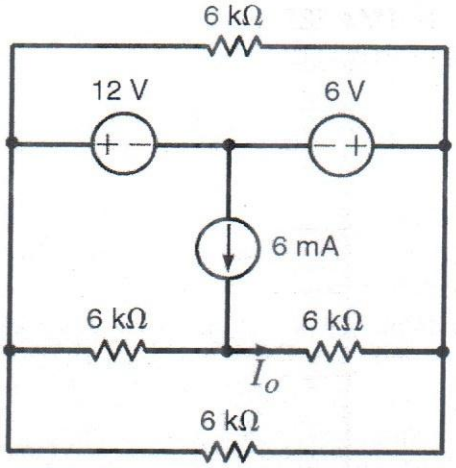

Figure 4(a)

b) Calculate the maximum power that can be transferred to R_L in the circuit of Figure 4(b). 12

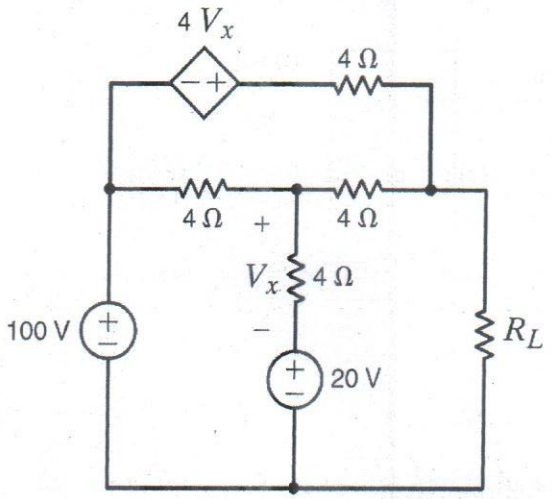

Figure 4(b)

B.Sc. Engg.(EE), 1st Sem. Date: March 12, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: Math 4121
Course Title: Mathematics 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 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 the condition for which the general equation of second degree represents a pair of straight lines. 13

   b) Identify the curve $17x^2+18xy-7y^2-16x-32y-18=0$. Reduce the equation to its standard form. 12

2. a) Test the continuity and differentiability of the following function: 13

$$f(x)=\begin{cases}5x-4 & 0<x\le 1\\ 4x^2-3x & 1<x<2\\ 3x+4 & x\ge 2\end{cases} \quad \text{at } x=1 \text{ and } x=2.$$

   b) If $y=\dfrac{1}{x^2+9}$ find y_n. 12

3. a) If $y=(x^2-1)^n$, then show that $(x^2-1)y_{n+2}+2xy_{n+1}-n(n+1)y_n=0$. 13

   b) Expand $x^4+4x^3+6x^2+4x+1$ in powers of $x+1$. 6

   c) Evaluate $\underset{x\to\frac{\pi}{2}}{Lt}(\sin x)^{\tan x}$. 6

4. a) State Euler's theorem. If $u=f(y-z,z-x,x-y)$ then prove that $\dfrac{\partial u}{\partial x}+\dfrac{\partial u}{\partial y}+\dfrac{\partial u}{\partial z}=0$. 13

   b) Prove that the curves $\dfrac{x^2}{a}+\dfrac{y^2}{b}=1$ and $\dfrac{x^2}{a'}+\dfrac{y^2}{b'}=1$ will cut orthogonally if $a-b=a'-b'$. 12

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B.Sc. Engg.(EE)/HDEE, 1st Sem. Date: March 07, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: Phy 4121
Course Title: Engineering Physics 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 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) Briefly explain Thomson Plum Pudding and Rutherford atom models. What are the successes and failures of these models? 10

   b) According to Bohr atom model show that the expressions for radii and energies of orbiting electrons in an atom are $r_n = \frac{n^2 h^2 \varepsilon_0}{\pi m e^2}$ and $E_n = -\frac{me^4}{8\varepsilon_0^2 h^2}\frac{1}{n^2}$, respectively, where the symbols have their usual meaning. 15

2. a) Why the interatomic or intermolecular bond exists in solid? Briefly explain various types of bonds in solids. 10

   b) Draw a typical unit cell of sodium chloride crystal. What is lattice energy? Derive an expression for lattice energy of sodium chloride crystal. 15

3. a) What is interference of light? Write down the conditions for constructive and destructive interference of light. 10

   b) Draw schematically the arrangement of Fresnel bi-prism experiment. Explain how the wavelength of light can be determined with the help of a Fresnel's bi-prism. 10

   c) Suppose that Young's experiment is performed with blue-green light of wavelength 500 nm. The slits are 1.20 mm apart, and the viewing screen is 5.40 m from the slits. How far apart are the bright fringes near the center of the interference pattern? 5

4. a) What do you mean by diffraction of light? Distinguish between Fresnel and Fraunhofer classes of diffraction. 8

   b) What is diffraction grating? Write down grating equation by mentioning each term. A diffraction grating having 180 lines/mm is illuminated with a light signal containing only two wavelengths, $\lambda_1 = 400$ nm and $\lambda_2 = 500$ nm. The signal is incident perpendicularly on the grating. What is the angular separation between the second-order maxima of these two wavelengths? 12

   c) Show that the smallest object that can be resolved in an optical microscope is about the same size as the wavelength of light being used. 5

B.Sc. Engg.(EE), 1st Sem. Date: March 11, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: Math 4123
Course Title: Matrix and Differential Equation

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) Define symmetric and skew-symmetric. If A and B are symmetric matrices, then show that $AB + BA$ is symmetric and $AB - BA$ is skew-symmetric. 8

   b) Prove that $adjAB = (adjB)(adjA)$. 5

   c) Find the inverse of $A = \begin{bmatrix} 3 & 0 & 0 & 1 \\ 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 2 \\ 1 & 0 & 0 & 1 \end{bmatrix}$ by adjoint method. 12

2. a) Find the canonical matrix of $A = \begin{bmatrix} 2 & 7 & 3 & 5 \\ 1 & 2 & 3 & 4 \\ 3 & 8 & 1 & -2 \\ 4 & 13 & 1 & -1 \end{bmatrix}$ and hence find rank. 13

   b) Solve the following system of linear equations, 12

$$\begin{aligned} x_1 + 2x_2 - x_3 &= 2 \\ 3x_1 + x_2 + 2x_3 &= 11 \\ 4x_1 + 4x_2 - 3x_3 &= 3 \\ 2x_1 - x_2 + 3x_3 &= 9 \end{aligned}$$

3. a) Find the differential equation of the family of curves, $y = Ae^{3x} + Be^{-3x}$, where, A and B are arbitrary constants. 8

   b) Solve the initial value problem: $(x+1)\frac{dy}{dx} + y = \ln x$, $y(1) = 10$. 9

   c) Solve: $(x - y^3 + y^2 \sin x)\, dx = (3xy^2 + 2y \cos x)\, dy$. 8

4. a) Solve the following differential equations:

(i) $(x^3 + y^3)dx - 3xy^2dy = 0$ and 8

(ii) $\frac{dy}{dx} = y(xy^3 - 1)$. 9

b) A 12 V battery is connected to a series circuit in which the inductance is henry and the resistance is 10 ohms. Determine the current i if the initial current is zero. 8

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B.Sc. SWE, 1st Sem. Date: March 11, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: Phy 4143
Course Title: Physics 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) For the circuit shown in Fig. 1(a), find out the values of v_0 and i_0. 10

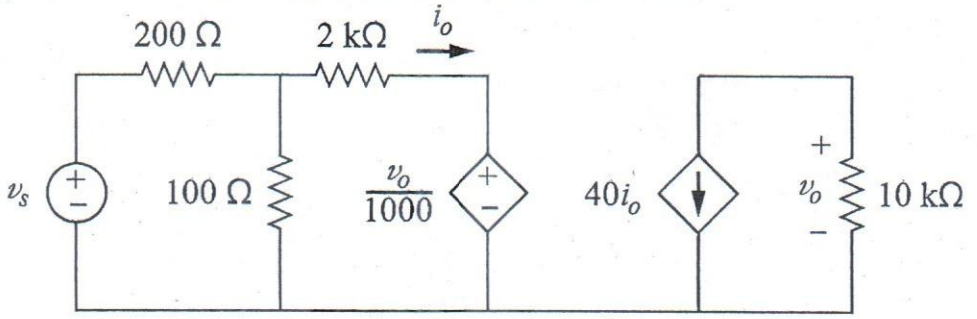

Fig. 1(a)

b) For the circuit shown in Fig. 1 (b), find out thevenin equivalent resistance from terminal a-b. 15

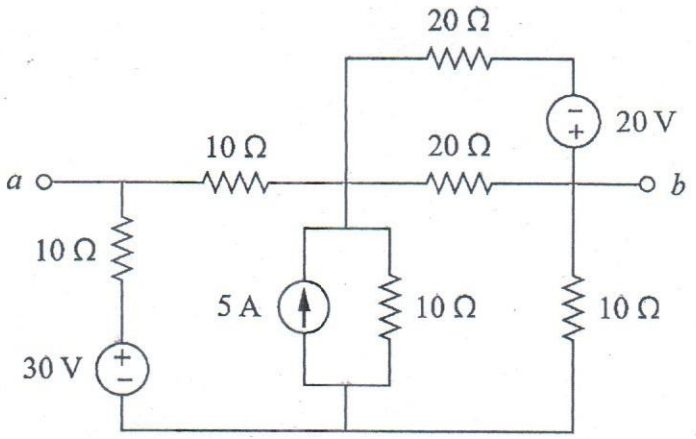

Fig. 1 (b)

2. a) Use nodal analysis to calculate v_0 and i_0 in the circuit shown in Fig. 2 (a). 10

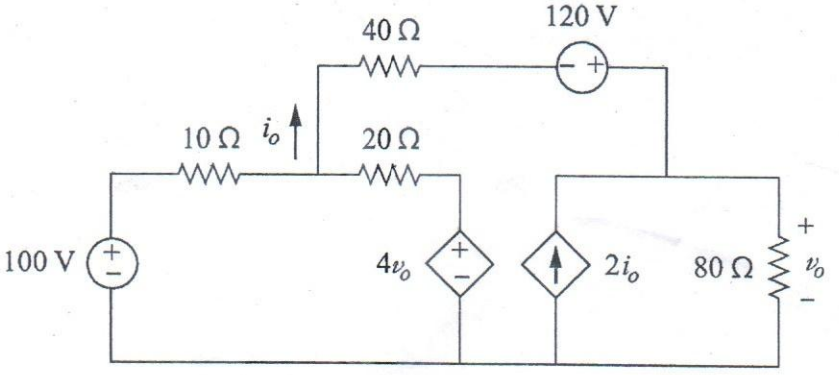

Fig. 2 (a)

b) Find current, i_o for the following circuit shown in Fig. 2(b). Use superposition theorem. 15

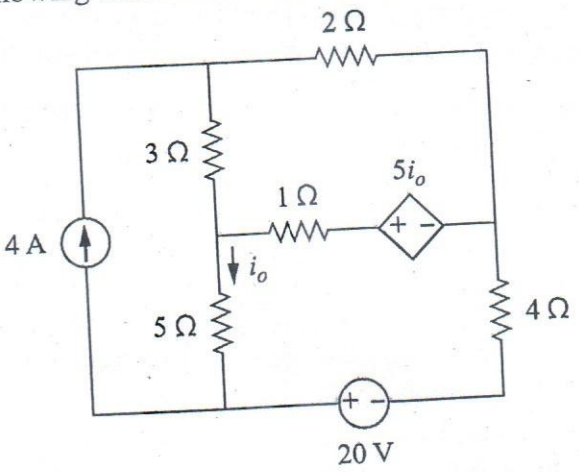

Fig. 2(b)

3. a) The charge flowing through an electric tube is shown in Fig. 3(a). Find and draw the current wave shape through the tube. 8

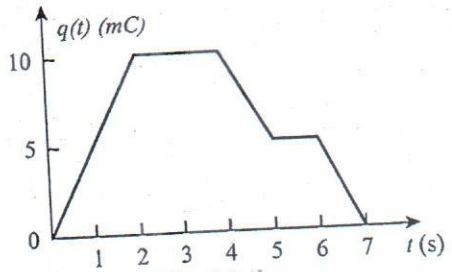

Fig. 3(a)

b) Find current, I in the following circuit of Fig. 3 (b). Assume, all resistors are of equal valued (assume any value) and E = 20 V. 8

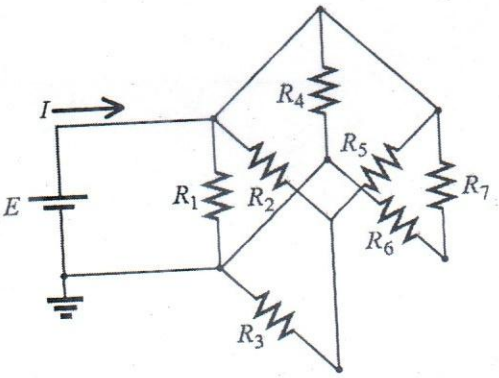

Fig. 3(b)

c) Find out i_1, i_2 and i_3 from the following circuit given in Fig. 3(c).

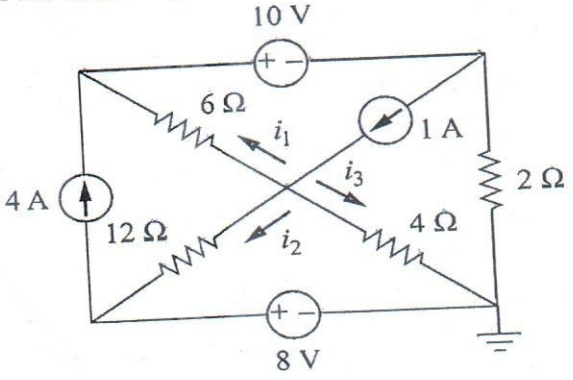

Fig. 3(c)

4. a) Find current, I through R_2 for the following circuit shown in Fig. 4 (a). Assume, $R_1 = 10\ \Omega$, $R_2 = 4\ \Omega$ and $R_3 = 5\ \Omega$. 5

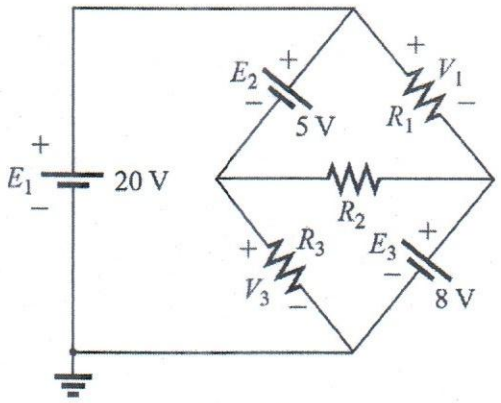

Fig. 4 (a)

b) Find I_5, I_S and V_7 from the following circuit shown in Fig. 4 (b), where $E = 10$ V, $R_1 = 4$ kΩ, $R_2 = 8$ kΩ, $R_3 = 12$ kΩ, $R_4 = 24$ kΩ, $R_5 = 12$ kΩ, $R_6 = 10$ kΩ, $R_7 = 10$ kΩ, $R_8 = 5$ kΩ and $R_9 = 5$ kΩ. 10

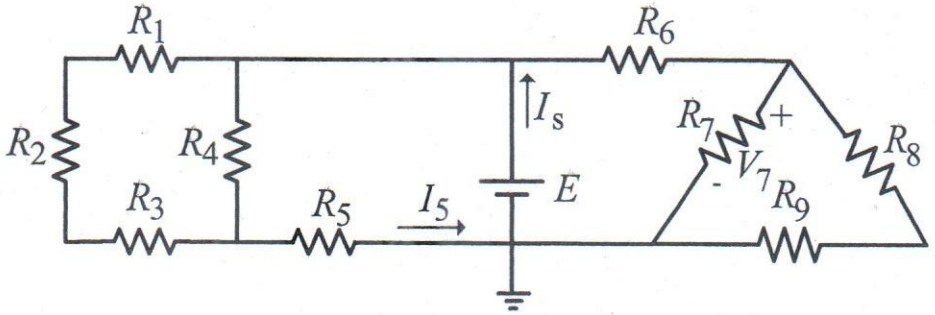

Fig. 4 (b)

c) Find the equivalent resistance with respect to terminals A and B in the following circuit shown in Fig. 4 (c). Assume all the resistance values are equal to 1 kΩ. 10

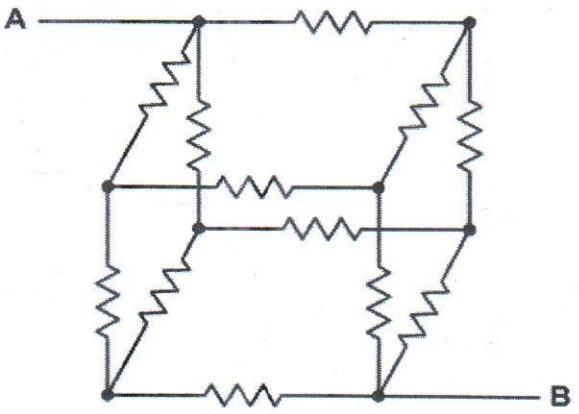

Fig. 4 (c)

BBA in TM, 1st Sem. Date: March 07, 2019 (Morning)

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 4161 — Time: 90 Minutes
Course Title: Electrical and Electronic Technology I — 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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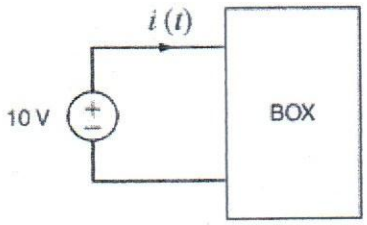
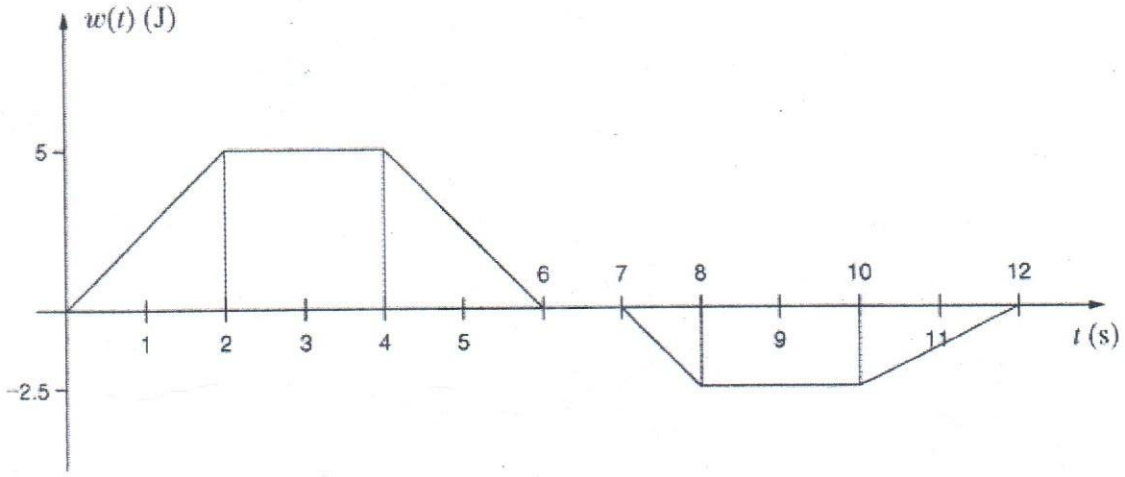
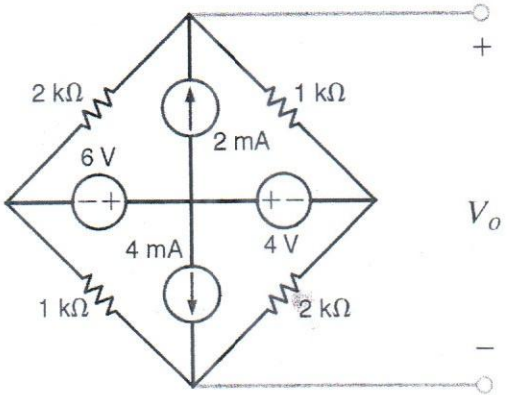
1. a) What are dependent sources? Explain different types of dependent sources with circuits. 06

   b) The energy absorbed by the BOX in the following figure is given below the box. Calculate and sketch the current flowing into the BOX. Also calculate the charge which enters the BOX between 0 and 12 seconds. 09

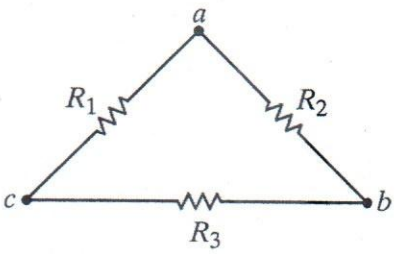


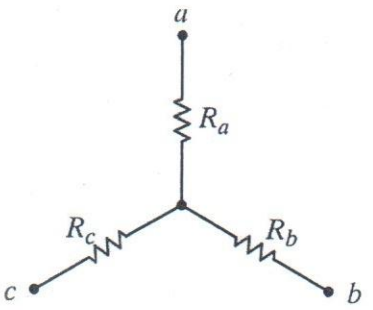


   c) Find V_0 in the following network using loop analysis. 10



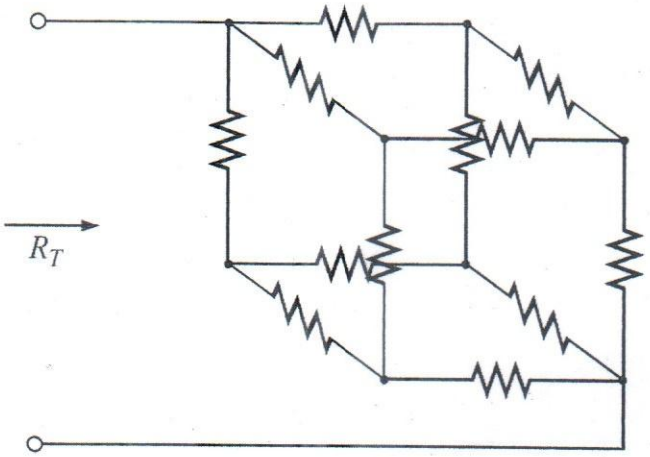
2. a) What are Wye to Delta and Delta to Wye transformations? Derive the equations for R_1, R_2 and R_3 in terms of R_a, R_b and R_c and vice versa from the following figure. 10



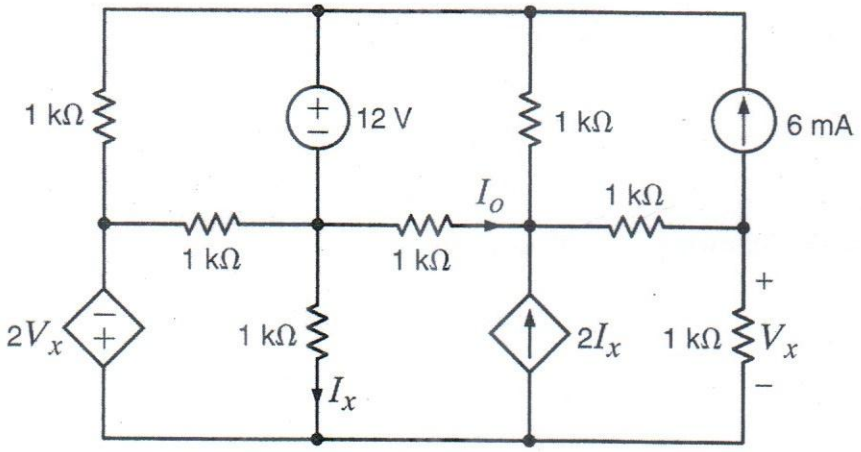


b) State and explain Ohm's law, KCL and KVL. 06

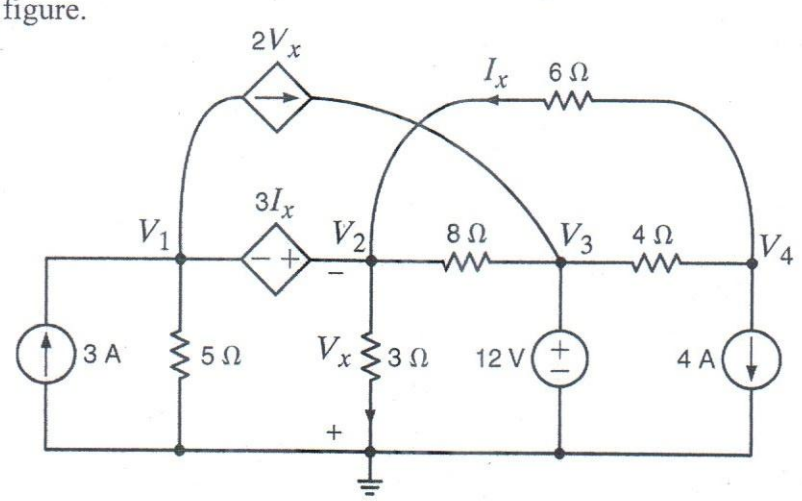
c) If all the resistors of the cube in the following figure are 10 Ω, what is the total resistance, R_T? 09



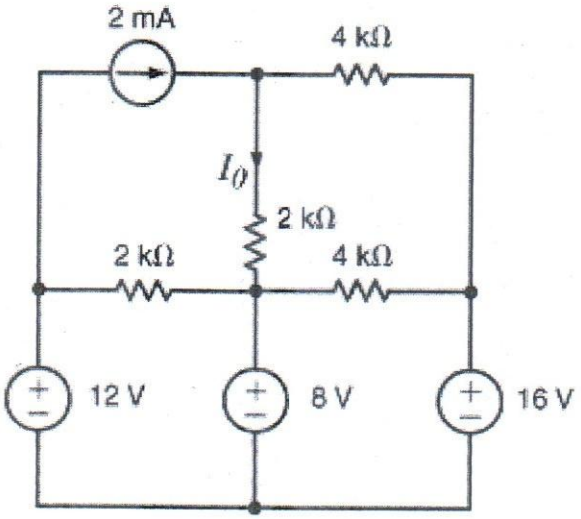
3. a) Using loop analysis, find I_0 in the circuit in figure below. 15



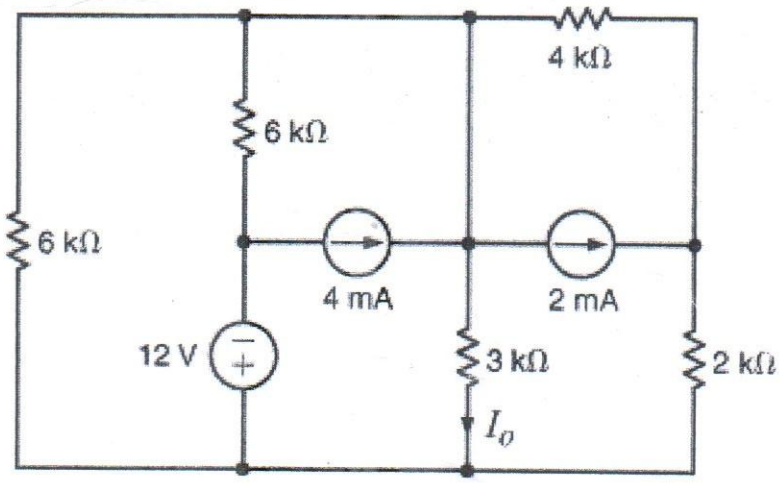
b) Use nodal analysis to determine the node voltages defined in the circuit in following figure. 10



4. a) Use Thevenin's theorem to find I_0 in the following figure. 15



b) Use superposition to find I_0 in the circuit. 10



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.

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

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

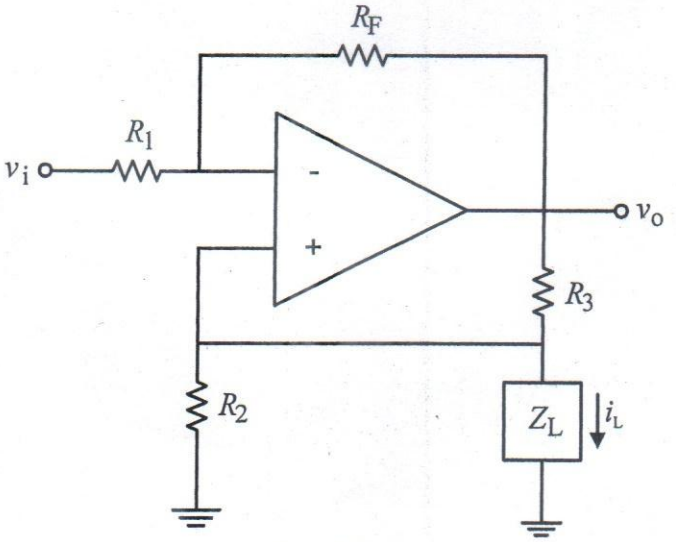

Fig. 2(b)

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. 7

   b) Derive the ideal form of the general feedback transfer function and define the loop gain factor. 8

   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. 10

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

Date: 11 March, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4305/EEE 4391
Course Title: Energy Conversion I

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

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. Assume suitable values for any missing data.

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1. a) Draw and developed diagram of a simple 2-layer lap-winding for a 4-pole generator having 14 coils with appropriate commutator segment connections and brush positions. 20

   b) In light of the design in question 1(a), comment on the advantages and disadvantages we face in case of a lap-winding. 05

2. a) What is armature reaction? Briefly explain the different effects of armature reaction with proper diagrams. 08

   b) Derive the total voltage induced in a rectangular loop of wire rotating in a bi-polar magnetic field in terms of the speed of rotation with appropriate diagrams. 07

   c) Sketch the power flow diagram of a DC generator with accountings for all the possible loss components. 05

   d) How can we manipulate the properties of magnetic field to produce different types of AC and DC machine actions? 05

3. a) For a 300 kW, 600 V, long-shunt compound generator, shunt field resistance = 75 Ω, armature resistance including brush contacts = 0.03 Ω, commutating field winding resistance = 0.011 Ω, series field resistance = 0.012 Ω and diverter resistance = 0.036 Ω. Calculate the voltage and power generated by the armature when the machine is delivering at full load. 08

   b) What is commutation? Explain the process of commutation in a DC generator with suitable coil diagrams. 07

   c) "Calculations of flux in a core in any DC machine is at its best accurate to within 5% of the real answer." Justify the statement. 05

   d) Write a short note on compensating windings. 05

4. a) What is the drop reaction triangle? How can this triangle be drawn from the load saturation curve of a separately-excited generator? Sketch necessary diagrams to justify your answer. 08

b) For the linear DC machine shown in Fig. 4(b), 07

i) What is the no-load steady-state speed of the bar?

ii) If the bar is loaded with 20 N force opposite to the direction of the motion, what is the new steady-state speed?

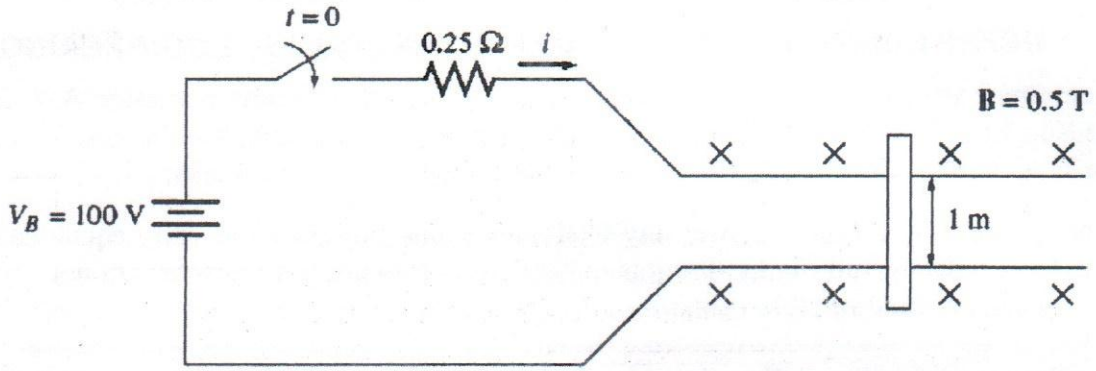

Fig. 4(b)

c) What are major functions of pole cores, pole shoes and armature core in a DC machine? 05

d) What are the significances using of slip ring and split ring? What is a commutator? Explain the working principle of a bi-segmented commutator. 05

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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
Course No.: EEE 4307
Course Title: Digital Electronics

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.

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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

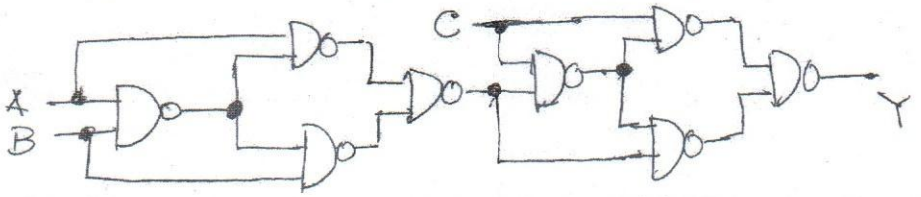
a) Find the value of X. 12
(i) $(MNOP\ .\ 9A)_{32} = (X)_{10}$
(ii) $(667154271276727\ .\ 45735)_8 = (X)_{32}$
(iii) $(16QP32\ .\ DE)_{32} = (X)_{16}$

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.

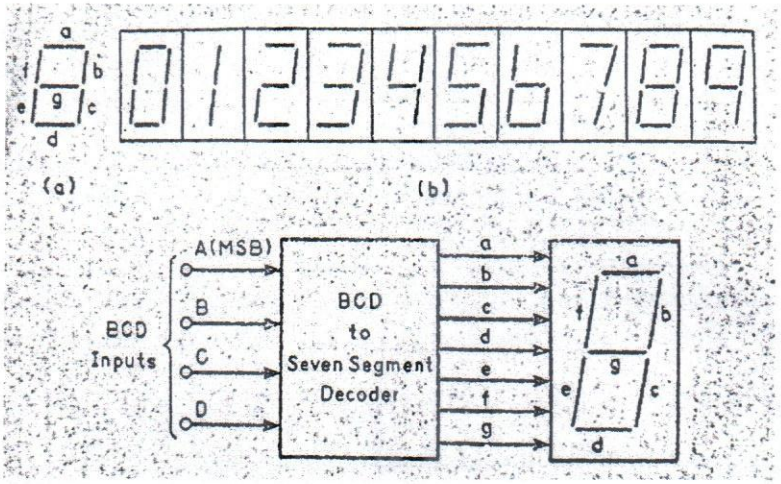
2. a) Design a full-subtractor. Show the truth table and construct Boolean expression for all possible inputs. Draw the logic diagram. Realize this using half-subtractor and other necessary gates. Implement it by 4 × 1 MUX. 10

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
$F(w, x, y, z) = \Pi\ (2, 5, 6, 7, 10, 11, 12, 13, 14)$

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. 25



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

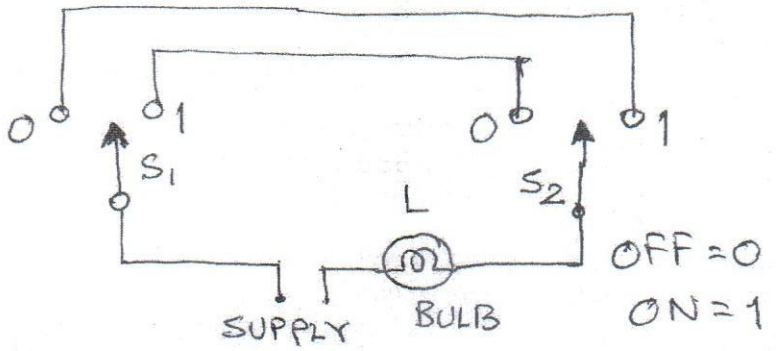
4 a) The control unit for a chemical process is to be designed. Temperature and pressure are the two variables to be controlled. The control is exercised by switching a heater on or off and by opening or closing a valve. The control scheme is shown below where the central square represents normal operation.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

Pressure ↑	Heater off Valve open Alarm off	Heater off Valve open Alarm off	Heater off Valve open Alarm on
	Heater on Valve closed Alarm off	Heater off Valve closed Alarm off	Heater off Valve closed Alarm off
	Heater off Valve open Alarm on	Heater off Valve closed Alarm off	Heater off Valve closed Alarm off

Temperature →

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



(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.

	00	01	11	10
00		1		1
01	1		1	
11		1		1
10	1		1	

B.Sc. Engg.(ME)/HDME, 3rd Sem. Date: March 04, 2019(Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: Phy 4313
Course Title: Basic Electronics and Semiconductor Physics

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.

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1. a) What are the majority and minority carriers? Describe the differences between n-type and p-type semiconductor materials. 5

   b) What are the equivalent models available for p-n junction diode? Draw the equivalent circuit and sketch the forward characteristics for each model. 7

1. c) Considering $V_Z = 10$ V and I_Z (maximum) = 32 mA, for the network of Fig. 1(c), determine the range of R_L and I_{RL} that will result in V_{RL} being maintained at 10 V. Also determine the maximum wattage rating of the diode. 13

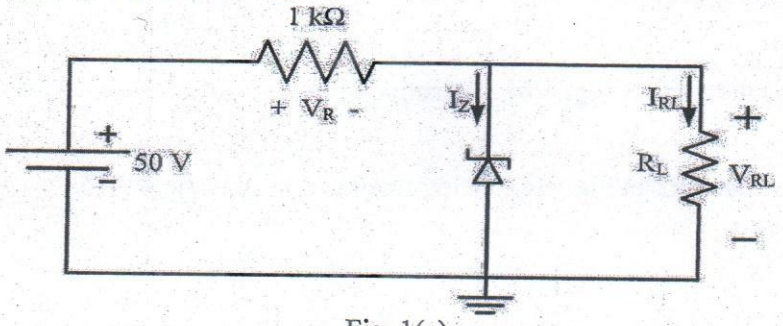

Fig. 1(c)

2. a) Discuss the steps of *load-line analysis* for a circuit having a voltage source, diode and resistor connected in series. 7

   b) Sketch V_o for the circuits in Fig. 2b(i) and Fig. 2b(ii). Consider Vin = 10 Vp-p and V = 3 V. 8

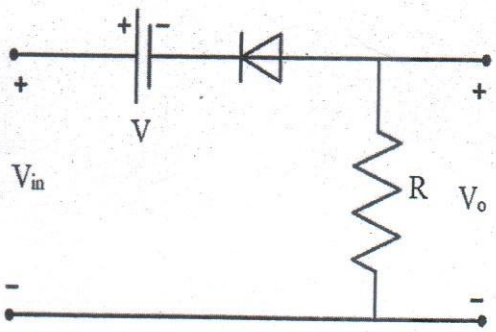

Fig. 2b(i)

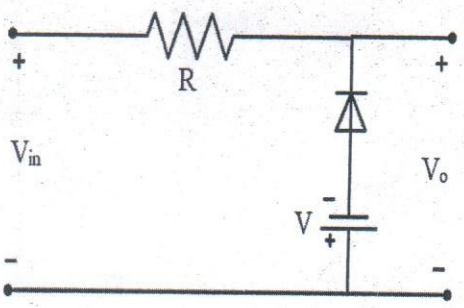

Fig. 2b(ii)

c) Determine V_o for the network of Fig. 2c(i) for the input indicated in Fig. 2c(ii) using silicon diode with threshold voltage, $V_T = 0.75$ V. Consider V = 5 V, C = 1 μF and R = 1000 Ω. 10

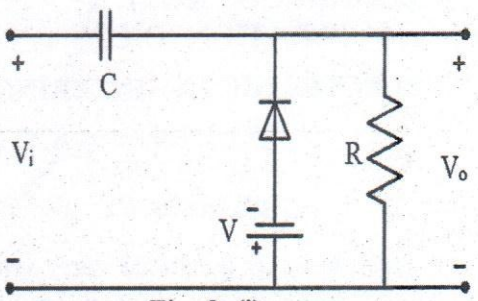

Fig. 2c(i)

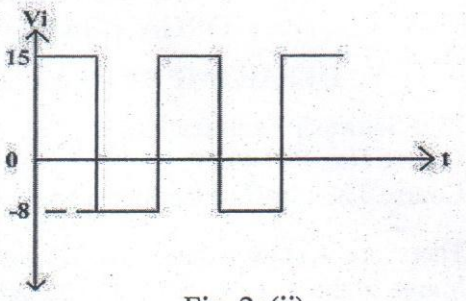

Fig. 2c(ii)

3. a) What is rectifier? How many types of rectifiers are there? What are their advantages and disadvantages? Draw the circuit diagram of a full wave rectifier using two silicon diodes and sketch the input and output wave shapes. Also calculate the average value of the output voltage. 15

b) Sketch the common-emitter BJT configuration (for both npn and pnp) and indicate the polarity of the applied bias and resulting current directions. Also draw the collector characteristics and base characteristics. 10

4. a) Describe the transistor amplifying action with example. 5

b) For the network of Fig. 4(b), determine I_C and V_{CE}. Assume $\beta = 100$. 10

c) For the network in Fig. 4(c), Determine I_C, V_{CE}. Assume $\beta = 75$. 10

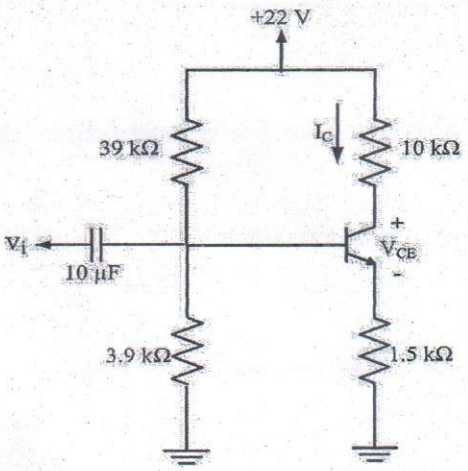

Fig. 4(b)

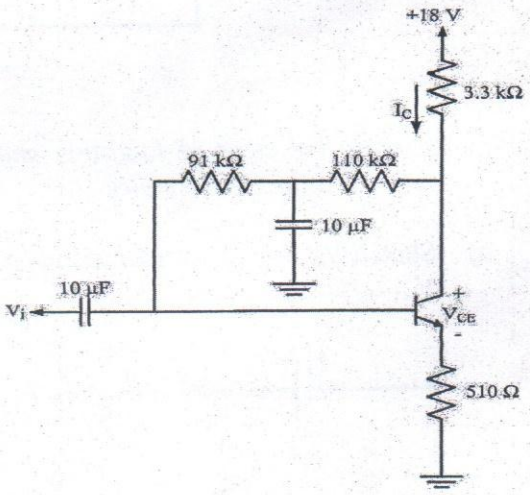

Fig. 4(c)

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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.

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B.Sc. Engg. (CSE), 3rd Sem. Date: 11 March, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4383
Course Title: Electronic Devices and Circuits

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. Assume suitable value for any missing data.

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1. a) Draw the detailed transfer characteristics of a pn junction diode composed of Ge, Si and GaAs in the same graph and indicate different regions in the diagram. 07

b) For a small ac signal as the input, derive the expression for power gain of a common emitter transistor configuration using hybrid equivalent circuit. 07

c) Determine I_D and V_D for the circuit in Fig. 1(c) with V_{DD} = 5 V and R = 1.1 kΩ using the iterative analysis method. Assume the diode current is 1.5 mA at a voltage of 0.7 V. 07

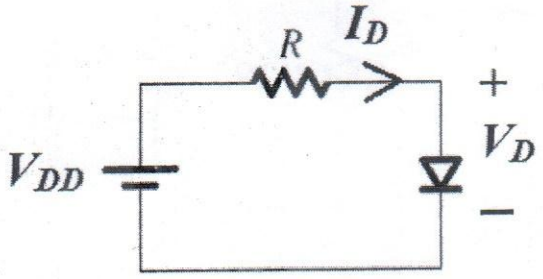

Fig. 1(c)

d) What is the purpose of DC biasing in BJT? 04

2. a) Design a full wave rectifier and draw the input and output waveshapes for this circuit. 05

b) Draw the majority and minority carrier concentrations profile of a pnp transistor in the forward active mode. Explain the different currents generated due to the flow of these carriers and their relations. 07

c) Draw the V_{CB}-I_C characteristics of an pnp transistor fed with a constant emitter current I_E. Explain the conditions for reaching the saturation for this transistor. What happens to I_C in saturation? 07

d) What is Q-point? Describe the significance of biasing in case of fixing a Q-point and its effect on amplification in a common-emitter connection for small signals. 06

3. a) What is an oscillator? Describe the working principle of an oscillator with necessary diagrams. 06

b) Define the static and dynamic resistance of a diode. 05

c) What is a virtual ground? What are the characteristics of an ideal op-amp? 06

d) In the circuit of Fig. 3(d), If $\beta = 50$, find I_E, I_B, V_E, I_C and V_C. 08

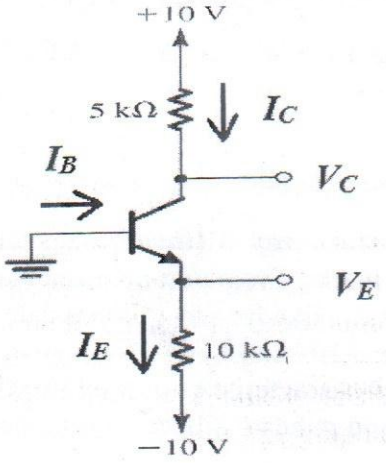

Fig. 3(d)

4. a) For the circuit in Fig. 4(a), calculate the values of I_E, I_B, V_E, V_B, I_C and V_C. 08

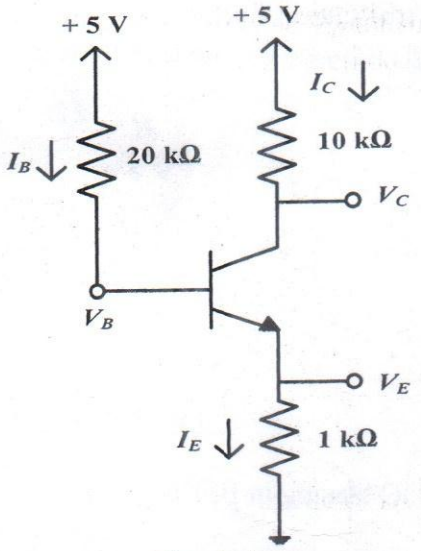

Fig. 4(a)

b) Implement the expression $Vo = -5u + 1.5v + 3.3x + 7y - 11z$ using op-amps. 06

c) Write down Shockley's equation for the diode current. Explain the mode of operation of a PN junction diode under the forward and reverse bias conditions. 06

d) What are α and β for a BJT? Derive the expression by which α and β are related to each other. 05

B.Sc. Engg.(CEE), 3rd 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.: EEE 4385
Course Title: Electrical and Electronic Technology

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) Calculate the equivalent resistance R_{ab} in the circuit shown in Fig. 1(a), where, $R_1 = 10\ \Omega$, $R_2 = 3\ \Omega$, $R_3 = 6\ \Omega$, $R_4 = 12\ \Omega$, $R_5 = 1\ \Omega$, $R_6 = 4\ \Omega$, $R_7 = 1\ \Omega$ and $R_8 = 5\ \Omega$. 5

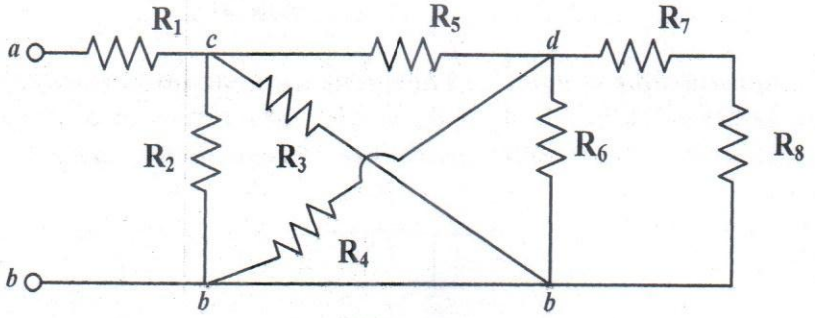

Fig. 1(a)

b) Find the voltages and currents in the circuit shown in Fig. 1(b) by applying Kirchhoff's voltage law (KVL) and Kirchhoff's current law (KCL), where $E_1 = 10$ V, $E_2 = 5$ V, $R_1 = 2\ \Omega$, $R_2 = 8\ \Omega$ and $R_3 = 4\ \Omega$. 6

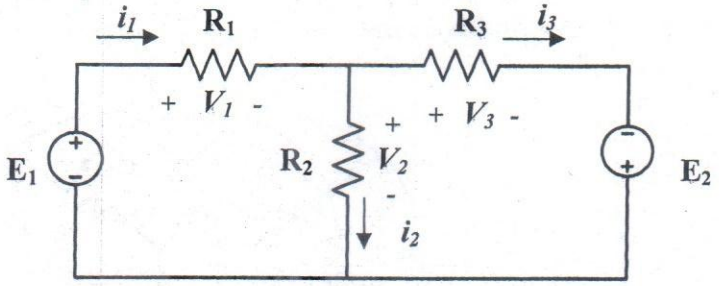

Fig. 1(b)

c) Obtain the equivalent resistance R_{ab} for the circuit shown in Fig. 1(c) where, E = 120 V, $R_1 = 12.5\ \Omega$, $R_2 = 5\ \Omega$, $R_3 = 10\ \Omega$, $R_4 = 15\ \Omega$, $R_5 = 20\ \Omega$ and $R_6 = 30\ \Omega$ and use it to determine the current *i*. 10

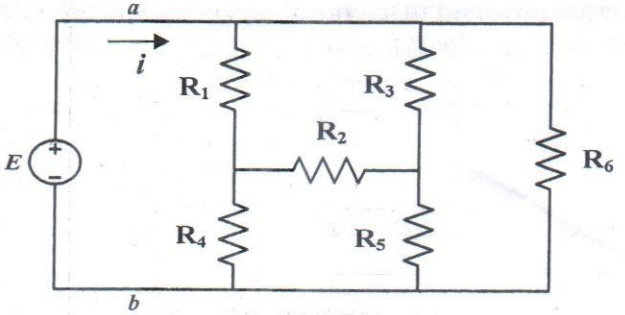

Fig. 1(c)

d) In a household, a 120 W personal computer (PC) is run for 4 h/day, while a 60 W bulb runs for 8 h/day. If the utility company charges Tk. 4.5/kWh, calculate how much the household pays for the year 2016 on the PC and the bulb. 4

2. a) Determine the voltages at the nodes shown in Fig. 2(a), where $R_1 = 2\ \Omega$, $R_2 = 4\ \Omega$, $R_3 = 8\ \Omega$ and $R_4 = 4\ \Omega$ using Nodal Analysis. 6

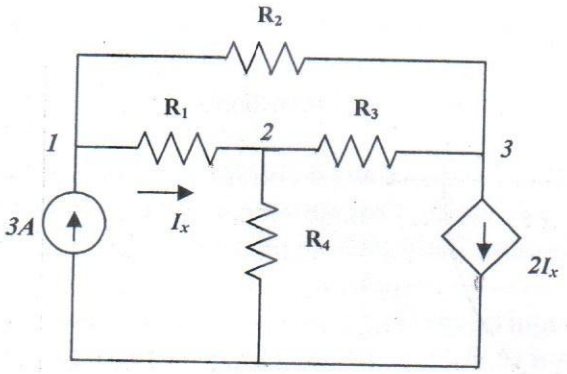

Fig. 2(a)

b) What is superposition principle? For the network shown in Fig. 2(b), where, E = 100 V, $R_1 = 20\ \Omega$, $R_2 = 30\ \Omega$, $R_3 = 8\ \Omega$, $R_4 = 10\ \Omega$, $R_5 = 15\ \Omega$, $R_6 = 10\ \Omega$ and $R_7 = 10\ \Omega$. Use superposition theorem to determine the voltage across the resistor R_4. 10

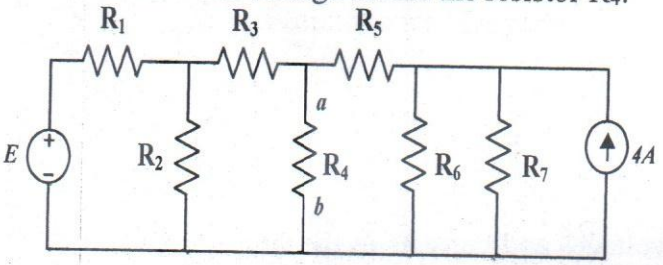

Fig.2(b)

c) Using mesh analysis, find i_1, i_2 and i_3 in circuit shown in Fig. 2(c). 9

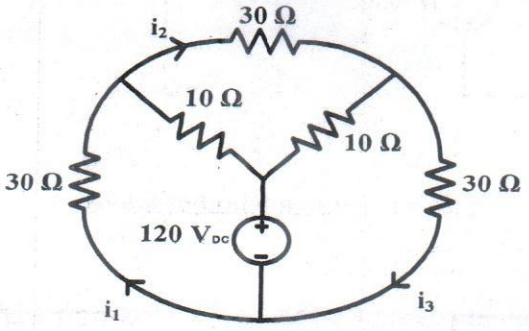

Fig. 2(c)

3. a) Find the Norton equivalent network of the circuit shown in Fig. 3(a) between the terminal *a-b* where, E = 4 V, $R_1 = 8$ kΩ and $R_2 = 50$ kΩ. 10

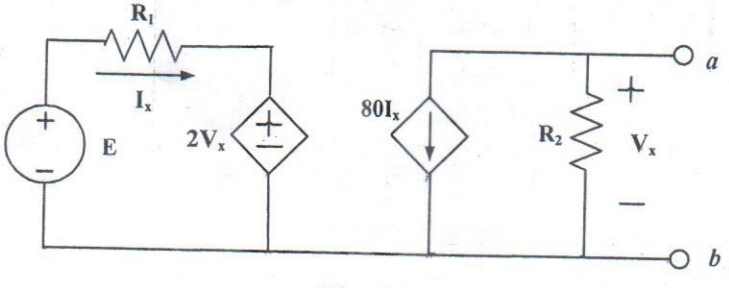

Fig. 3(a)

b) Define maximum power transfer theorem. For the circuit shown in Fig. 3(b), find the Thevenin equivalent circuit at terminal *a-b*. 15

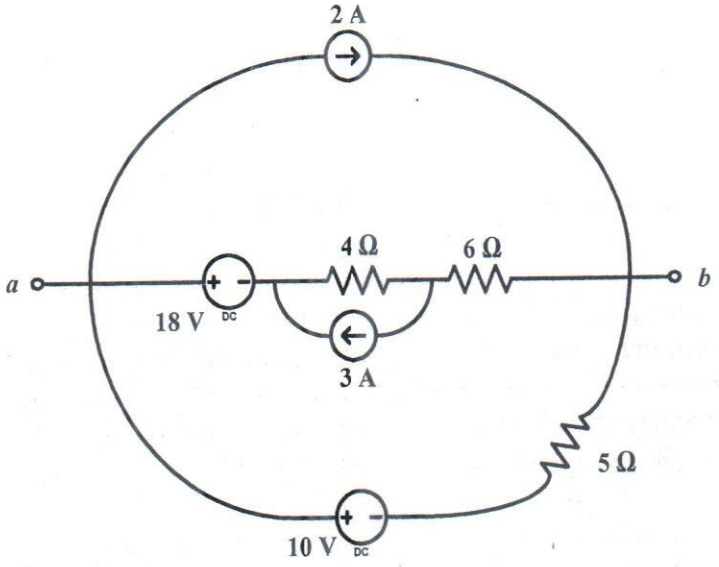

Fig. 3(b)

4. a) What is admittance? Determine current I_0 of Fig. 4(a) using Norton's theorem. 15

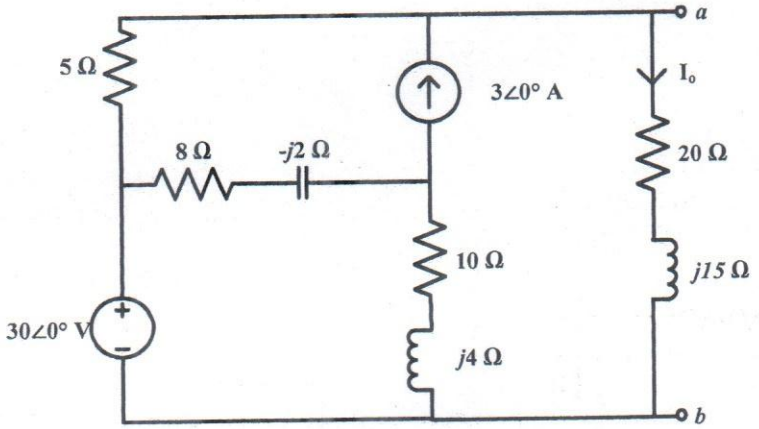

Fig. 4(a)

b) Use nodal analysis to find v_o in the circuit of Fig. 4(b). Let $\omega = 2$ krad/s. 10

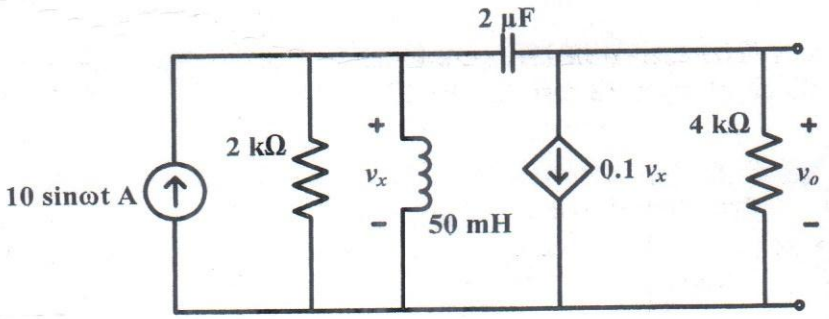

Fig. 4(b)

B.Sc. Engg.(EE)/HDEE, 5th Sem. Date: March 11, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4501
Course Title: Electromagnetic Fields and Waves

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. Figures in the left margin indicate full marks. Programmable calculators are not allowed. Do not write on this question paper.

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1. a) Define surface and volume elements in (i) Rectangular, (ii) Cylindrical and (iii) Spherical coordinate systems. 5

   b) Define Electric Field ($\vec{E}$), Displacement density ($\vec{D}$) and Potential. In what ways $\vec{D}$ is different from charge densities? 5

   c) The separation between the parallel plates of a capacitor is very small compared with their area. As a result, the plates can be approximated as infinitely extended surfaces with uniform charge surface density. Under this approximation find the electric filed $\vec{E}$ at (i) outside and (ii) insdie the capacitor. 5

   d) The electron beam in a certain cathode ray tube possesses cylindrical symmetry as shown in Fig. 1(d) below, and the charge density is represented by the volume charge density $\rho_v = -0.1/(\rho^2 + 10^{-8})$ pC/m^3 for $0 < \rho < 3 \times 10^{-4}$ m, and $\rho_v = 0$ for $\rho > 3 \times 10^{-4}$ m. (*a*) Find the total charge per meter along the length of the beam; (*b*) if the electron velocity is 5×10^7 m/s, and with one ampere defined as 1 C/s, find the beam current. 10

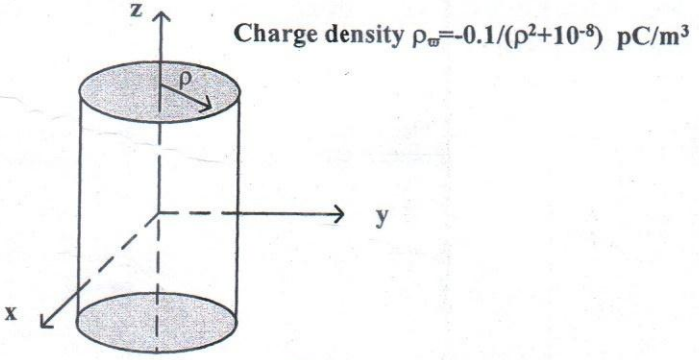

Fig. 1(d)

2. a) Define stream lines of an electric field vector. How is the equation of a streamline obtained from the field components? Given the electric field $\vec{E} = (4x - 2y)\hat{a}_x - (2x + 4y)\hat{a}_y$ V/m. Find the equation of the stremline that passes through the point P(2, 3, -4). 5

   b) A point charge of 0.25 μC is located at r = 0, and uniform surface charge densities are located as follows: 2 mC/m^2 at r = 1 cm, and −0.6 mC/m^2 at r = 1.8 cm. Calculate $\vec{D}$ at: (i) r = 0.5 cm, (ii) r = 1.5 cm, (iii) r = 2.5 cm and (iv) what uniform surface charge density should be established at r = 3 cm to cause $\vec{D}$ = 0 at r = 3.5 cm? 10

c) Fig. 2(c) represents a coaxial cable having an inner radius $a = 1\,\text{mm}$ and an outer radius $a = 4\,\text{mm}$. The space between the conductors is assumed to be filed with Teflon (ε_r=2.1). The total charge on the inner conductor is 50 nC. Using Gauss's law calculate the charge densities on each conductor and the electric field $\vec{E}$ in $a < \rho < b$ and $\rho > b$. 10

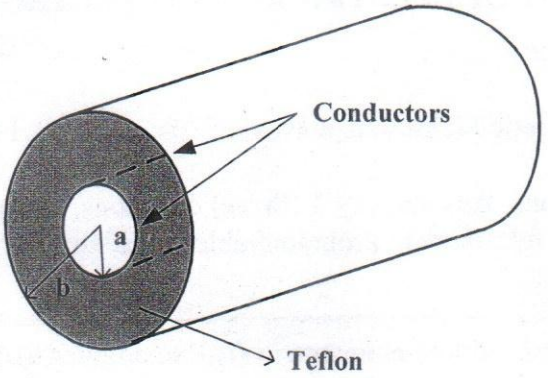

Fig. 2(c)

3. a) State Gauss's law. Show that the point form of this law (Maxwell's First equation) can be expressed as $\vec{\nabla} \bullet \vec{D} = \rho_v$. Determine an expression for the volume charge density associated with each $\vec{D}$ field: (i) $\vec{D} = \frac{4xy}{z}\hat{a}_x + \frac{2x^2}{z}\hat{a}_y - \frac{2x^2y}{z^2}\hat{a}_z$ C/m^2 and (ii) $\vec{D} = z\sin\phi\hat{a}_\rho + z\cos\phi\hat{a}_\phi + \rho\sin\phi\hat{a}_z$ C/m^2. 12

b) The potential distribution $V(x, y, z)$ in a region is given as, $V = x^2y(z+3)$ V. Find (i) $\vec{E}$ at (3, 4, -6) and the charge within the cube $0 < x, y, z < 1$. (Hint: Use gradient operation on V) 13

4. a) A charge is carried in the field of an infinitely extended line charge from point B to point A as shown in Fig. 4(a). Find the work done if the movement occurs along (i) the circular path and (ii) the radial path. 10

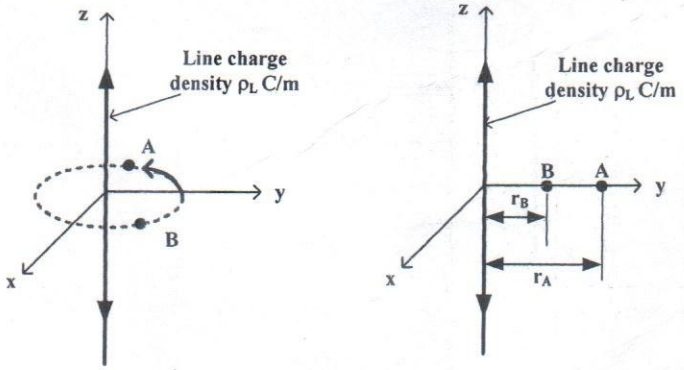

Fig. 4(a)

b) An electric field is expressed in rectangular coordinates by $\vec{E} = 6x^2\hat{a}_x + 6y\hat{a}_y + 4\hat{a}_z$ V/m. Find: (a) V_{MN} if point M and N are specified by M (2, 6, -1) and N (-3, -3, 2); (b) V_M if V=0 at Q (4, -2, -35); (c) V_N if V=2 at P (1, 2, -4). 10

c) An electric dipole located at the origin in free space has a moment $\vec{p} = 3\hat{a}_x - 2\hat{a}_y + \hat{a}_z$ nC.m. Find the potential at point P(2, 3, 4) due to that dipole. 5

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B.Sc. Engg. (EE) / HDEE (5th Sem.)
B.Sc. TE (2-Yr) (1st Sem.)

Date: 05 March, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4503/4591
Course Title: Industrial Electronics 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 margin indicate full marks. Do not write on this question paper. Assume reasonable value for any missing data and assume that the power devices are ideal.

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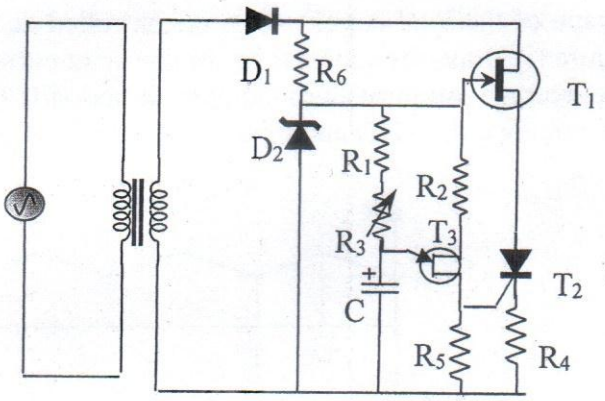
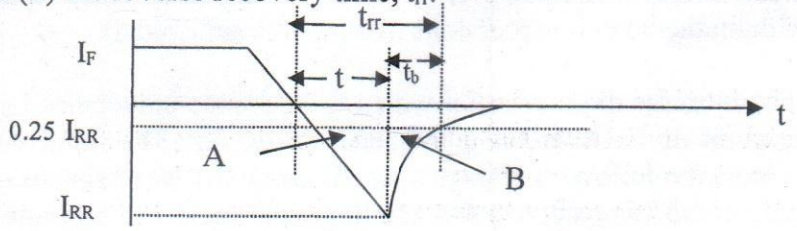
1. a) (i) Explain why you will prefer to use power electronics rather than linear electronics to convert same amount of high power. 09
(ii) Following is a circuit used for power processing purpose. Identify the power electronic devices/components) used in this circuit and mention their control characteristics (Which devices are controlled/uncontrolled turned on and turned off.)

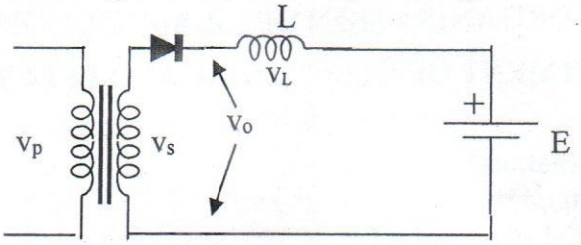


b) (i) Why is the reverse recovery characteristic of a semiconductor device considered so important? (ii) Following is a reverse recovery characteristic of a semiconductor device whose data are as follows: Area, A= 150 amp-μs, area B= 120 amp-μs, di/dt=40A/μs. Find (i) I_{RR} and (ii) the reverse recovery time, t_{rr}. 07

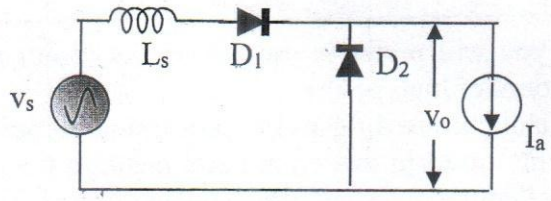


c) Propose a simple diode circuit with passive elements that provides under-damped current so that a thyristor can be turned off forcefully. The dc source voltage of the circuit is 220 V. Design the circuit for a damping factor of 45000 ohm/henry. Take resonant angular frequency as 10^6 rad/s and capacitance as 0.05μF. Find the equation of the decaying current with initial conditions of $v_c(t=0)=0$ and $i(t=0)=0$. 09

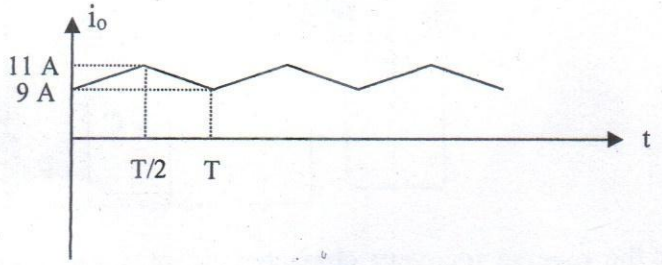
2. a) Following is a diode circuit whose input voltage is v_s=381sin314t (V), and the battery voltage is E=100 V. The current stops conducting at β=215°. (i) Draw the wave-shape of the v_o and also (ii) calculate the average value of the output voltage. 08



b) Draw (i) the output voltage wave-shape and calculate, (ii) the commutation angle and (iii) the average output voltage of the following circuit. Following data are given: The input is sinusoidal with rms voltage of 220 V, frequency=50 Hz, L_s=10mH and I_a=15A. 08

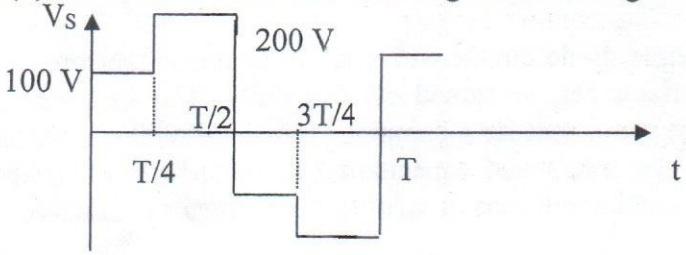


c) The wave-shape of the load current of an uncontrolled ac to dc converter is shown in the following figure (i) Draw the wave- shape of the input current for full wave conversion, (ii) Calculate the average value of the load current and (iii) Ignoring the ripple value of the input current calculate the THD and input power factor of the converter. 09



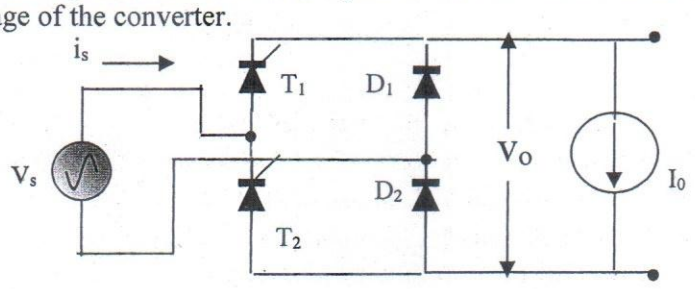
3. a) "A full bridge rectifier with a source inductance for a highly inductive load provides less output voltage than that of a rectifier without source inductance"-Justify the statement with proper circuit diagram including wave-shapes of input voltage, input current and output voltage with mathematical expressions (the input is sinusoidal). 15

b) A single phase bridge diode rectifier with a finite source inductance L_S=5 mH has a load of constant current of 10 A. It has a frequency of 50 Hz. The input voltage has the wave-shape shown in the following figure. Now, (i) Draw the wave shapes of source current and output voltage and (ii) calculate the commutation angle and average value of the output voltage. 10



4. a) Draw the circuit diagram of a full bridge controlled rectifier neglecting the effect of source inductance. The rectifier is feeding a large dc motor whose current is essentially constant. If the thyristors are fired at $\omega t = \alpha$ and at $\omega t = \pi+\alpha$ for a sinusoidal input to get full-wave rectified voltage, (i) draw output voltage, (ii) input current wave-shapes, (iii) find out the expression of average value of the output voltage and (iv) If the load is replaced by a resistive load state whether the input current will be continuous or discontinuous. 12

b) Draw v_s, i_s,and v_o waveforms and identify the devices conducting for various intervals for $\alpha=30^o$ for the following converter where input is 50 Hz sinisoidal.Find the expression of average output voltage of the converter. 13



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B.Sc.TE (2-Yr), 1st Sem.
B.Sc. Engg.(EE)/ HDEE, 5th Sem. Date: March 04, 2019 (Morning)

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 4523 / EEE 4595 — Time: 90 Minutes
Course Title: Switchgear and Protection Equipment -I — 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 preserve their usual meanings.

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1. a) What do you mean by a protective relay? Write the functions of protective relay. How is a protective relay different from a Circuit Breaker? 8

   b) "Dead zone cannot be present in a typical power system", explain this statement using proper diagram. Explain different methods of backup protection. 9

   c) Differentiate between Current Transformer (C.T.) and Potential Transformer (P.T.). Why should secondary of C.T. not be kept open circuited? 8

2. a) Explain ratio error and phase angle error with proper equation. A C.T. has a single turn primary and 400 secondary turns. The magnetizing current is 90 A while the actual primary current is 2078 A. Secondary circuit phase angle is 28°. Calculate the core loss current, actual ratio and ratio error when the secondary carries 5A current. 12

   b) Explain resistance switching with proper diagram. Write down the conditions of resistance switching for different types of oscillation. 13

3. a) What do you understand by ratings of a circuit breaker? Explain different ratings of a circuit breaker. 15

   b) A three phase alternator has the line voltage of 11 kV. The generator is connected to a circuit breaker. The inductive reactance of the circuit breaker is 5 ohm per phase. The distributed capacitance of the circuit breaker between phase and neutral is 0.01 μF. Determine the following : (i) peak restriking voltage across the circuit breaker (ii) frequency of restriking voltage transient (iii) average rate of restriking voltage transient (iv) maximum rate of rise of recovery voltage. Neglect first pole to clear factor. 10

4. a) What do you mean by arc extinction? What are the methods of arc extinction? Explain in details how ionization of gas occurs in the circuit breakers. 10

   b) Explain the working principle of air-blast circuit breaker. What are the problems of conventional air-blast circuit breaker? Explain the mechanism of modifying the conventional structure. 15

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B.Sc. Engg.(EE)/ HDEE, 5th Sem

Date: March 8, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4531
Course Title: Energy Conversion III

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 preserve their usual meaning.

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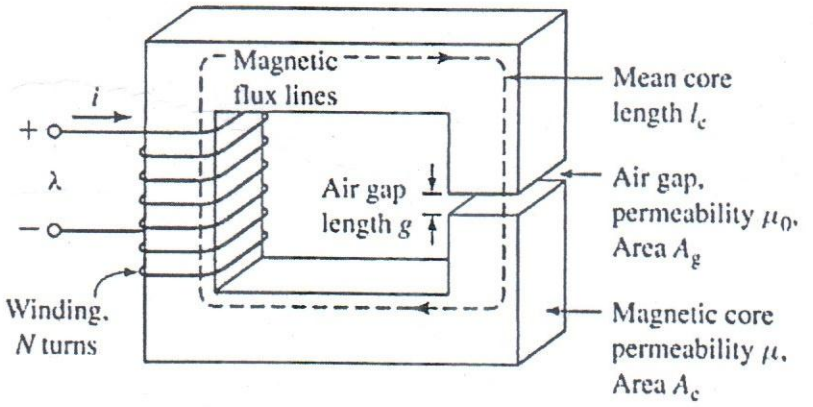
1. a) What are Rankine Cycle and Brayton Cycle? How many energy conversion processes are there? Draw the figures of photovoltaic system and thermoelectric cooling system with proper labeling. 10

   b) Describe Faraday's law of electromagnetic induction. With proper circuit diagram, find out the dynamic equation of singly excited electromechanical system. 7

   c) State the law of energy conservation. Mention three conventional and non-conventional energy sources and explain them briefly. 8

2. a) What is co-energy? Draw the e-q curve of a simple charged capacitor and point out energy and co-energy and write the corresponding integral equations. For energy in electrostatic field, show that $W_{fld} = W'_{fld} = \frac{1}{2}Ce^2$. 10

   b) The magnetic circuit shown in the following figure has dimensions as $A_c = A_g = 10\ cm^2$, $g = 0.060$ cm, $l_c = 40$ cm, $N = 600$ turns, $\mu_r = 70{,}000$ for core material, $B_c = 0.1$ T. (i) Find the core and air gap reluctances (ii) Flux φ and current i (iii) Write a MATLAB script where the inductance of the magnetic circuit should be plotted as function of core permeability over the range $100 \le \mu_r \le 100000$. 15



3. a) Define self inductance and mutual inductances. Show that the expression of energy in a doubly excited magnetic system is $W_{fld} = \frac{1}{2}L_{11}i_1^2 + \frac{1}{2}L_{22}i_2^2 + L_{12}i_1i_2$ 10

b) Write a MATLAB script to plot the inductance of a magnetic circuit with $\mu_r = 70{,}000$ as a function of air-gap length where the air-gap is varied from 0.01 cm to 0.10 cm. For initializing circuit parameters, assume any value. 10

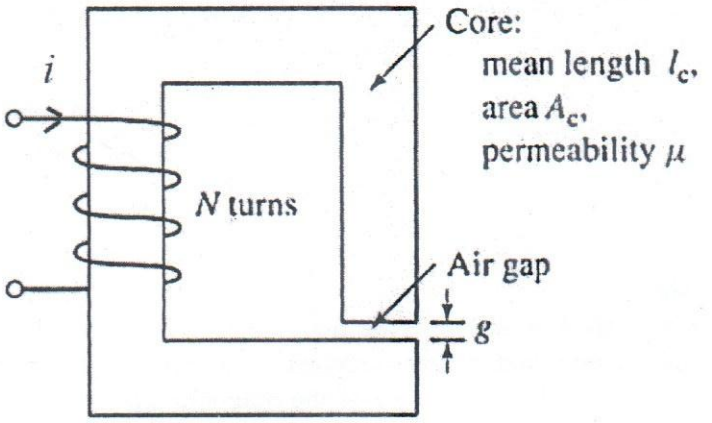
c) Why air-gap is used in electromagnetic circuits? What would be the effect on the circuit if the air-gap is varied? Explain briefly. 5

4. a) What are the losses of an electro-mechanical system? Write the energy balance equation and explain briefly. 5

b) What is co-efficient of coupling? Show that, the co-efficient of coupling is the geometric mean of coupling factors k_1 and k_2. 5

c) Explain the concept of duality in an electromagnetic system. 5

d) For the following magnetic circuit the core dimensions are: $A_c = 1.8\times10^{-3}$ m^2, $l_c = 0.6$ m, $g = 2.3\times10^{-3}$ m^2, N = 83 turns. Assume the core is of infinte permeability and neglect the effects of fringing fields at the air gap and leakage flux. (i) Calculate reluctance of core and air-gap. For current i= 1.5 A, calculate (ii) total flux (iii) flux linkage of the coil and (iv) coil inductance (v) Number of turns required to achieve an inductance of 12 mH. 10



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 4541 — Time: 90 Minutes
Course Title: Wireless Communication — 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. a) Based on the theorem of Shannon's capacity, explain all possible ways that make the data rate capacity different between LOS and non-LOS links. What are the two widely used types of twisted pair cables? 10

   b) Why is a gap used between uplink and downlink frequency ranges for FDD? Which 3GPP release did introduce Device-to-Device (D2D) communication? How does carrier aggregation increase the data rate? 7

   c) An electromagnetic wave has wave number 62.83 rad/meter and magnetic field intensity 0.2 amp/meter in air. The gain of the receiving antenna is 20 dBi. Determine the power received by the receiving antenna. 8

2. a) Write down the names of the companies which play major role in the development of 3GPP specifications. Which series of 3GPP specifications is dedicated for LTE? How much data rate, approximately, has been recently achieved in 5G tests? Give examples of applications that require very low latency. What is the major difference in the RAN structure between LTE and UMTS? 10

   b) How is the range of operating frequencies changing in the case of 5G cellular communication compared to technologies up to 4G? What can be the advantages and disadvantages of this new frequency range? Write down a few particular frequency values, which will be commonly used, within the frequency range for 5G. 8

   c) Write down the function of ICX when a Robi user calls another Robi user. How are voice calls managed presently for LTE users in Bangladesh? Compare the advantages and disadvantages of VoIP and TDM when international voice calls are routed. 7

3. a) Derive an expression for Doppler shift and show that it is less at lower frequencies in wireless communication. 7

   b) Why did Bangladesh reject an offer for connection with the SEA-ME-WE-3? How expensive was this offer of connection? In the design of an antenna, what are the basic steps used in the process? 6

   c) The estimated flat range of the frequency response of a multipath channel is 100 kHz. A user is traveling at 120 km/hour. The frequency of the transmitted signal is 6 GHz. Both frequency selective fading and slow fading need to be avoided. What is the permissible range of symbol rate? Also, mention which technologies, among GSM, UMTS and LTE, can avoid frequency selective fading. 12

4. a) Derive an expression for received power in the case of two-ray model for a large distance between the transmitter and the receiver. 10

   b) A user is allocated 2 slots in every TDMA frame in GPRS. Determine the instant data rate, overall gross data rate, and overall net data. 9

   c) With enough present bandwidth capacity on submarine cable, should Bangladesh continue with some share of internet service via ITC? Give reasons. If 5G cellular communication is now deployed in a village in Bangladesh but the villagers do not experience good data rate, then what may be the possible reason for poor data rate? 6

B.Sc. Engg.(EE) / HDEE, 5th Sem. Date: 08 March 2019 (Morning)

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 4551 — Time: 90 Minutes
Course Title: Data Communication and Networking 1 — 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 preserve their usual meanings.

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1. a) What is a network? Why is the Internet called network of networks? As a network designer, you are asked to develop an inter network (Internet) with basic network components. Briefly define each of the components and their working principles using suitable illustrations. 10

   b) Design a network for an educational institution like IUT to provide students and faculty members with the access to online information. Use suitable illustrations. 10

   c) "Network has made telecommuting available to individuals", explain with suitable example. 5

2. a) As a network engineer, to create a computer network, you are asked to select between circuit switching and packet switching; what do you choose? Justify your answer using suitable illustrations. Mention the advantage and disadvantage of circuit switching and packet switching. 12

   b) You want to send 100 data from a source to a destination. Explain how data passes using following methods. 13
      i) Circuit switching,
      ii)Packet switching.
      Use suitable illustrations. Explain which technique is better: i) with respect to guaranteed service, and ii) with respect to faster delivery time.

3. a) You are asked to create networks between computer devices by choosing from the five different network topologies classified by Area Network (AN). Write those five categories. Briefly explain each of them with suitable diagrams. 10

   b) Explain Ring Topology, Start Topology and Bus Topology. Discuss the advantages and disadvantages of these three topologies. For the Internet connectivity which topology is suitable. Justify your answer. What is Ethernet? 10

   c) What is Throughput in networking? Why is it important for data transfer? How does bottle neck occur if throughput is not considered perfectly. 5

4. a) Why do we need queue in the packet switching? How does queue create data loss in the network? Mention four sources of packet delay in the figure. Briefly explain each of them using suitable illustrations. 8

   b) What is routing table? How does routing table work? Explain using suitable illustration. 5

   c) Network can be classified into two categories by their component roles i.e., P2P and Client-Server. Write down the role of P2P network and Client-Server network. Write down the examples of different servers. 12

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B.Sc. TE. (2-Yr), 1st Sem. Date: March 12, 2019 (Morning)

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 4597 — Time: 90 Minutes
Course Title: Telecommunication Principles — 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. All symbols bear their usual meanings. Assume reasonable values for missing data.

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1. a) What is the difference between SNR and dynamic range? What are the the effects in SNR value when $Vs = V_n$, $V_s >> V_n$ and $Vs < V_n$? 4+5

   b) Define modulation index for amplitude modulation (AM). When is the carrier said to be over-modulated and what is its after effect? Show that multiplication of a signal g(t) by $\cos \omega_c t$ shifts the spectrum $G(\omega)$ by $\pm\omega_c$. 4+6

   c) 'For many baseband signals, the wavelengths are too large for reasonable antenna dimensions'- Explain with an example. What can we do in this regard to solve this problem? 3+3

2. a) Define and explain multiplier and nonlinear modulators. Why are nonlinear modulators also known as single balanced modulators? 7+3

   b) What are the schemes that can improve spectral efficiency of amplitude modulation? In which of the following cases, ordinary amplitude modulation (DSB-LC) will be more suitable? Explain. 4+4
      i. Point to point communication.
      ii. Broadcast communication system.

   c) A scheme for coherent demodulation is shown in Fig. 2(c). Show that this scheme can demodulate the AM signal $[A+ m(t)]\cos \omega_c t$ regardless of the value of A, where m(t) is the message signal. 7

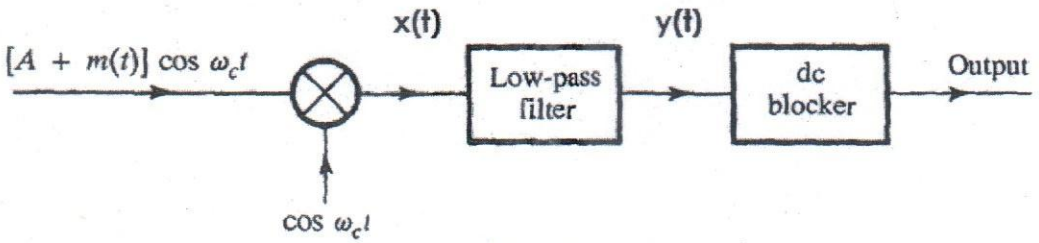

Fig. 2(c)

3. a) Explain the process of frequency mixing. Define up and down conversions. 6+3

   b) Name the methods for generation of SSB signal. Using the single-tone modulating signal $\cos \omega_m t$, verify that the output of the SSB generator by phase shifter is indeed an SSB signal, and show that an upper-sideband (USB) or a lower-sideband (LSB) signal results from subtraction or addition at the summation junction. Also demonstrate the coherent demodulation of this SSB signal. 2+14

4. a) Define and explain quadrature amplitude modulation (QAM). With an example show how you can separate the baseband signals in this scheme. 6+7

   b) What are the advantages of Vestigial Sideband (VSB) amplitude modulation? Mention the use of VSB in broadcast television along with its associated problems. 3+4

   c) Why is the advantage of AM over DSB modulation? State the condition for demodulation of AM by an envelope detector. 2+3

B.Sc. Engg.(EE), 7th 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
Course No.: EEE 4701
Course Title: Digital Signal Processing 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 margin indicate full marks. Programmable calculators are not allowed. Do not write on this question paper.

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1. a) What are the major applications of Digital Signal Processing? What are the limitations of Digital Signal Processing? 12

   b) Describe Digital Signal Processing scheme with schematic diagram. Why is it necessary to introduce an analog low-pass filter before ADC? 13

2. a) An analog signal contains frequencies up to 10 kHz. 15
      i) What range of sampling frequencies dose allow exact reconstruction of this signal from its samples?
      ii) Suppose that we sample this signal with a sampling frequency F_s = 8 kHz. Explain with proper diagram what happens to the frequency component F_1 = 5 kHz after passing through the DAC.
      iii) Repeat part (ii) for a frequency component F_2 = 9 kHz.

   b) Describe the aliasing effect with proper example and diagram. 10

3. a) What is the fundamental difference between convolution sum and correlation process? Explain it with proper example and diagram. 12

   b) The discrete-time system 13

$$y(n) = ny(n-1) + x(n), \qquad n \geq 0$$

   is at rest [i.e., $y(-1) = 0$]. Check if the system is linear time invariant and BIBO stable.

4. a) Determine the total solution for $n \geq 0$ of a discrete-time system characterized by the following difference equation: 12

$$y[n] + y[n-1] - 6y[n-2] = x[n],$$

   for a input $x[n] = (-3)^n \mu[n]$ and with the initial conditions $y(-1) = 1$ and $y(-2) = -1$.

   b) Derive and draw approximately the real part, imaginary part, magnitude and phase response for the following system: 13

$$h[n] = \alpha^n \mu[n], \qquad |\alpha| < 1.$$

B.Sc. Engg. (EE), 7th Sem. Date: March 05, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4703
Course Title: Communication Engineering 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.

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1. a) Write the properties of autocorrelation of an energy signal and a power signal. Explain the bandwidth of different data in different perspective. 13

   b) Classify the following signals as energy signals or power signals. Find the normalized energy or normalized power of each. 12

   (i) $x(t) = A\ \cos 2\pi f_0 t \quad$ for $-\infty < t < \infty$

   (ii) $x(t) = \begin{cases} A\ \cos 2\pi f_0 t & \text{for } -\frac{T_0}{2} \le t \le \frac{T_0}{2}, \text{where } T_0 = 1/f \\ 0 & elsewhere \end{cases}$

   (iii) $x(t) = \begin{cases} A\ \exp(-at) & \text{for } t > 0, a > 0 \\ 0 & elsewhere \end{cases}$

2. a) Explain uniform and non uniform quantization? Which kind of quantization is used for speech communication? Explain in details. 13

   b) In the compact disc (CD) digital audio system, an analog signal is digitized so that the ratio of the peak-signal power to the peak-quantization noise power is at least 96 dB. The sampling rate is 44.1 kilo samples/s. 12
   (i) How many quantization levels of the analog signal are needed for $(S/N_q)_{peak} = 96dB$?
   (ii) How many bits per sample are needed for the number of levels found in part (i)?
   (iii) What is the data rate in bits/s?

3. a) Prove that the probability of bit error $P_B = Q\left(\frac{a_1 - a_2}{2\sigma_0}\right)$, where symbols carry their usual meanings. How can you optimize the error performance? Use antipodal and orthogonal signals to support your answer. 13

   b) Bipolar pulse signals, $s_i(t)$ $(i = 1, 2)$, of amplitude $\pm 1V$ are received in the presence of AWGN that has a variance of $0.1\ V^2$. Determine the optimum (minimum probability of error) detection threshold, γ_0, for matched filter detection if the a priori probabilities are: $(i)\ P(s_1) = 0.5$; $(ii)\ P(s_1) = 0.7$; $(iii)\ P(s_1) = 0.2$. (iv) Explain the effect of the a priori probabilities on the value of γ_0. 12

4. a) Derive the impulse response of a matched filter that produces the maximum output signal to noise ratio. Explain the correlation realization of a matched filter. 13

   b) What is correlative coding? Explain Duobinary Coding and Decoding with a demonstration. Also explain precoding with an Illustration. 12

B.Sc. Engg. (EE) 7th Sem.
B.Sc.TE (2Yr), 3rd Sem.
B.Sc.TE (1Yr), 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.: EEE 4705/EEE 4791
Course Title: Control System Engineering

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. Use suitable assumptions for missing information.

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1. a) Define control system. Write four primary reasons of building control systems. 1+4

   b) Using suitable diagram, show different test waveforms used in control systems. 5

   c) Derive the equation of a generalized second order system. Derive the solution of underdamped second order system. Hence find the equation to evaluate the peak time (Tp) and percentage overshoot (%OS). 15

2. a) Why is in classical control system design Laplace transformation preferred over differential equations? 2

   b) Derive the transfer function of an electromechanical system shown in Fig. 2(b). 13

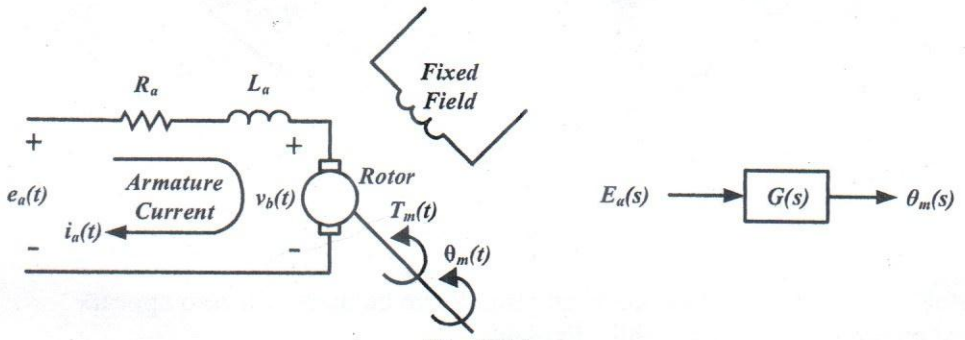

Fig. 2(b)

   c) For the rotational mechanical system of Fig. 2(c), find the transfer function $G(s) = \theta_2(s)/T(s)$. 10

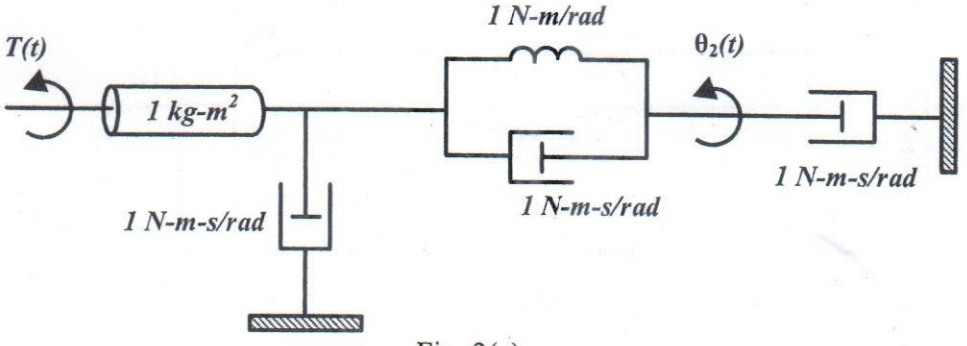

Fig. 2(c)

3 a) Using block diagram reduction technique find the transfer function, T(s) = C(s)/R(s) of the Fig. 3(a). 13

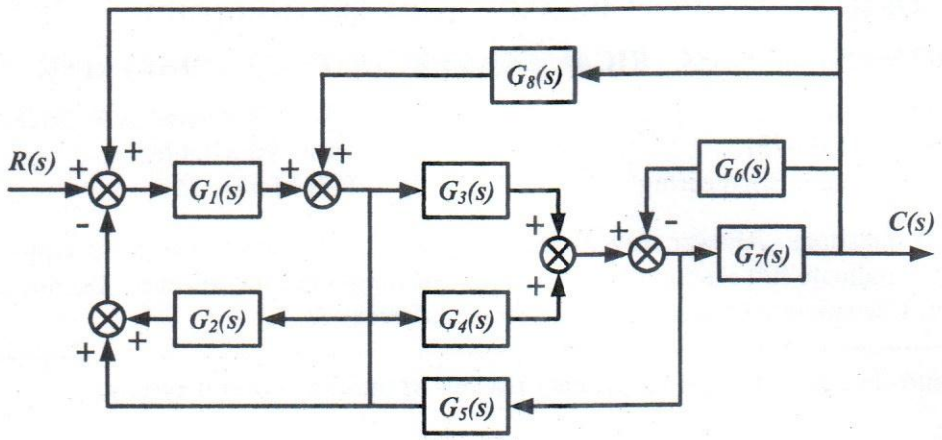

Fig. 3(a)

b) Using Mason's rule, find the transfer function, T(s) = C(s)/R(s), for the system shown in Fig. 3(b). 12

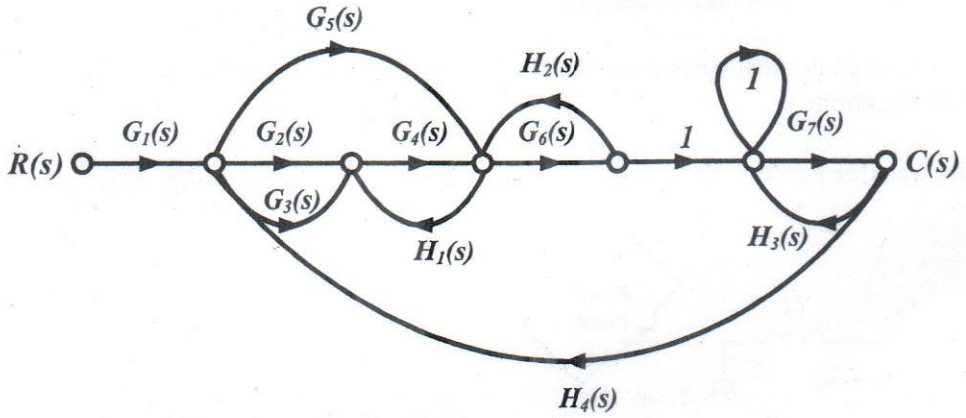

Fig. 3(b)

4 a) Define stability of a control system. What remark can be made if a zero appears in the first column of the Routh table? Explain. 5

b) For the unity feedback system shown in Fig. 4(a) find the number of poles in the left half-plane, the right half-plane and on the jω-axis. Draw conclusions about the stability of the feedback system.. 10

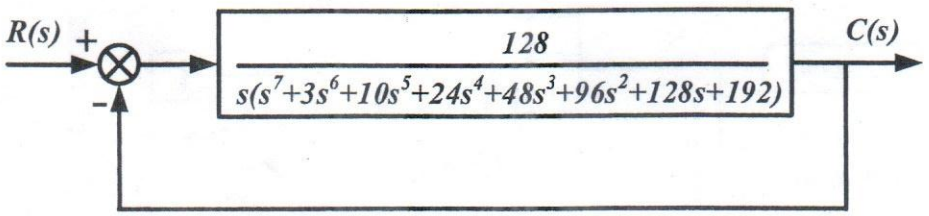

Fig. 4(a)

c) Use Routh-Hurwitz criterion to find the range of K for which the system of Fig. 4(b) is stable. 10

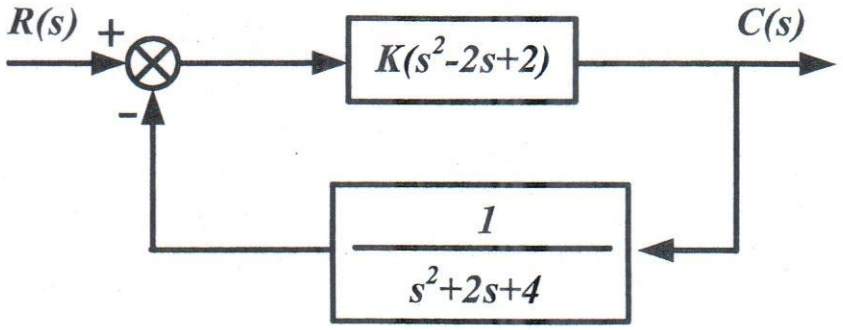

Fig. 4(b)

B.Sc. Engg.(EE),7th Sem. Date: March 11, 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 4731 — Time: 90 Minutes
Course Title: Power System III — 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. All symbols carry their usual meanings.

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1. a) Classify power system stability according to the concept of creating imbalance between oppositely acting forces within the system. How could one differentiate between small disturbance and large disturbance stability? Explain in short. 08

   b) What should be the angular speed of the rotor of a synchronous machine under equilibrium condition? How is it different than that of an induction machine? 02

   c) Fig. 1 (c) represents the cross-sectional view of a two-pole synchronous machine under loaded condition. i) Draw the rotor mmf phasor for the given field current direction, ii) Explain the concept of θ_m, iii) Find out the direction of excitation voltage, iv) Calculate the corresponding electrical angle of θ_m and v) Draw the corresponding phasor diagram considering zero armature resistance. 15

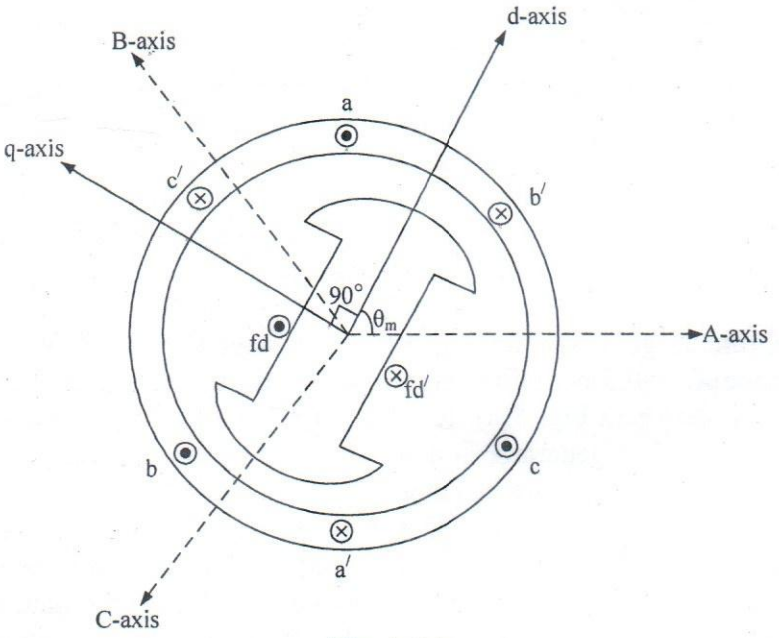

Fig. 1 (c)

2. a) Mention the applications of salient pole and non-salient pole machines. In which case the rotor speed is higher for deliveringpower at a certain frequency? Discuss in short. 05

b) Fig. 2 (b) represents the current injection model of a single machine infinite bus system. 12

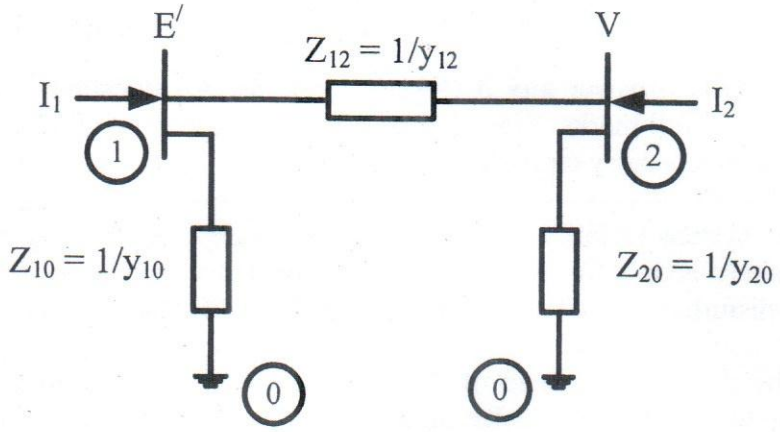

Fig. 2 (b)

i) Derive the expressions for the entries of the bus admittance matrix.
ii) Considering a lossless system, find out the expressions of real and reactive power transfer from bus (node) 1 to bus (node) 2.
iii) Find out the expression of maximum real power transfer over the transmission line (Z_{12}).

c) Consider a salient-pole synchronous machine characterized by the following parameters: $X_d = 1.2$, $X_q = 0.8$, $X_d' = 0.5$, $R_a = 0$ per unit. 08
The machine is directly connected to an infinite bus of voltage 1.05 per unit. The amount of real power delivered by the machine is 0.8 per unit at 0.9 power factor lagging. i) Calculate the q-axis transient voltage (E_q') for the machine, ii) Find out the expression of real power transfer of the machine.

3. a) A 50-Hz synchronous generator having inertia constant H = 10 MJ/MVA and a transient reactance $X_d' = 0.3$ per unit is connected to an infinite bus through a purely reactive circuit as shown in Fig. 3(a). Reactances are marked on the diagram on a common system base. The generator is delivering real power of 0.65 per unit, 0.85 power factor lagging to the infinite bus at a voltage of V = 1.1 per unit. Assume the per unit damping power coefficient is D = 0.14. Consider a small disturbance of $\Delta\delta = 12^0$. Calculate i) the voltage behind transient reactance, ii) the rotor angle at this operating point, iii) the synchronizing power coefficient, iv) the natural angular frequency of oscillation, v) the damped angular frequency of oscillation. Obtain equations describing the motion of the rotor angle and the generator frequency. 15

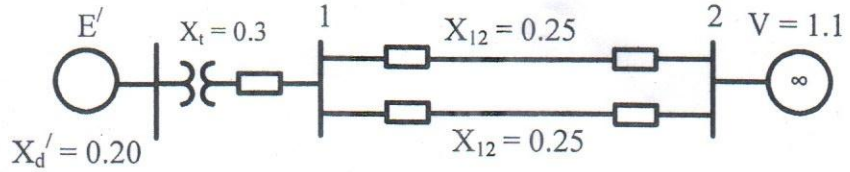

Fig. 3(a)

b) What is meant by *synchronizing power coefficient*? How does it affect the steady state stability limit of a synchronous machine? Explain with the help of power-angle diagram. 10

4. a) What is economic load dispatch problem in power system operation? Mention its importance from the power supplier point of view. 05

b) Which constraints are to be incorporated into the system model while studying the economic load dispatch problem? Explain with examples. 05

c) What is the difference between local and global optimal point? Which of them should be sought while running an optimization algorithm? Mention the reason. 05

d) The fuel-cost functions for three thermal plants in Tk./h are given by 10

$$C_1 = 600 + 5.3\,P_1 + 0.003\,P_1^2$$
$$C_2 = 500 + 5.9\,P_2 + 0.005\,P_2^2 \quad .$$
$$C_3 = 400 + 5.1\,P_3 + 0.007\,P_3^2$$

Where P_1, P_2 and P_3 are in kW. The total load P_D is 700 kW. Neglecting line losses and generator limits, find the optimal dispatch and the total cost in Tk./h by iterative technique using the gradient method. Consider initial value of $\lambda = 7.0$ Tk./kWh.

B.Sc. Engg. (EEE), 7th Sem. Date: March 12, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid Semester Examination
Course No.: EEE 4741
Course Title: Optical Communication

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. All symbols bear their usual meaning. Assume reasonable values for missing data.

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1. a) What multiplexing technique is used in the fourth generation lightwave system? Describe fifth generation of fiber-optic communication system. 6

   b) Derive the equation that provides the minimum bit-rate required for digital representation of an analog signal of bandwidth Δf in terms of signal to noise ratio (SNR). The minimum bit rate for analog TV transmission is 66 Mbps with a signal bandwidth of 4 MHz. Find out the SNR value. 8+3

   c) Compare return to zero (RZ) with non-return to zero (NRZ) modulation formats of the resulting optical bit-stream. How are TDM based digital hierarchies used in North America-Japan and Europe different from each other? 4+4

2. a) Draw cross-section and refractive index profile for step-index and graded index fiber. 4

   b) Explain 'numerical aperture' and express it in terms of fractional index change, Δ. Using suitable diagram, derive a measure of pulse broadening in step-index fiber. 10

   c) Show ray trajectories in a graded-index fiber. How is it possible for all the rays to arrive together at the fiber output in the graded index fiber? Using geometrical optics, show that parabolic index fiber doesn't exhibit intermodal dispersion. 6+5

3. a) Find out effective core area, normalized propagation constant and confinement factor for a fiber with core radius 3.15 μm and normalized frequency, V = 2.3. Also calculate the value of numerical aperture and effective index taking wavelength, λ = 1.2 μm and fractional index, $\Delta = 3.25 \times 10^{-3}$. 12

   b) Clarify the concept of mode in optical fiber. When does a mode cease to be guided? 3+2

   c) What is mie scattering? Compare macro and microbending losses in optical fiber. 2+6

4. a) From the expression of normalized spot size find out 'confinement factor' for V=2. 7

   b) A typical fiber has n_1=1.45, λ=1.2 μm, $\Delta = 5 \times 10^{-3}$. What will be the maximum value of core radius for the fiber to behave as a single mode fiber? What is required to be done to continue with the single mode operation if the core radius is changed to 4 μm? 7

   c) Define zero dispersion wavelength. Explain fiber birefringence covering degree of modal birefringence, beat length, fast and slow axis. 3+8

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B.Sc. Engg. (EEE), 7th Sem. Date: March 12, 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 4765 — Time: 90 Minutes
Course Title: Embedded System Design — 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. All symbols bear their usual meanings.

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1. a) What are the different layers of abstraction in digital system design? Draw the Gajski and Kuhn's Y-chart showing different design domains. 2+5

   b) Briefly explain the vector types in VHDL. 3

   c) With examples show ways to concatenate multiple signals in VHDL. 3

   d) Write a complete VHDL code of a 4-bit ALU which can perform addition, subtraction, AND-operation, OR-operation, NOT-operation and XOR-operation. 12

2. a) If channel width is 10, draw the internal and external connections, while Fs = 4 and Fc = 0.6. 5

   b) Draw the rechability tree and rechability graph for the Fig. 2(b). 10

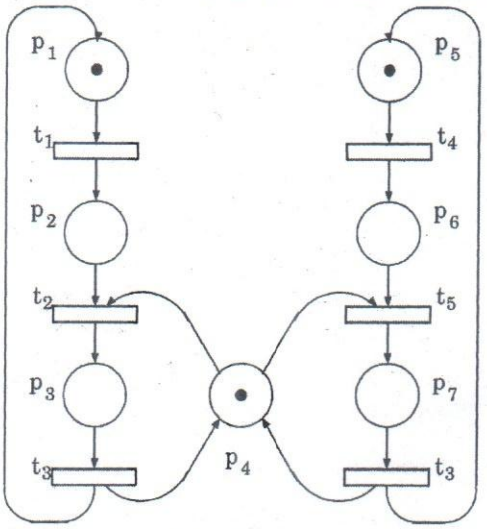

Fig: 2(b)

   c) Find the incidence matrix for the Fig. 2(b). 4

   d) Write a VHDL testbench of full adder. 6

3. a) What is the necessity of a bitstream file in FPGA? 3

   b) Show switch box connection of bidirectional and unidirectional mesh-based FPGA routing architecture. 6

	c)	What is an Antifuse? What are the main components of a BLE?	10
	d)	Mention nine different values of scalar type STD_ULOGIC.	6
4.	a)	Mention 6 (six) directory names and their functions of an Embedded Linux system.	5
	b)	What are the major FPGA structural classifications?	6
	c)	Draw a block diagram of SRAM based programmable switch. Also mention the pros and cons of this type of switch.	7
	d)	Draw the generic block diagram of Mutual Exclusion PN (Petri Net) structure. Also illustrate with a real-world example.	7

BSc TE (1-yr), 1st sem.
BSc TE (2-yr), 3rd sem.

Date: March 05, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No. EEE 4793
Course Title: Advanced Electronics

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.

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1. a) Briefly explain direct and indirect semiconductors. From (E,k) diagram, describe direct and indirect electron transition in semiconductors. (4+4)

   b) Define fermi-dirac distribution function. What will be the shape of fermi-dirac distribution function at T= 0 K and also at higher temperatures for the following cases. (2+6)

   (i) $E < E_F$ *(ii)* $E > E_F$ *(iii)* $E = E_F$

   c) A Si sample is doped with 10^{17} As atoms/cm^3.What is the equilibrium hole concentration n_0 at 300 K? Where is E_F relative to E_i? *(n_i=1.5. 10^{10}, assuming $n_0 = N_d$).* (9)

2. a) What is Luminescence? Mention its important types according to the excitation mechanism. Discuss the mechanisms involved in excitation and recombination of carriers in photoluminescence when a trapping level for electrons is present. (8)

   b) Derive the expressions for concentration of electrons and holes in a semiconductor at equilibrium. (9)

   c) Show schematically electrons and holes concentrations at thermal equilibrium by using fermi-dirac distribution function, density of states and band diagram for (8)
      i) Intrinsic semiconductors,
      ii) n-type semiconductors,
      iii) P-type semiconductors.

3. a) Briefly explain optical absorption process in semiconductors. Also discuss dependence of optical absorption coefficient "α" on the wavelength of incident light. (6+4)

   b) Derive the equations for the instantaneous concentrations of excess carriers $\delta n(t)$ and $\delta p(t)$ after a short flash of light is applied at t = 0. Write the expression for carrier life time. (10)

   c) A 0.46 μm-thick sample of GaAs is illuminated with monochromatic light of $h\gamma = 2$ eV. The absorption coefficient α is 5×10^4 cm^{-1}. The power incident on the sample is 10 mW. Find the total energy absorbed by the sample per second (J/s). (5)

4. a) Briefly discuss the process of diffusion. Derive diffusion current density equations for electrons and holes. (7)

   b) Discuss the effect of recombination in diffusion process. Derive continuity equation and diffusion equation for holes and electrons. (8)

   c) In a very long p-type Si bar with cross-sectional area, A = $0.5cm^2$ and Na = 10^{17} cm^{-3}, we inject holes such that the steady state excess hole concentration is $5 \times 10^{16} cm^{-3}$ at x = 0. What is the steady state separation between F_p and E_c at x = 1000×10^{-8}m? What is the hole current there? How much is the excess stored hole charge? Assume that μ_p = 500 cm^2/V-s and $\tau_p = 10^{-10}$ s. ($n_i = 1.5 \times 10^{10} cm^{-3}$). (10)

M.Sc. Engg./ PhD (EE) Date: March 12, 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 6307 — Time: 90 Minutes
Course Title: Power System Modeling — 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. All symbols carry their usual meanings.

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1. a) What is the significance of swing equation in power system stability analysis? What are the assumptions made for representing a synchronous machine by the classical generator model? Discuss in brief. 10

   b) Consider the rotating part of a synchronous machine represented by a single mass having moment of inertia J (kg-m^2). Assuming the rotor was initially at rest (at time t = 0 sec.), an input torque T_m (N-m) is applied at the shaft of the rotating mass to create an angular acceleration α (rad/s^2). Considering an output electromagnetic torque T_e(N-m) gets induced at the shaft due to the acceleration, 15
   - i) What would be the direction of T_e ?
   - ii) What would be the value of the angular velocity of the shaft at $t = 0^+$ sec.?
   - iii) Write down the corresponding equation of motion in terms of rotor acceleration.
   - iv) Rewrite the equation of motion of part (iii) in terms of rotor angular position (mechanical).
   - v) Discuss the concept of stationary and rotating reference frames. Which one is beneficial for the present case? Explain in short with neat diagram.
   - vi) Obtain the equation of motion in terms of electrical angular position.
   - vii) What would be the speed of the rotor once an equilibrium is reached?
   - viii) Represent the equation of motion of part (vi) in per unit form.

2. a) Consider a given abc-dq0 transformation matrix T_{dq0} as follows. 10

$$T_{dq0} = k_1 \begin{bmatrix} \cos(\theta_s) & \cos(\theta_s - 120^\circ) & \cos(\theta_s + 120^\circ) \\ -\sin(\theta_s) & -\sin(\theta_s - 120^\circ) & -\sin(\theta_s + 120^\circ) \\ k_2 & k_2 & k_2 \end{bmatrix}$$

Show that using $k_1 = \sqrt{\frac{2}{3}}$ and $k_2 = \sqrt{\frac{1}{2}}$, a power invariant transformation can be achieved.

b) Consider a synchronous generator supplying real power, P_t = 1.2 p.u and reactive power, Q_t = 0.4 p.u with terminal with voltage V_t = 1.10 p.u. The generator is connected to an infinite bus system having voltage V_b through a transmission line having reactance X_L = 0.8 p.u. The machine parameters (in p.u except otherwise stated) are given in the following table. 15

Parameter	Value	Parameter	Value
H	2.0	D	3.0
X_d	1.6	X_q	0.8
X_d'	0.6	T_{do}'	4 sec.
f	50 hz.		

Calculate the initial values of the system variables and construct the corresponding phasor diagram.

3. a) What is the necessity of power system modeling? Why should a trade-off be maintained between modeling complexity and simulation time? 05

b) Fig. 3(b) represents the cross-sectional view of a two-pole synchronous machine under loaded condition. 20

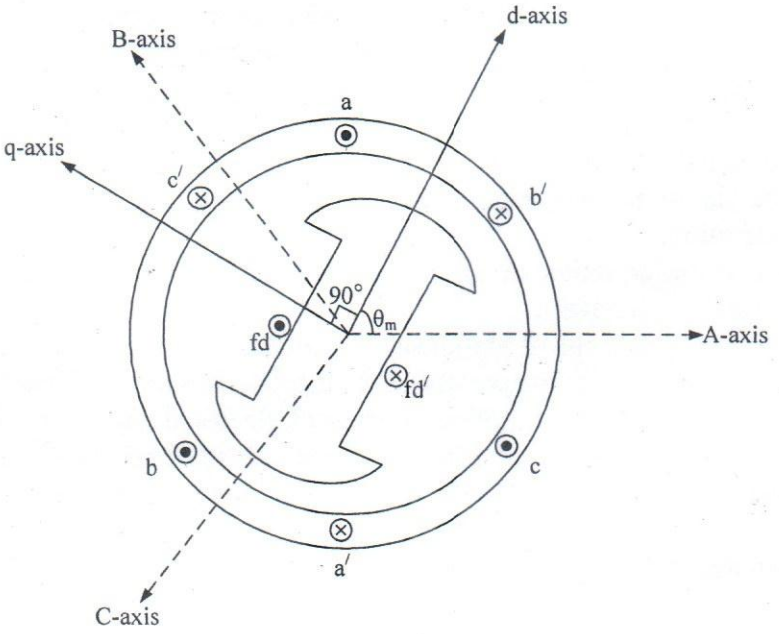

Fig. 3(b)

i) Redraw the diagram including d-axis and q-axis damper coils for representing the *Model 2.2*.
ii) Explain the reasons of incorporating the damper coils into the diagram.
iii) Show the variation of air-gap permeance as a function of rotor angle (θ_m) and discuss it's nature.
iv) Obtain the expressions for inductance l_{cc} and l_{bc}.

4. a) Explain the necessity of using an exciter for a synchronous machine. Briefly discuss the capability limits associated with a synchronous generator. 08

b) What is a brushless excitation system? Mention its advantages over brushed excitation systems. 05

c) The transfer function model of a DC exciter is shown in Fig. 4c (i). Reduce the block diagram to the one shown in Fig. 4c (ii) and find out the expressions for K and T. 07

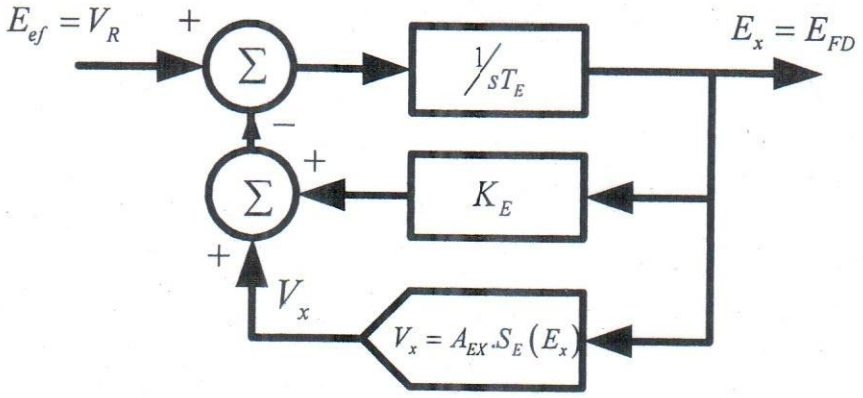

Fig. 4c (i)

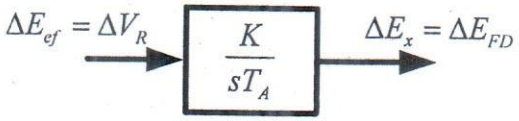

Fig. 4c (ii)

d) Explain the difference between the constant resistance load saturation curve and the open circuit curve for a separately excited DC excitation system. 05

Li 130

M.Sc.TE (2 Yr), 3rd Sem. Date: March 08, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 6393
Course Title: Energy Conversion

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.

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1. a) State types of sources of energy with example. 06

   b) Define the following terms with appropriate equation: 06
      i) Power balance
      ii) Conversion efficiency
      iii) Steady state conversion efficiency.

   c) State the input energy, output energy and typical conversion efficiency for following energy conversion devices: 13
      i) Steam turbine
      ii) Electric generator
      iii) Incandescent lamp
      iv) Solar cell
      v) Battery
      vi) Power plant boiler
      vii) Automotive engine.

2. a) Point out the advantages and applications of solar energy. Explain the distinctions between different generations of solar cells. 08+05

   b) Define following terms in regards to a solar PV system: 12
      i) Balance of system
      ii) Hard cost
      iii) Soft cost
      iv) Net metering

3. a) Describe step by step method for designing a solar PV system. 10

   b) Design solar PV system for a house with following appliances: 15
      i) Four 15 W lamp used for 5 hours a day,
      ii) Two 60 W fan used for 4 hours a day and
      iii) One 80 W refrigerator with compressor running for 16 hours a day.

   The system will be powered by 12 Vdc, 220 Wp (Isc = 8 mA) PV module with panel generation factor of 4 and 5 days of autonomy. Apply general assumption elsewhere.

4. a) State the zeroth, first, second and third law of thermodynamics. 10

b) Define following terms from thermodynamics perspective: 15
   i) Thermodynamic equilibrium
   ii) Law of conservation of energy
   iii) Isolated system
   iv) Heat
   v) Work
   vi) Entropy

M.Sc.Engg. (EE)/Ph.D. (EE) 132 Date: March 05, 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 6403 — Time: 90 Minutes
Course Title: Wireless Communication — 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. a) What is the basic purpose of modulation in wireless communication? Why is the use of higher and higher frequencies adopted in the course of time? What is the operating bandwidth for UMTS (from 3GPP) and CDMA2000 (from 3GPP2)? 10

   b) How long is a slot in millisecond and how many chips are there in the slot? 5

   c) Write down any two OVSF codes with spreading factor 4. Using them, show that a wrong use of code by the receiver does not allow detection of anything. 10

2. a) Why scrambling codes can be used to different cells whereas OVSF codes must be used to differentiate the users in the same cell in UMTS? How many primary scrambling codes (PSCs) are available and why are so many PSCs required? How many scrambling codes are available for use in uplink and why are so many scrambling codes required in uplink? 9

   b) Write down any four OVSF codes with spreading factor 8. 6

   c) Determine and plot autocorrelation properties of the sequence 1110010 by rotating its whole length. 10

3. a) Assume that the whole OVSF code tree is used for the data transfer and 128 users were using spreading factor 128 in the cell. Then cutting off the service of some users, these new spreading factors have been allocated: 1 user with spreading factor 4, 2 users with spreading factor 16 and 1 user with spreading factor 32. What is the new number of users in the cell? 8

   b) What are the minimum and maximum values of spreading factor in uplink and downlink in UMTS? What is the typical value of spreading factor for voice? Determine the data rate in kbps when the spreading factor is 256. 8

   c) User A transmits information 1 −1 using OVSF code 1 −1 1 −1. User B transmits information −1 1 using OVSF code 1 −1 −1 1. Show the spreading of signal and the composite signal waveform. Then show how user B can detect the correct information bits. 9

4. a) For Rayleigh fading model, derive the relationship between the amplitude of the received signal and in-phase and quadrature components of Gaussian random variables. 10

   b) The salaries of employees in a company are normally distributed with a mean of Tk. 50,000 and a standard deviation of Tk. 20,000. Determine what percent of people earn less than Tk. 40,000. Determine what percent of people earn between Tk. 45,000 and Tk. 65,000. 10

   c) Explain what is actually meant by outage probability of wireless coverage at a particular distance. 5

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.9	.00005	.00005	.00004	.00004	.00004	.00004	.00004	.00004	.00003	.00003
-3.8	.00007	.00007	.00007	.00006	.00006	.00006	.00006	.00005	.00005	.00005
-3.7	.00011	.00010	.00010	.00010	.00009	.00009	.00008	.00008	.00008	.00008
-3.6	.00016	.00015	.00015	.00014	.00014	.00013	.00013	.00012	.00012	.00011
-3.5	.00023	.00022	.00022	.00021	.00020	.00019	.00019	.00018	.00017	.00017
-3.4	.00034	.00032	.00031	.00030	.00029	.00028	.00027	.00026	.00025	.00024
-3.3	.00048	.00047	.00045	.00043	.00042	.00040	.00039	.00038	.00036	.00035
-3.2	.00069	.00066	.00064	.00062	.00060	.00058	.00056	.00054	.00052	.00050
-3.1	.00097	.00094	.00090	.00087	.00084	.00082	.00079	.00076	.00074	.00071
-3.0	.00135	.00131	.00126	.00122	.00118	.00114	.00111	.00107	.00104	.00100
-2.9	.00187	.00181	.00175	.00169	.00164	.00159	.00154	.00149	.00144	.00139
-2.8	.00256	.00248	.00240	.00233	.00226	.00219	.00212	.00205	.00199	.00193
-2.7	.00347	.00336	.00326	.00317	.00307	.00298	.00289	.00280	.00272	.00264
-2.6	.00466	.00453	.00440	.00427	.00415	.00402	.00391	.00379	.00368	.00357
-2.5	.00621	.00604	.00587	.00570	.00554	.00539	.00523	.00508	.00494	.00480
-2.4	.00820	.00798	.00776	.00755	.00734	.00714	.00695	.00676	.00657	.00639
-2.3	.01072	.01044	.01017	.00990	.00964	.00939	.00914	.00889	.00866	.00842
-2.2	.01390	.01355	.01321	.01287	.01255	.01222	.01191	.01160	.01130	.01101
-2.1	.01786	.01743	.01700	.01659	.01618	.01578	.01539	.01500	.01463	.01426
-2.0	.02275	.02222	.02169	.02118	.02068	.02018	.01970	.01923	.01876	.01831
-1.9	.02872	.02807	.02743	.02680	.02619	.02559	.02500	.02442	.02385	.02330
-1.8	.03593	.03515	.03438	.03362	.03288	.03216	.03144	.03074	.03005	.02938
-1.7	.04457	.04363	.04272	.04182	.04093	.04006	.03920	.03836	.03754	.03673
-1.6	.05480	.05370	.05262	.05155	.05050	.04947	.04846	.04746	.04648	.04551
-1.5	.06681	.06552	.06426	.06301	.06178	.06057	.05938	.05821	.05705	.05592
-1.4	.08076	.07927	.07780	.07636	.07493	.07353	.07215	.07078	.06944	.06811
-1.3	.09680	.09510	.09342	.09176	.09012	.08851	.08691	.08534	.08379	.08226
-1.2	.11507	.11314	.11123	.10935	.10749	.10565	.10383	.10204	.10027	.09853
-1.1	.13567	.13350	.13136	.12924	.12714	.12507	.12302	.12100	.11900	.11702
-1.0	.15866	.15625	.15386	.15151	.14917	.14686	.14457	.14231	.14007	.13786
-0.9	.18406	.18141	.17879	.17619	.17361	.17106	.16853	.16602	.16354	.16109
-0.8	.21186	.20897	.20611	.20327	.20045	.19766	.19489	.19215	.18943	.18673
-0.7	.24196	.23885	.23576	.23270	.22965	.22663	.22363	.22065	.21770	.21476
-0.6	.27425	.27093	.26763	.26435	.26109	.25785	.25463	.25143	.24825	.24510
-0.5	.30854	.30503	.30153	.29806	.29460	.29116	.28774	.28434	.28096	.27760
-0.4	.34458	.34090	.33724	.33360	.32997	.32636	.32276	.31918	.31561	.31207
-0.3	.38209	.37828	.37448	.37070	.36693	.36317	.35942	.35569	.35197	.34827
-0.2	.42074	.41683	.41294	.40905	.40517	.40129	.39743	.39358	.38974	.38591
-0.1	.46017	.45620	.45224	.44828	.44433	.44038	.43644	.43251	.42858	.42465
-0.0	.50000	.49601	.49202	.48803	.48405	.48006	.47608	.47210	.46812	.46414

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
0.1	.53983	.54380	.54776	.55172	.55567	.55962	.56356	.56749	.57142	.57535
0.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
0.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
0.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
0.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
0.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
0.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
0.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
0.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
1.0	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91309	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
2.0	.97725	.97778	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
2.3	.98928	.98956	.98983	.99010	.99036	.99061	.99086	.99111	.99134	.99158
2.4	.99180	.99202	.99224	.99245	.99266	.99286	.99305	.99324	.99343	.99361
2.5	.99379	.99396	.99413	.99430	.99446	.99461	.99477	.99492	.99506	.99520
2.6	.99534	.99547	.99560	.99573	.99585	.99598	.99609	.99621	.99632	.99643
2.7	.99653	.99664	.99674	.99683	.99693	.99702	.99711	.99720	.99728	.99736
2.8	.99744	.99752	.99760	.99767	.99774	.99781	.99788	.99795	.99801	.99807
2.9	.99813	.99819	.99825	.99831	.99836	.99841	.99846	.99851	.99856	.99861
3.0	.99865	.99869	.99874	.99878	.99882	.99886	.99889	.99893	.99896	.99900
3.1	.99903	.99906	.99910	.99913	.99916	.99918	.99921	.99924	.99926	.99929
3.2	.99931	.99934	.99936	.99938	.99940	.99942	.99944	.99946	.99948	.99950
3.3	.99952	.99953	.99955	.99957	.99958	.99960	.99961	.99962	.99964	.99965
3.4	.99966	.99968	.99969	.99970	.99971	.99972	.99973	.99974	.99975	.99976
3.5	.99977	.99978	.99978	.99979	.99980	.99981	.99981	.99982	.99983	.99983
3.6	.99984	.99985	.99985	.99986	.99986	.99987	.99987	.99988	.99988	.99989
3.7	.99989	.99990	.99990	.99990	.99991	.99991	.99992	.99992	.99992	.99992
3.8	.99993	.99993	.99993	.99994	.99994	.99994	.99994	.99995	.99995	.99995
3.9	.99995	.99995	.99996	.99996	.99996	.99996	.99996	.99996	.99997	.99997

M.Sc. Engg.(EE) / Ph.D. (EE)/M.Sc.TE 1st 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 6411 — Time: 90 Minutes
Course Title: Wireless Ad Hoc and Sensor Networks — 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. Any symbol preserve the usual meaning.

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1. a) For personal area networking (PAN), both IR and Bluetooth technologies have their advantages and disadvantages. Justify your choice of technology between IR and Bluetooth technologies by mentioning appropriate applications. 5

   b) You and your friend want to share data between two wireless enable devices with the help of Bluetooth. Write down the basic characteristics and parameters of Bluetooth communication.
   What is spread-spectrum frequency hopping of Bluetooth? Briefly explain with examples. 8

   c) At the beginning of the data transferring, how does the Bluetooth device create connection with another Bluetooth device?
   Briefly discuss Bluetooth Piconets.
   How does Bluetooth operate during data transferring? Briefly explain the operation state with suitable flow chart. 12

2. a) As a network engineer, to create a computer network, you are asked to select between circuit switching and packet switching; what do you choose? Justify your answer. 4

   b) Why do we need queue in the packet switching? How does queue create data loss in the network? Mention four sources of packet delay in the figure. Briefly explain each of them. 8

   c) Network can be classified into two categories by their component roles i.e., P2P and Client-Server. Write down the characteristics of P2P network and Client-Server network. 6

   d) What do you understand by transmission control protocol (TCP), and user datagram protocol (UDP)?
   What do you understand by connection-oriented and connectionless services?
   Is downloading a music file from the Internet connection-oriented or connectionless?
   Is email connection-oriented or connectionless? 7

3. a) As a network designer, why do you need protocol suite? What do happen among network components if there is no protocol suite? 5

   b) Networks are complex, with many "pieces" such as hosts, routers, links of various media, applications, hardware, software, etc. To deal with these complex systems a layering based protocol standard called Open Systems Interconnection (OSI) model is widely used. Write the name of layers of OSI model. Explain the responsible job done by each layer and how do they contribute to the whole network. 12

   c) What is the basic difference between OSI model and TCP/IP model? Briefly explain by comparing the layers of both models with suitable tabular forms. 8

4. a) In wireless networking, performance metrics are: i) Throughput, ii) delay, iii) fairness, iv) stability, v) channel fading, vi) energy consumption, and vii) power management. As a wireless network designer, how do you consider each of them for the efficient wireless connectivity? Justify your answer by briefly explaining each of them. 12

   b) According to the IEEE standard, following wireless technologies are widely used according to the application categories: (802.21), (802.22), (802.11), (802.15.1), (802.16e), (2G, 3G), (802.20), (802.15.3), (802.16), (802.15.4). 10
   Write down their names according to the applications and classify them according to the Area Network (AN).
   Also, for the above standards, draw the comparison graph for Range vs Data Rate (for 0.01 Mbps to 1000 Mbps).

   c) What is Zigbee? In what kind of application do you use Zigbee? 3

M.Sc. Engg.(EE)/Ph.D.(EE) 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.: EEE 6601
Course Title: Antennas and Propagation

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) Draw an antenna equivalent circuit. What is the main difference between the antenna equivalent circuit and an RLC circuit? 5

   b) What is stub matching? Briefly explain the design procedure of single stub matching. 10

   c) Design a stub to match a transmission line which is connected to a load impedance of $z_L = (450 - j600)\ \Omega$. The characteristic impedance of the line is 300 Ω. The operating frequency is 20 MHz. 10

2. a) Define: Radiation resistance, directivity, antenna bandwidth. 5

   b) Derive the expression for radiated power by half-wave dipole. 10

   c) Find the directivity of an oscillating electric dipole. 10

3. a) Draw the radiation patterns of dipole for dipole length = λ/2, λ, and 2λ. 5

   b) Find out the relationship between W_T and W_R. 10

   c) Find the basic transmission loss between a ground-based antenna and airborne antenna when the distance between the antennas are 1.6 and 16 km at frequency f = 3 GHz. 10

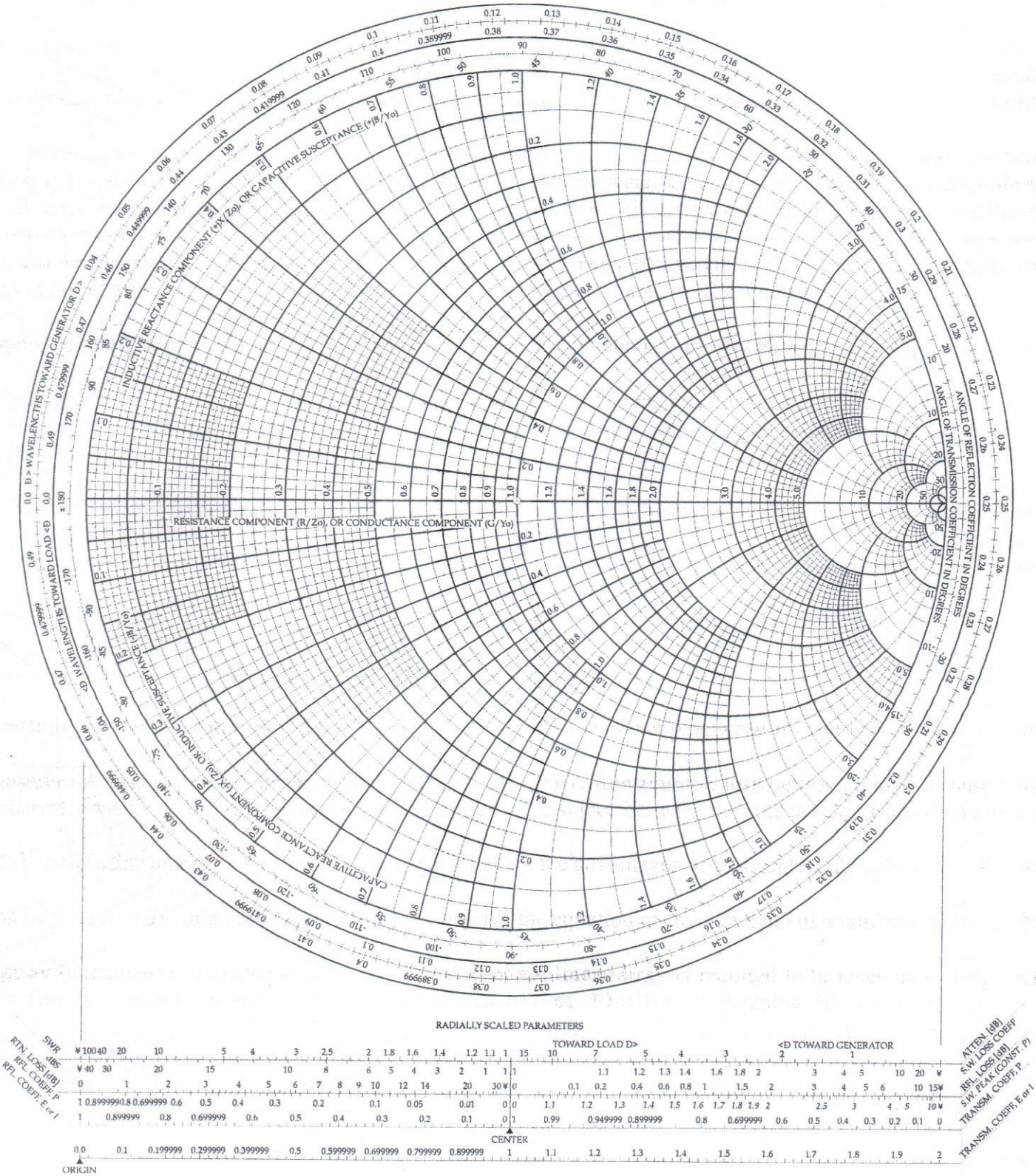
4. a) What are the advantages of array antenna? 5

   b) Derive the equation of field strength of a uniform linear array. 10

   c) A uniform linear array is required to produce an end-fire beam when it is operated at a frequency of 10 GHz. It contains 50 radiators and are spaced at 0.5λ. Find the progressive phase shift required to produce the end-fire beam. 10

IMPEDANCE SMITH CHART

Introduction to RF Circuit Design



Ph. D/M.Sc. Engg.(EE) Date: March 08 , 2019(Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid Semester Examination
Course No.: EEE 6607
Course Title: Computational Electromagnetics

Winter Semester, A. Y. 2018-2019
Time: 90 Mins
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. a) Classification of Electromagnetic (EM) problems is needed to select the most appropriate method for solving a given problem. Describe how EM problem are classified based on 13
   (i) the solution region of the problem
   (ii) the nature of the mathematical equation describing the problem
   (iii) the associated boundary condition

   Based on item (ii) above classify the EM problems described by

   - $e^x \frac{\partial^2 V}{\partial x^2} + \cos y \frac{\partial^2 V}{\partial x \partial y} - \frac{\partial^2 V}{\partial y^2} = 0$
   - $\frac{\partial^2 V}{\partial x^2} = \frac{1}{u^2} \frac{\partial^2 V}{\partial t^2}$
   - $(y^2+1)\frac{\partial^2 V}{\partial x^2} + (x^2+1)\frac{\partial^2 V}{\partial y^2} = 0$

   b) A 2D electrostatic problem defined as 12

$$\nabla^2 V(x,y) = 0, 0 < x, y < 2$$
$$V(x,0) = 0, V(0,y) = 0$$
$$V(x,2) = 100, \quad 0 < x < 2.$$

   Find $V(x,y)$ inside the region using separation of variable technique.

2. a) Derive the generalized Finite Difference (FD) scheme for Laplace equation. The application of this FD scheme often leads to a large system of sparse simultaneous algebraic equations. What are the most commonly used methods to solve such sparse system? 12

   b) The cross-section of a rectangular coaxial cable is shown below. The inner conductor is maintained at a potential of 100 V. Find V at the interior points numerically using FD method. 13

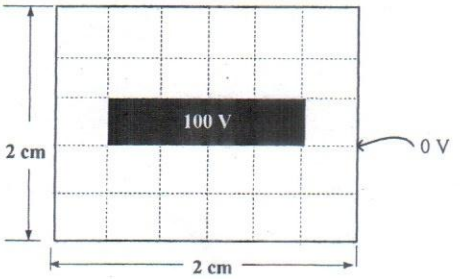

Fig. 2(b)

3. a) Derive and draw the computational modules of conventional FD and Crank- Nicholson schemes for the 1-D $k\frac{\partial \varphi}{\partial t} = \frac{\partial^2 \varphi}{\partial x^2}$ for $0 < r \le 1/2$ and $r = 1$, where $r = \frac{\Delta t}{k(\Delta x)^2}$. 15

b) What are meant by accuracy and stability of an algorithm? How von Neumann's method can be adopted to find the stability criterion of an FD scheme. Illustrate the method for a 1-D parabolic type EM problem. 10

4 Solve the EM problem $\frac{\partial \varphi}{\partial t} = \frac{\partial^2 \varphi}{\partial x^2}$, $0 \le x \le 1$, $t > 0$, subject to initial and boundary conditions 25

$$\phi(x,0) = x(1-x), \quad 0 \le x \le 1,$$
$$\phi(0,t) = 0 = \phi(1,t), \quad t > 0$$

Use $\Delta x = 0.25$ and $r = \frac{\Delta t}{(\Delta x)^2} = 0.5$.

M.Sc. Engg. (EE)/Ph.D
M.Sc.TE, 1st Sem.

Date: March 11, 2019 (Afternoon)

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

Mid-Semester Examination
Course No.: EEE 6705/EEE 6195
Course Title: Digital Control System

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. Use suitable assumptions for missing information.

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1. a) Briefly explain the significance of Z transformation in designing digital controller for continuous-time system. [5]

   b) Prove that, [10]

$$Z\left[x(t+nT)\right]=z^n\left[X(z)-\sum_{k=0}^{n-1}x(kT)z^{-k}\right].$$

   Where, $x(t)=0$ for $t<0$ and $x(t)$ has the z transform $X(z)$.

   c) Find $x(k)$ using direct division method for $k=0,1,2,3,4$ when $X(z)$ is given by, [10]

$$X(z)=\frac{10z+5}{(z-1)(z-0.2)}.$$

2. a) Obtain the z transform of the cosine function, [7]

$$x(t)=\begin{cases}\cos\omega t, & 0\le t\\ 0, & t<0\end{cases}.$$

   b) Mention different methods of obtaining inverse z transform. Obtain $x(kT)$ by using the inversion integral method when $X(z)$ is given by, [10]

$$X(z)=\frac{z\left(1-e^{-aT}\right)}{(z-1)\left(z-e^{-aT}\right)}$$

   c) Solve the following difference equation by use of z transform: [8]

$$x(k+2)+3x(k+1)+2x(k)=0,\ x(0)=0,\ x(1)=1.$$

3 a) Show that, the Laplace transform of the impulse-sampled signal $x^*(t)$ is same as the z transform of signal $x(t)$ if e^{Ts} is defined as z, or $e^{Ts}=z$. [10]

   b) With necessary mathematics, explain the procedure of obtaining z transform by the convolution integral method. Derive formulas to evaluate the convolution integral using left half plane. [15]

4 a) Derive formulas to evaluate the convolution integral using right half plane. [8]

   b) Derive the transfer function of the zero-order hold. [10]

$$G_{h0}(s)=\frac{1-e^{-Ts}}{s}.$$

   c) Obtain the z transform of, [7]

$$X(s)=\frac{1-e^{-Ts}}{s}\frac{1}{s+1}.$$

Table 2-1: Table of z Transform

	$X(s)$	$x(t)$	$x(kT)$ or $x(k)$	$X(z)$
1.	-	-	Kronecker delta $\delta_o(k)$ $1,\ k=0$ $0,\ k\neq 0$	1
2.	-	-	$\delta_o(n-k)$ $1,\ n=k$ $0,\ n\neq k$	z^{-k}
3.	$\frac{1}{s}$	$1(t)$	$1(k)$	$\frac{1}{1-z^{-1}}$
4.	$\frac{1}{s+a}$	e^{-at}	e^{-akt}	$\frac{1}{1-e^{-aT}z^{-1}}$
5.	$\frac{1}{s^2}$	t	kT	$\frac{Tz^{-1}}{\left(1-z^{-1}\right)^2}$
6.	$\frac{2}{s^3}$	t^2	$(kT)^2$	$\frac{T^2z^{-1}\left(1+z^{-1}\right)}{\left(1-z^{-1}\right)^3}$
7.	$\frac{6}{s^4}$	t^3	$(kT)^3$	$\frac{T^3z^{-1}\left(1+4z^{-1}+z^{-2}\right)}{\left(1-z^{-1}\right)^4}$
8.	$\frac{a}{s(s+a)}$	$1-e^{-at}$	$1-e^{-akt}$	$\frac{\left(1-e^{-aT}\right)z^{-1}}{\left(1-z^{-1}\right)\left(1-e^{-aT}z^{-1}\right)}$
9.	$\frac{b-a}{(s+a)(s+b)}$	$e^{-at}-e^{-bt}$	$e^{-akt}-e^{-bkt}$	$\frac{\left(e^{-aT}-e^{-bT}\right)z^{-1}}{\left(1-e^{-aT}z^{-1}\right)\left(1-e^{-bT}z^{-1}\right)}$
10.	$\frac{1}{(s+a)^2}$	te^{-at}	kTe^{-akt}	$\frac{Te^{-aT}z^{-1}}{\left(1-e^{-aT}z^{-1}\right)^2}$
11.	$\frac{s}{(s+a)^2}$	$(1-at)e^{-at}$	$(1-akt)e^{-akt}$	$\frac{1-(1+aT)e^{-aT}z^{-1}}{\left(1-e^{-aT}z^{-1}\right)^2}$
12.	$\frac{2}{(s+a)^3}$	t^2e^{-at}	$(kT)^2e^{-akt}$	$\frac{T^2e^{-aT}\left(1+e^{-aT}z^{-1}\right)z^{-1}}{\left(1-e^{-aT}z^{-1}\right)^3}$
13.	$\frac{a^2}{s^2(s+a)}$	$at-1+e^{-at}$	$akt-1+e^{-akt}$	$\frac{\left[\left(at-1+e^{-aT}\right)+\left(1-e^{-aT}-aTe^{-aT}\right)z^{-1}\right]z^{-1}}{\left(1-z^{-1}\right)^2\left(1-e^{-aT}z^{-1}\right)}$
14.	$\frac{\omega}{s^2+\omega^2}$	$\sin\omega t$	$\sin\omega kT$	$\frac{z^{-1}\sin\omega T}{1-2z^{-1}\cos\omega T+z^{-2}}$

15.	$\frac{s}{s^2+\omega^2}$	$\cos \omega t$	$\cos \omega kT$	$\frac{1-z^{-1}\cos \omega T}{1-2z^{-1}\cos \omega T+z^{-2}}$
16.	$\frac{\omega}{(s+a)^2+\omega^2}$	$e^{-at}\sin \omega t$	$e^{-akT}\sin \omega kT$	$\frac{e^{-aT}z^{-1}\sin \omega T}{1-2e^{-aT}z^{-1}\cos \omega T+e^{-2aT}z^{-2}}$
17.	$\frac{s}{(s+a)^2+\omega^2}$	$e^{-at}\cos \omega t$	$e^{-akT}\cos \omega kT$	$\frac{1-e^{-aT}z^{-1}\cos \omega T}{1-2e^{-aT}z^{-1}\cos \omega T+e^{-2aT}z^{-2}}$
18.			a^k	$\frac{1}{1-az^{-1}}$
19.			a^{k-1} $k=1,2,3,\ldots$	$\frac{z^{-1}}{1-az^{-1}}$
20.			ka^{k-1}	$\frac{z^{-1}}{(1-az^{-1})^2}$
21.			k^2a^{k-1}	$\frac{z^{-1}(1+az^{-1})}{(1-az^{-1})^3}$
22.			k^3a^{k-1}	$\frac{z^{-1}(1+4az^{-1}+a^2z^{-2})}{(1-az^{-1})^4}$
23.			k^4a^{k-1}	$\frac{z^{-1}(1+11az^{-1}+11a^2z^{-2}+a^3z^{-3})}{(1-az^{-1})^5}$
24.			$a^k\cos k\pi$	$\frac{1}{1+az^{-1}}$
25.			$\frac{k(k-1)}{2!}$	$\frac{z^{-2}}{(1-z^{-1})^3}$
26.		$\frac{k(k-1)\ldots(k-m+2)}{(m-1)!}$		$\frac{z^{-m+1}}{(1-z^{-1})^m}$
27.			$\frac{k(k-1)}{2!}a^{k-2}$	$\frac{z^{-2}}{(1-az^{-1})^3}$
28.		$\frac{k(k-1)\ldots(k-m+2)}{(m-1)!}a^{k-m+1}$		$\frac{z^{-m+1}}{(1-az^{-1})^m}$

Table 2.2: Important Properties and Theorems of the z Transform

	$x(t)$ or $x(k)$	$Z[x(t)]$ or $Z[x(k)]$
1.	$ax(t)$	$aX(z)$
2.	$ax_1(t)+bx_2(t)$	$aX_1(z)+bX_2(z)$
3.	$x(t+T)$ or $x(k+1)$	$zX(z)-zx(0)$
4.	$x(t+2T)$	$z^2X(z)-z^2x(0)-zx(T)$
5.	$x(k+2)$	$z^2X(z)-z^2x(0)-zx(1)$
6.	$x(t+kT)$	$z^kX(z)-z^kx(0)-z^{k-1}x(T)-\ldots-zx(kT-T)$
7.	$x(t-kT)$	$z^{-k}X(z)$
8.	$x(n+k)$	$z^kX(z)-z^kx(0)-z^{k-1}x(T)-\ldots-zx(k-1)$
9.	$x(n-k)$	$z^{-k}X(z)$
10.	$tx(t)$	$-Tz\frac{d}{dz}X(z)$
11.	$kx(k)$	$-z\frac{d}{dz}X(z)$
12.	$e^{-at}x(t)$	$X\left(ze^{aT}\right)$
13.	$e^{-ak}x(k)$	$X\left(ze^{a}\right)$
14.	$a^kx(k)$	$X\left(\frac{z}{a}\right)$
15.	$ka^kx(k)$	$-z\frac{d}{dz}X\left(\frac{z}{a}\right)$
16.	$x(0)$	$\lim_{z\to\infty}X(z)$ if the limit exists
17.	$x(\infty)$	$\lim_{z\to 1}\left[\left(1-z^{-1}\right)X(z)\right]$ if $\left(1-z^{-1}\right)X(z)$ is analytic on and outside the unit circle
18.	$\nabla x(k)=x(k)-x(k-1)$	$\left(1-z^{-1}\right)X(z)$
19.	$\Delta x(k)=x(k+1)-x(k)$	$(z-1)X(z)-zx(0)$
20.	$\sum_{k=0}^{n}x(k)$	$\frac{1}{1-z^{-1}}X(z)$
21.	$\frac{\partial}{\partial a}x(t,a)$	$\frac{\partial}{\partial a}x(z,a)$
22.	$k^mx(k)$	$\left(-z\frac{d}{dz}\right)^mX(z)$
23.	$\sum_{k=0}^{n}x(kT)y(nT-kT)$	$X(z)Y(z)$
24.	$\sum_{k=0}^{\infty}x(k)$	$X(1)$