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B.Sc. Engg. (EE), 2nd Sem. Date: 29 August, 2019 (Afternoon)

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

Mid-Semester Examination
Course No.: EEE 4201
Course Title: Electrical Circuit II

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 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) Solve for the voltage, *v(t)* of a circuit described by the integrodifferential equation: 05

$$\frac{d^2v}{dt^2} + 2\frac{dv}{dt} - 10\int v\,dt + 5v = 50\sin(5t - 30^0)$$

b) For a balanced delta connected load with $Z_\Delta = \sqrt{3}\angle 15^0$, sketch the phasor diagram for all the phase voltages, line voltages, phase currents, and line currents fed by a positive sequenced balanced wye connected source with $V_{an} = 10\angle 0^0$. 15

c) Formulate the mesh equations for the circuit in Fig. 1(c). 05

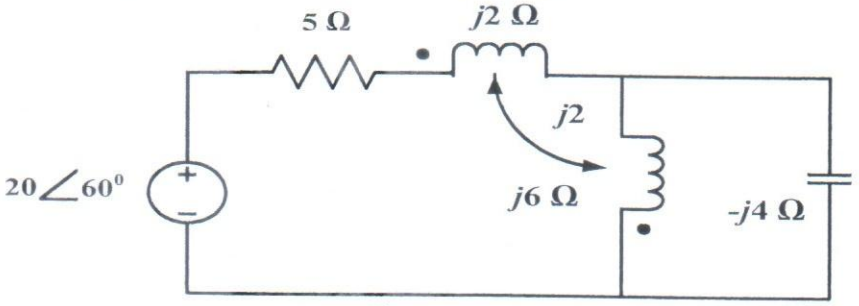


Fig. 1(c)

2. a) What are the advantages of using phasor representation for a sinusoid? 05

b) For the circuit in Fig. 2(b), calculate the total complex power, average power, and reactive power delivered by the voltage source, $V_i = 16\angle 45^0$. Sketch the corresponding power triangle and calculate the power factor from it. How would you improve the power factor of this circuit to unity? 15

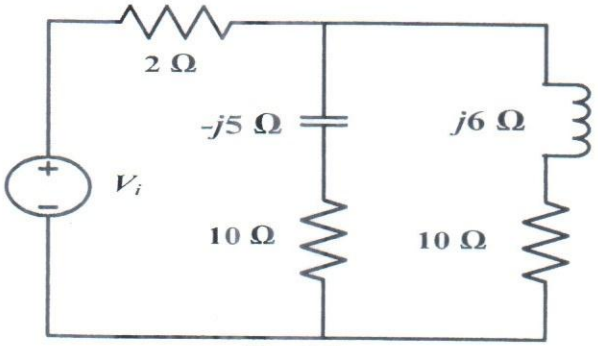


Fig. 2(b)

c) What are the reasons for using dot convention for a mutually induced voltage? 05

3. a) Your next-door neighbor has recently started rewiring his apartment and has asked for your opinion about which type of 3-ϕ connection he should choose. What would be your preferred suggestion and why? 05

b) Calculate the phase shift for V_0 for the circuit in Fig. 3(b) with respect to V_i. State whether the phase shift is leading or lagging (output with respect to input). 15

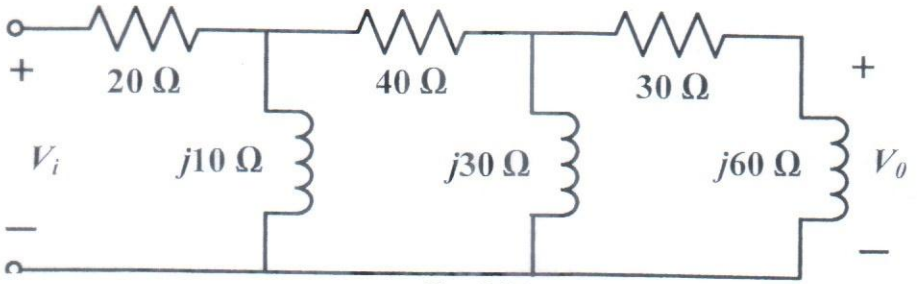


Fig. 3(b)

c) For the mutually inductive circuit in Fig. 3(c), determine the equivalent inductance between the terminals a-b. The arrow indicates the direction of current flow. 05

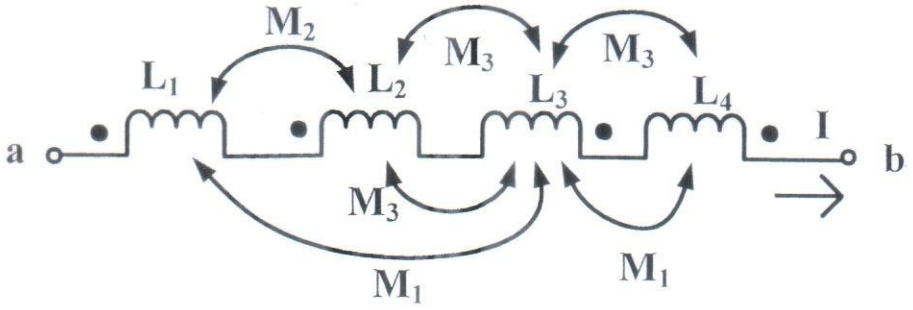


Fig. 3(c)

4. a) What is the loading effect in ladder networks? How can we combat this effect in a circuit? 05

b) Calculate the current Io for the circuit in Fig. 4(b). 15

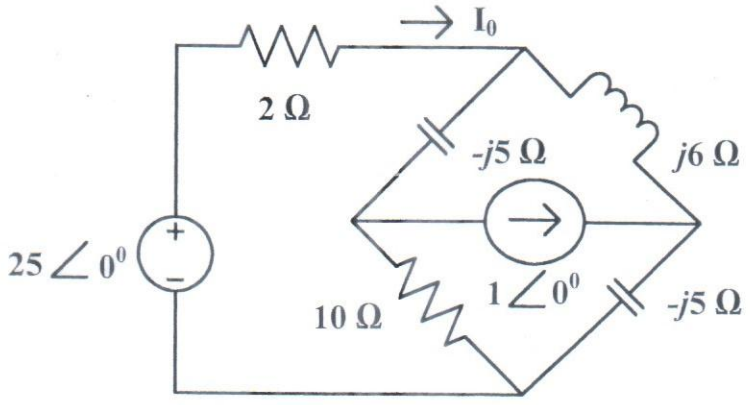


Fig. 4(b)

c) Of all the polyphase systems, why do we choose the 3-ϕ system for generation and distribution of electrical power? 05

(iv) When you visit your career services office, they give you a test that indicate professions to which you are best suited.

4. a) Following are the group of 30 scores in an achievement test: 15

60, 60, 63, 68, 70, 72, 75, 75, 75, 76, 76, 77, 78, 80,
83, 83, 84, 88, 93, 93, 93, 94, 94, 94, 94, 95, 97,

(i) Construct a grouped frequency distribution.

(ii) Graph your data by using both a histogram and a frequency polygon. Decide which frequency distribution is the best to represent the data.

(iii) Why is this distribution symmetrical, positively skewed, or negatively skewed?

b) In making a frequency distribution, you set the real limits for the lowest two intervals at 29.5-39.5 and 39.5-49.5: A friend objects, saying, "The intervals overlap, because both contain 39.5." 10

(i) Reply to your friend's objection.

(ii) Give the apparent limits and the interval width for both intervals.

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4203
Course Title: Electronics I

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

There are **4 (four)** questions. Answer **any 3 (Three)** questions. Programmable calculators are not allowed. Marks in the margin indicate full marks. Do not write on this question paper. Assume reasonable value for any missing data.

1.a) Draw the circuit diagram that includes a diode and which exhibits the following current voltage characteristic shown in Fig. 1(a). Find (i) the value of Y, (ii) if an arbitrary co-ordinate of the diode is given as 1 mA of current at a voltage of 0.7 V and the diode characteristic is such that voltage drop changes by 0.1 V for every decade change in current find the co-ordinates of Q by iterative analysis. 10

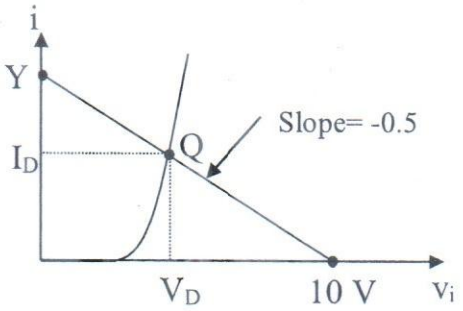


Fig. 1(a)

b) Find the value of V for the circuit in Fig. 1(b) provides a constant output voltage $V_0 = 2.1$ volt for no load condition. The voltage V_0 changes by 30 mV per 1 mA change of load current. Assume, n = 2. 08

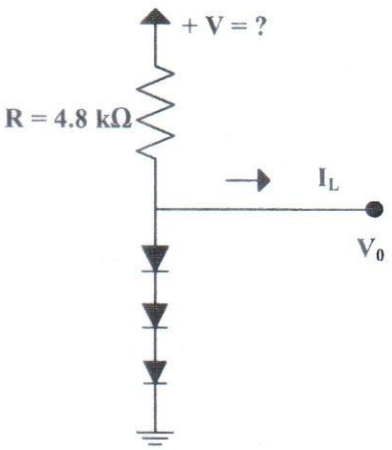


Fig. 1(b)

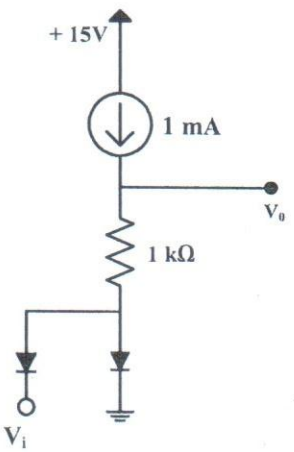


Fig. 1(c)

c) The input voltage Vi is 1 kHz, 10 V peak sine wave shown in Fig. 1(c) above. Sketch the resulting output waveform at V_0. 07

2.a) Determine the range of values of V_i that will maintain the Zener diode of the following figure shown in Fig. 2(a) in the 'ON' state. Maximum Zener current is $I_{ZM} = 60$ mA. 07

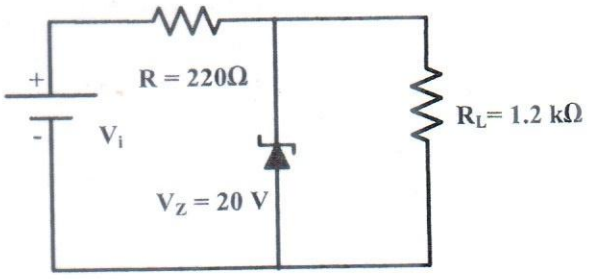


Fig. 2(a)

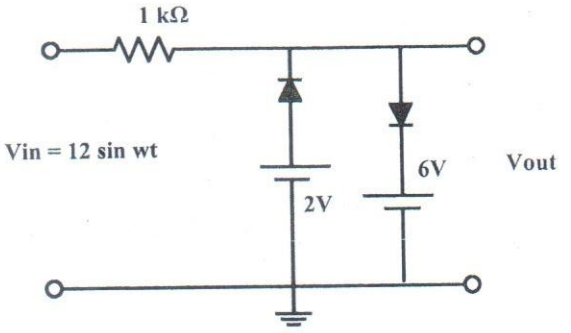
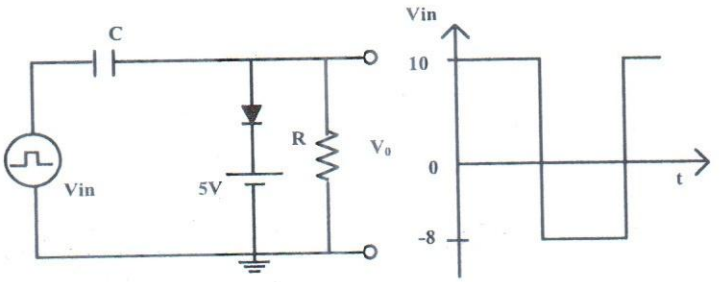


Fig 2(b)

b) Find the output waveshape for the clipper shown in Fig. 2(b) above. Assume, all diodes are ideal. 08

c) Find the output voltage waveshapes for the following clampers shown in Fig. 2(c). Assume, diodes are ideal. 10

(i)



(ii)

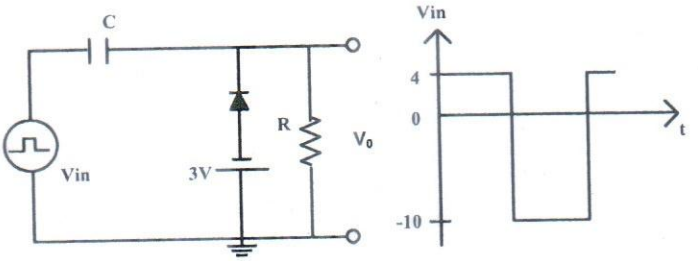


Fig. 2(c)

3.a) Write down the importance of biasing of Emitter-Base junction and Collector-Base junction of an *npn* BJT from the application point of view. 05

b) An *npn* transistor having $I_S = 10^{-15}$ A and $\beta = 100$ is connected as follows: The emitter is grounded, the base is fed with a constant-current source supplying a dc current of 10 μA, and the collector is connected to a 5 V dc supply via a resistance R_C of 3 kΩ. Assuming that the transistor is operating in the active mode, find V_{BE} and V_{CE}. Use these values to verify active-mode operation. Replace the current source with a resistance connected from the base to the 5 V dc supply. What resistance value is needed to result in the same operating conditions? 10

c) In the circuit shown in Fig. 3(c), the voltage at the emitter was measured and found to be -0.7 V. If $\beta = 50$, find I_E, I_B, I_C and V_C. 10

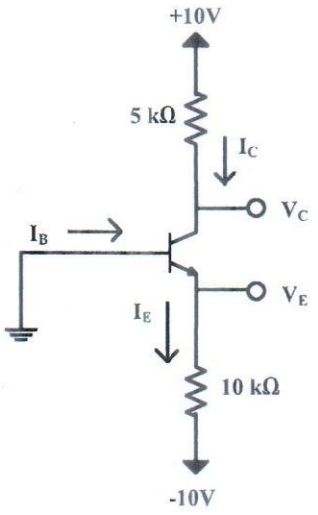


Fig. 3(c)

4.a) What is an early effect on a BJT. Explain this effect by proper circuit diagram and graphs beteen collector current and collector voltage. Derive the expression of output voltage. 8

b) For the circuit shown in Fig. 4(b), it is required to determine the value of the voltage V_{BB} that results in the transistor operating 9
(i) in the active mode with $V_{CE} = 4$ V,
(ii) at the edge of saturation,
(iii) deep in saturation with $\beta_{forced} = 10$.
For simplicity, assume that V_{BE} remains constant at 0.7 V. The transistor β is specified to be 100.

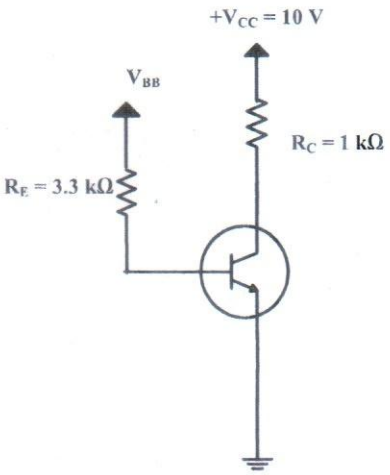


Fig. 4(b)

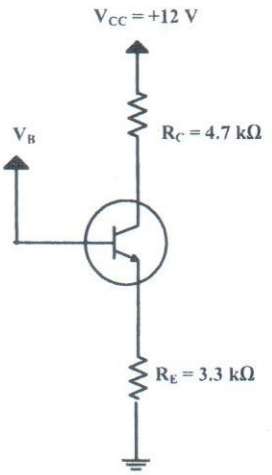


Fig. 4(c)

c) For the circuit in Fig. 4(c), find the highest voltage to which the base can be raised while the transistor remains in the active mode. Assume $\alpha = 1$. 8

B. Sc. Engg. (EE), 2nd Sem.
B. Sc. TE(2-Yr) 2nd Sem.

Date: August 30, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: Math 4221/Math 4629
Course Title: Mathematics III

Summer Semester A. Y. 2018-2019
Time: 90 Minutes
Full marks: 75

There are **4 (four)** questions. Answer **any 3 (three)** questions. 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) Prove that $\mathbf{a} \times (\mathbf{b} \times \mathbf{c}) = (\mathbf{a}.\mathbf{c})\,\mathbf{b} - (\mathbf{a}.\mathbf{b})\,\mathbf{c}$ (8)
hence show that $\mathbf{a} \times (\mathbf{b} \times \mathbf{c}) + \mathbf{b} \times (\mathbf{c} \times \mathbf{a}) + \mathbf{c} \times (\mathbf{a} \times \mathbf{b}) = \mathbf{0}$

b) Prove that the volume of the parallelepiped whose edges are the vectors $\mathbf{a} + \mathbf{b}$, $\mathbf{b} + \mathbf{c}$, $\mathbf{c} + \mathbf{a}$ is twice the volume whose edges are **a, b, c.** (8)

c) Find a set of vectors reciprocal to the set $\mathbf{i} + 2\mathbf{j} + 3\mathbf{k}$, $5\mathbf{i} - \mathbf{j} - \mathbf{k}$ and $\mathbf{i} - \mathbf{j} + \mathbf{k}$. (9)

2. a) (i) Prove that $\nabla.(\nabla \times \mathbf{A}) = 0$ (6)

(ii) Evaluate $\nabla\left(3r^2 - 4\sqrt{r} + \frac{6}{\sqrt[3]{r}}\right)$ (6)

b) Determine the constant a, b, c so that vector (13)
$\mathbf{v} = (-4x-3y+az)\,\mathbf{I} + (bx+3y+5z) + (4x+cy+3z)$ is irrotational.
Find a scalar function ϕ so that $\mathbf{v} = \nabla\phi$.

3. a) Evaluate $\int_C \mathbf{F}.d\mathbf{r}$ where $\mathbf{F} = z\mathbf{i} + z\mathbf{j} + x\mathbf{k}$ and C is curve given by x=cost, (12)
y = sint, z = t from t = 0 to $t = \pi$.

b) Prove that $\mathbf{F} = (y^2\cos x + z^3)i + (2y\sin x - 4)j + (3xz^2 + 2)k$ is a conservative force field. Find the work done in moving an object in this field from (0,1,-1) to $(\frac{\pi}{2}, -1, 2)$. (13)

4. a) State and prove Green's theorem in the plane. (12)

b) Evaluate $\int_C (y-\sin x)dx+\cos x dy$ by using Green's theorem where C is the triangle formed by the straight lines y = 0 from (0,0) to $(\frac{\pi}{2},0)$, x = $\frac{\pi}{2}$ from $(\frac{\pi}{2}$, 0) to $(\frac{\pi}{2}$, 1) and y = $\frac{2x}{\pi}$ from $(\frac{\pi}{2}$, 1) to (0, 0). (13)

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B. Sc. Engg.(EE), 2nd Sem. Date: 23 August, 2019 (Afternoon)

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

Mid-Semester Examination — Summer Semester A. Y. 2018-2019
Course No.: Phy 4221 — Time: 90 Minutes
Course Title: Engineering Physics II — 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 the terms space lattice and basis of a crystal. 6
   (b) What is a unit cell? What do you understand by the lattice parameters of a unit cell? Write down the lattice parameters for cubic, orthorhombic and hexagonal crystal system with their lattice types. Draw unit cells of each lattice type. 12
   (c) What is the crystalline nature of lead (Pb) crystal? Draw a typical unit cell of this crystal. How many unit cells are in a Pb sheet of length *5.0 cm*, breadth *2.5 cm* and thickness 2.5 *mm*? How many Pb atoms are in that sheet? 7

2. (a) What are Miller indices? How Miller indices are determined? 7
   (b) Sketch the following crystal planes and directions in a cubic crystal system: (122), (112), [122] and [112]. 8
   (c) Draw a typical unit cell for NaCl crystal and explain its structure. Write expressions for lattice constant and packing factor in terms of atomic radii of Na and Cl. 10

3. (a) What are inertial and non-inertial frames of reference? Write down the postulates of the special theory of relativity. 7
   (b) Establish Einstein's mass-energy relation considering relativistic effect. Show that at low speed, the relativistic expression for the kinetic energy of a moving body reduces to the classical one. 13
   (c) A spacecraft is moving relative to earth. An observer on the earth finds that according to his clock, 3601s elapse between 1 PM and 2 PM on the spacecraft's clock. What is the spacecrafts' speed relative to the earth? 5

4. (a) Show graphically Rayleigh-Jeans prediction for the energy density of a blackbody cavity. Draw the Planck's energy density of blackbody radiation at various temperatures as a function of wavelength. Write down the experimentally observed facts of blackbody radiation. 10

(b) Explain the experimental characteristics of the photoelectric effect that cannot be explained in terms of classical mechanics. 10

(c) Calculate the threshold frequency and the corresponding wavelength of radiation incident on a certain metal whose work function is 3.31×10^{-19} joules. 5

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B.Sc. Engg.(CSE), 2nd Sem. Date: August 27, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: Phy 4241
Course Title: Physics II

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 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) An automobile battery is charged with a constant current of 2 A for five hours. The terminal voltage of the battery is $v = 11 + 0.5t$ V for $t > 0$, where t is in hours. 5

   i. Find the energy delivered to the battery during the five hours.
   ii. If electric energy costs 15 Tk./kWh, find the cost of charging the battery for five hours.

   b) The portable lighting equipment for a mine is located 100 meters from its dc supply source. The mine lights use a total of 5 kW and operate at 120 Vdc. Determine the required cross-sectional area of the copper wires used to connect the source to the mine lights if we require that the power lost in the copper wires be less than or equal to 5 percent of the power required by the mine lights. Assume that the resistivity of the copper is $1.7 \times 10^{-6}\ \Omega$. 6

   c) Most of us are familiar with the effects of a mild electric shock. The effects of a severe shock can be devastating and often fatal. Shock results when current is passed through the body. A person can be modeled as a network of resistances. Consider the model circuit shown in Fig. 1(c). Determine the voltage developed across the heart and the current flowing through the heart of the person when he or she firmly grasps one end of a voltage source whose other end is connected to the floor. The heart is represented by R_h. The floor has resistance to current flow equal to R_f, and the person is standing bare foot on the floor. This type of accident might occur at a swimming pool or boat dock. The upper-body resistance R_u and lower-body resistance R_L vary from person to person. 7

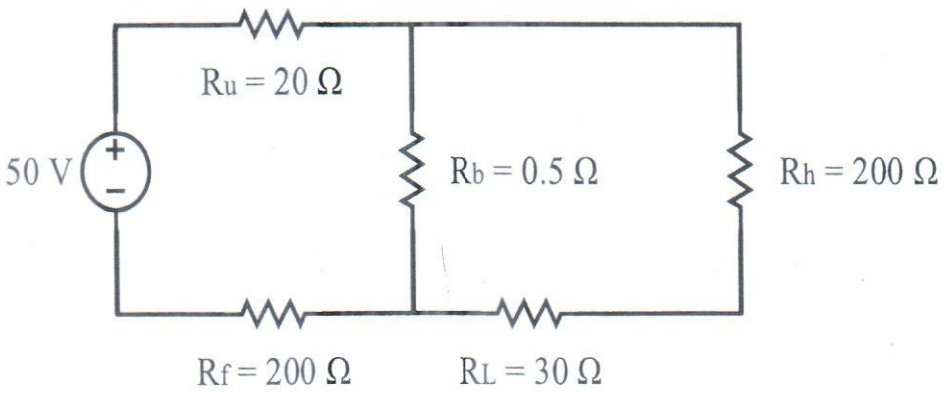

Fig. 1(c)

d) For the network in Fig. 1(d), find the resistance R_3 if the current through it is 2 A. 7

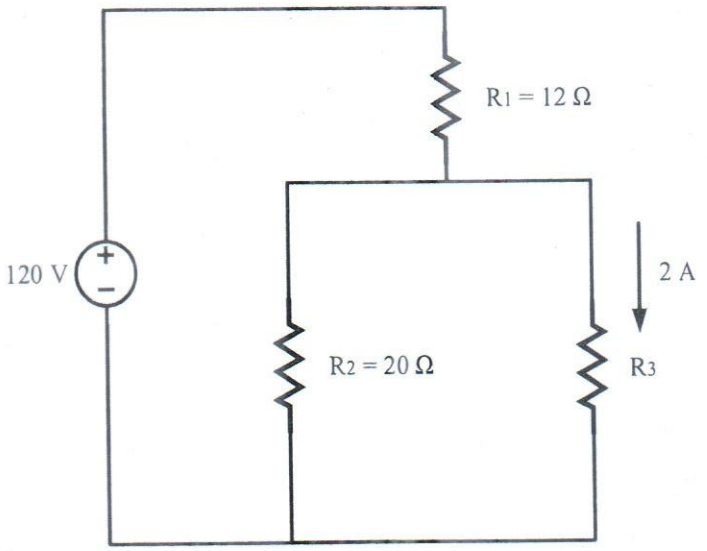

Fig. 1(d)

2. a) A phonograph pickup, stereo amplifier, and speaker are shown in Fig. 2(a.1) and redrawn as a circuit model as shown in Fig. 2(a.2). Determine the resistance R so that the voltage, V across the speaker is 16 V. Determine the power delivered to the speaker. 8

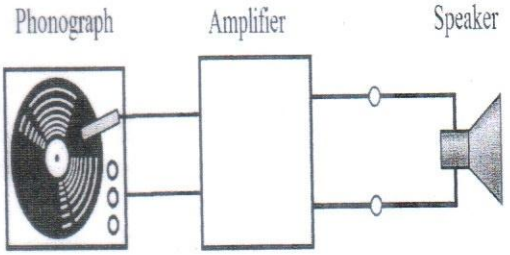

Fig. 2(a.1)

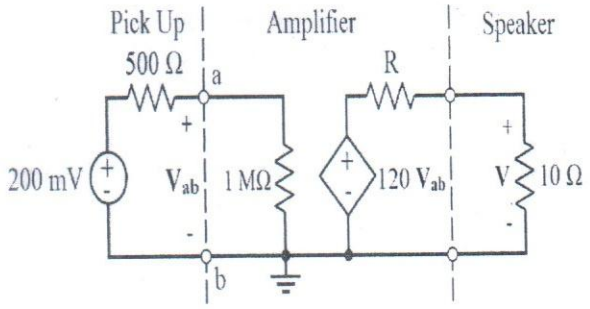

Fig. 2(a.2)

b) Find the power dissipated in the 3 Ω resistor of the circuit shown in Fig. 2(b). Also, find the energy stored in the 2 F capacitor and the 2 H inductor of the same circuit. 9

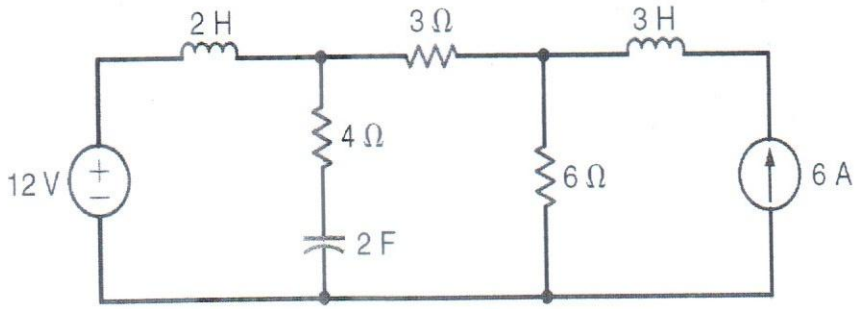

Fig. 2(b)

c) An electric current is applied to bone fractures that have not healed in the normal period of time. The process seeks to imitate natural electrical forces within the body. It takes only a small amount of electric stimulation to accelerate bone recovery. The direct current method uses an electrode that is implanted at the bone. This method has a success rate approaching 80 percent. 8

The implant is shown in Fig. 2(c.1), and the circuit model is shown in Fig. 2(c.2). Find the energy delivered to the cathode during a 24-hour period. The cathode is represented by the dependent voltage source and the 100 kΩ resistor.

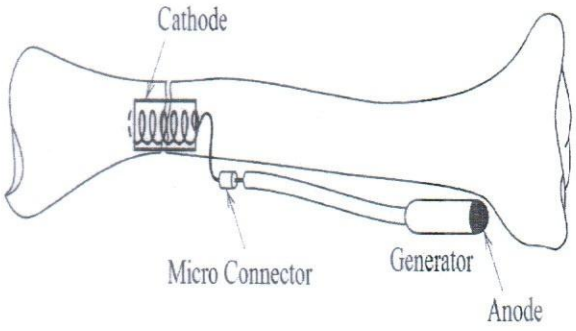

Fig. 2(c.1)

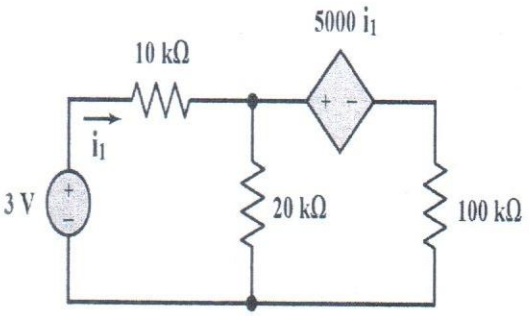

Fig. 2(c.2)

3. a) The circuit in Fig. 3(a) is a direct-current version of a typical three wire distribution system. The resistors R_a, R_b and R_c represent the resistances of the three conductors that connect the three loads R_1, R_2 and R_3 to the 125/250 V voltage supply. The resistors R_1 and R_2 represent loads connected to the 125 V circuits, and R_3 represents a load connected to the 250 V circuit. 12

i. Calculate V_1, V_2 and V_3 using nodal analysis.
ii. Calculate the power delivered to the load R_1, R_2 and R_3.

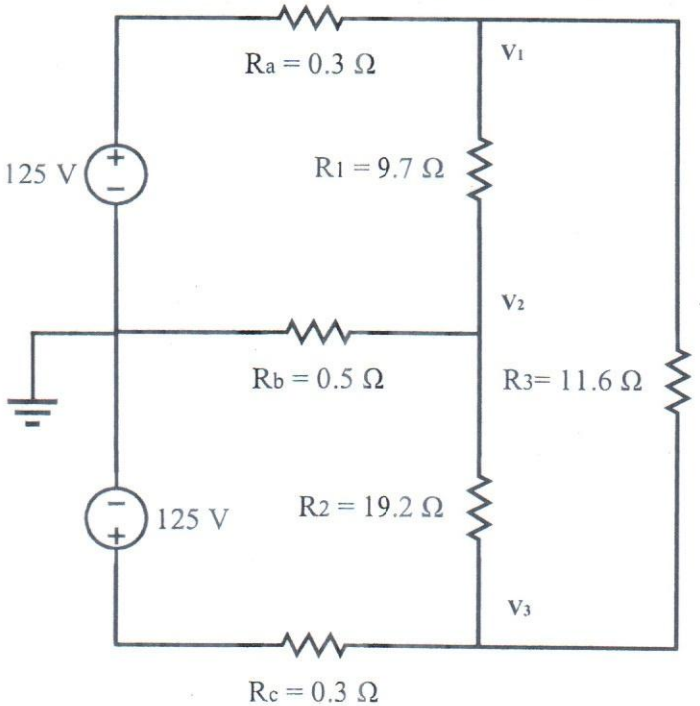

Fig. 3(a)

b) Find V_0 in the circuit of Figure 3(b) using mesh current analysis. 13

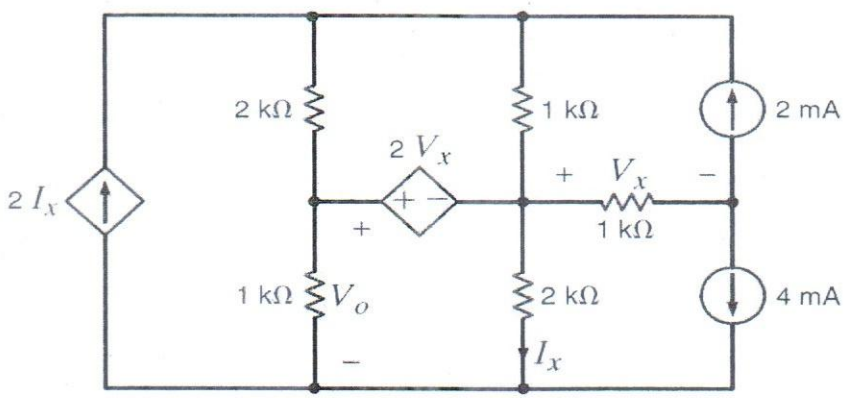

Figure 3(b)

4. a) Find I_0 in the circuit of Fig. 4(a) using superposition. 12

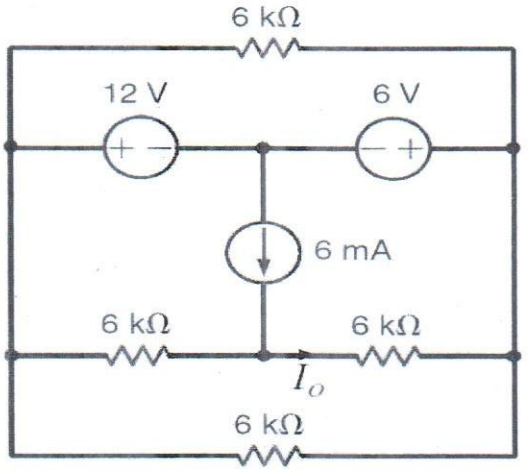

Fig. 4(a)

b) Find R_{Th} , V_{Th} at the *a-b* terminal from Fig. 4(b). 13

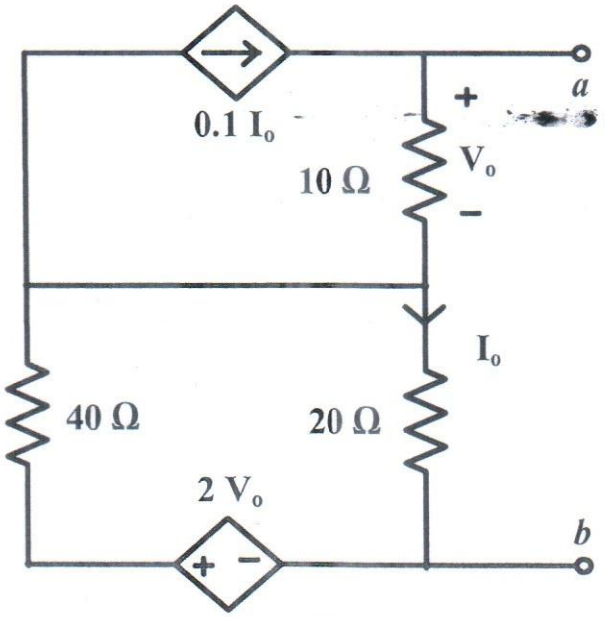

Fig. 4(b)

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Programme name with semester
BBA in TM, 2nd Sem.

Date: August 29, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4261
Course Title: Electrical and Electronic Technology II

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 in the margin indicate full marks. Programmable calculators are not allowed.

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1. a) What is the difference between *n*-type and *p*-type semiconductor materials. Describe the conditions established by forward, reverse and no-bias conditions on a *p-n* junction diode and how the resulting current is affected. 10

   b) Determine V_0 and I for the networks of Fig.1. 9

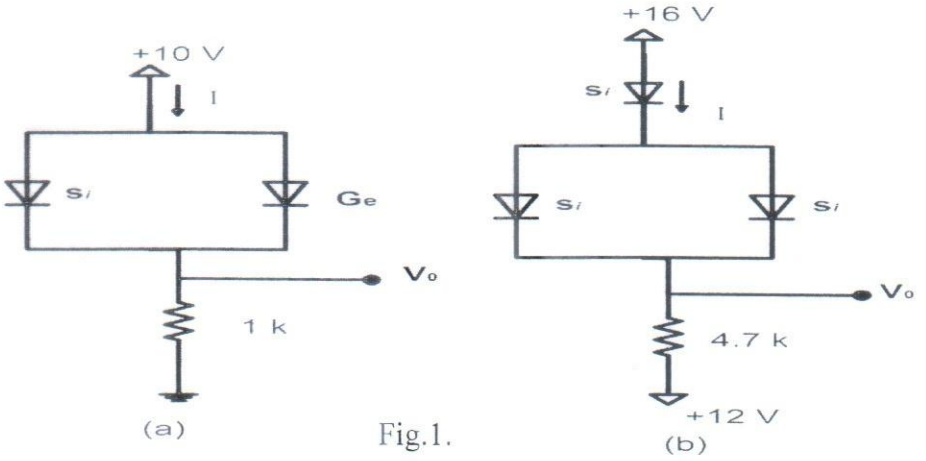

Fig.1.

   c) Determine the level of V_0 for the gate of Fig.2. 6

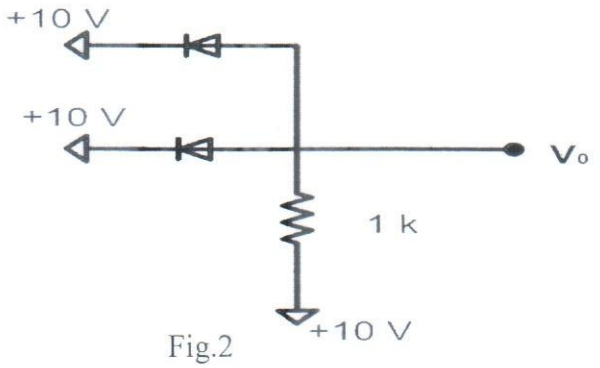

Fig.2

2. a) Sketch V_0 for the network of Fig.3. and determine the dc voltage available. Consider input as sinusoidal with a peak amplitude of 100 Volts. 12

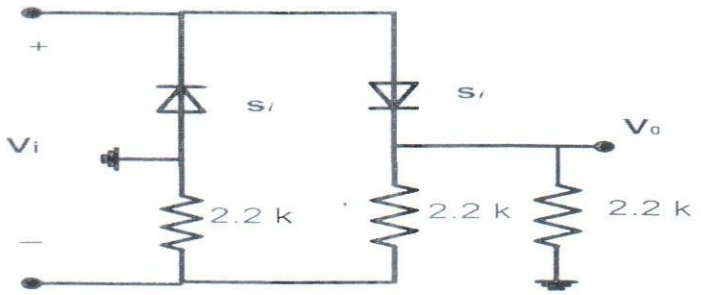

Fig.3.

b) Determine V_L, I_L, I_Z, and I_R for the network Fig.4. if R_L= 180 ohm. Also determine the minimum value of R_L to ensure that the Zener diode is in the "on" state. 13

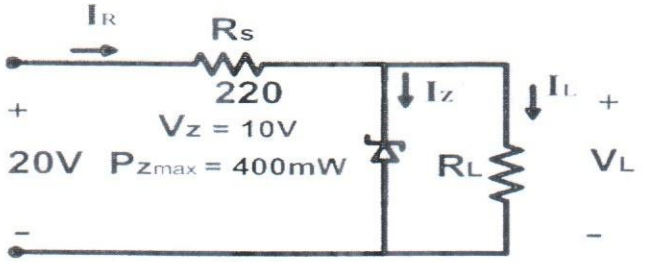

Fig.4.

3. a) Sketch V_0 for each network of Fig.5 for the input shown. Consider input as sinusoidal with a peak amplitude of 120 Volts. 12

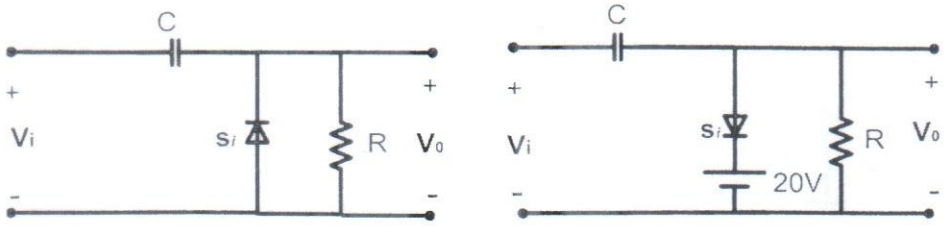

Fig.5.

b) Determine V_0 for each network of Fig.6 for the input shown. Consider input as sinusoidal with a peak amplitude of 80 Volts. 13

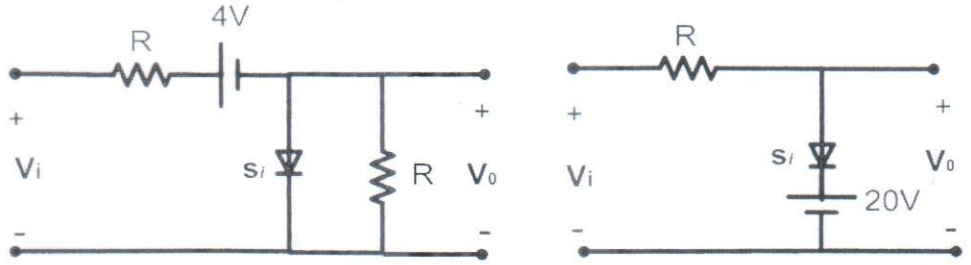

Fig.6.

4. a) What names are applied to the two types of BJT transistors? Sketch the basic construction of each and label the various minority and majority carriers in each when emitter-base junction is forward-biased and collector-base junction is reverse-biased. 11

b) Draw and explain the circuit diagrams of common-base and common-emitter configuration of npn transistor. Also draw the input and output characteristics for both configurations. Write down the necessary current and voltage relations. 14

B.Sc. Engg.(EEE) 2nd Sem. Date: August 26, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: CSE 4271
Course Title: Computer Programming

Summer Semester, A.Y. 2018-2019
Time: 90 Minutes
Full Marks: 50

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. **Question number 1 (one) is compulsory**.

Question No. 1 is compulsory.

1. a) Write a program which will take an integer amount of money as input and then will try to figure out how many cash notes of which types are required to meet the amount trying to minimize the total notes count. Consider you have cash notes of 500, 100, 50, 20, 10, 5, 2 & 1 available. 12

Sample Input	Sample Output
1075	500 : 2 50 : 1 20 : 1 5 : 1
14	10 : 1 2 : 2

b) What do you mean by typecasting? Write down the significance of typecasting. 4

2. a) Write a program to find the factorial of a number. Use an user defined function to perform the operation. Call the function with the specific number and have it return the factorial of that number inside the main function. 7

b) Write down the output for the following code: 10

```
#include<stdio.h>
int main()
{
   int a=25,b=3,c,d,e;
   b*=a;
   c=b++;
   a-=c=--a;
   d=++c%b;
   e=b/c;
   printf("\n%d",a);
   printf("\n%d",b);
   printf("\n%d",c);
   printf("\n%d",d);
   printf("\n%d",e);
   return 0;
}
```

3. a) In number theory, a perfect number is a positive integer that is equal to the sum of its proper positive divisors, that is, the sum of its positive divisors excluding the number itself. For example, 28 is a perfect number. Here, the positive divisors of 28 are: 1, 2, 4, 7, 14, and 28. The sum of the positive divisors excluding the number itself is: 13

1+2+4+7+14=28

Now, write a program to determine whether a given positive integer number, n is perfect or not.

b) Write down the syntaxes and give an example for each the following: 4

- while loop
- for loop
- do...while loop
- user-defined functions

4. a) Write a program that can detect whether a point is inside or outside a square. The square's sides are parallel to the axes of the XY plane. Your input is 5 integers. The first 2 integers represent the (x, y) coordinates of the bottom left corner of the square. The next integer represents the length of each of its sides. The next 2 integers represent the (x, y) coordinates of the query point. Print "Inside the square" if the query point is inside or on the boundary of the square. Otherwise print "Outside the square". 13

b) Mention the format specifiers and escape sequences with proper description. 4

B.Sc. Engg (MCE), 2nd Sem. Date: August 26, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4281
Course Title: Basic Electrical Engineering

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 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

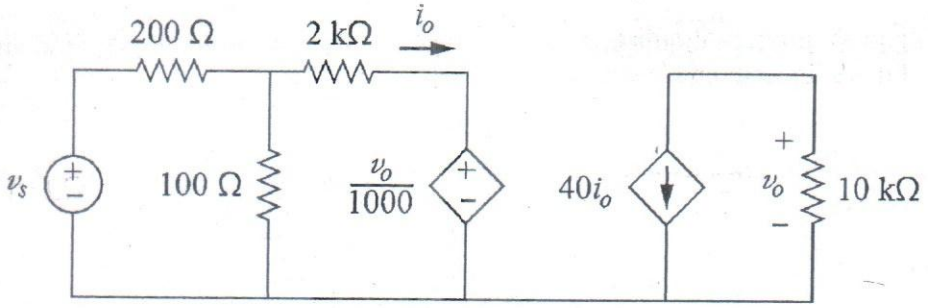

Fig. 1(a)

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

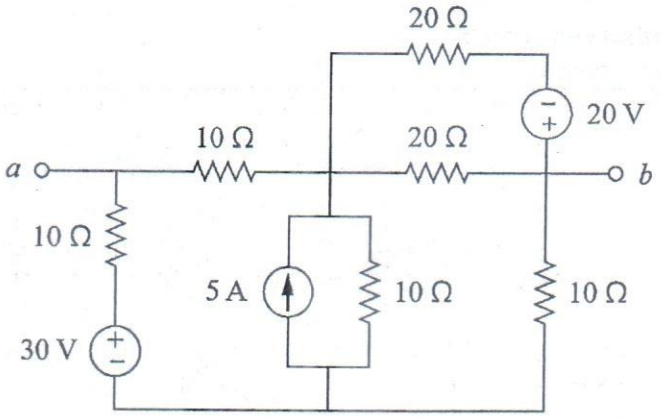

Fig. 1(b)

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

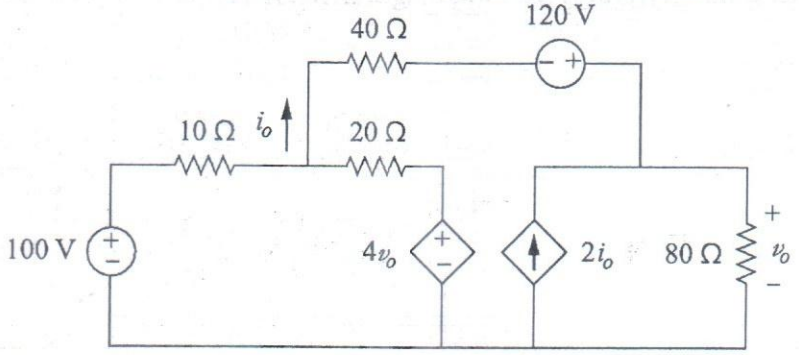

Fig. 2(a)

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

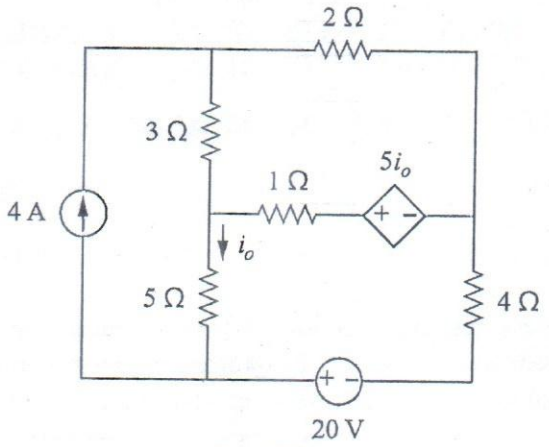

Fig. 2(b)

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

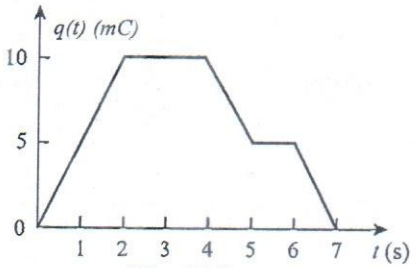

Fig. 3(a)

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

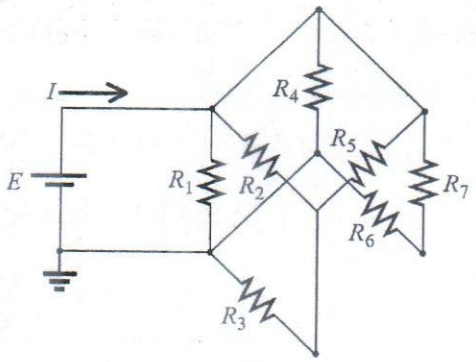

Fig. 3(b)

c) Find out i_1, i_2 and i_3 from the following circuit given in Fig. 3(c). 9

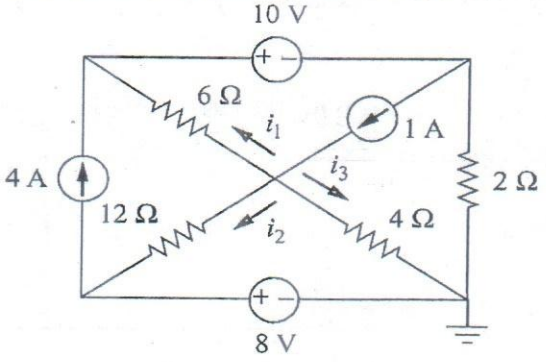

Fig. 3(c)

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

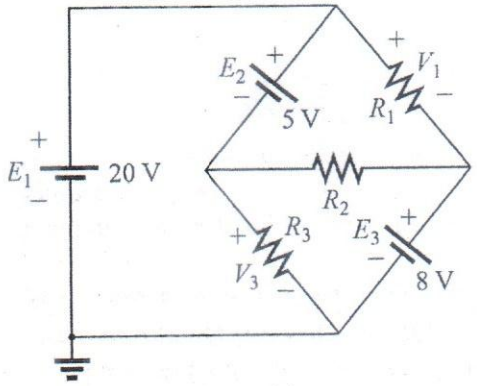

Fig. 4 (a)

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

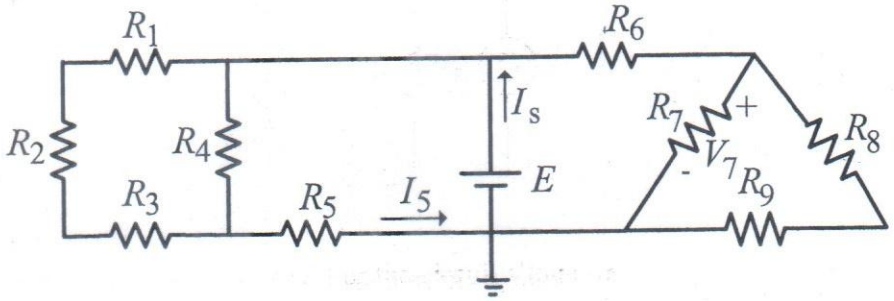

Fig. 4 (b)

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

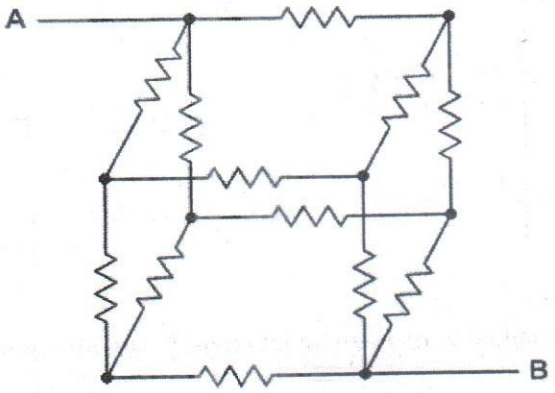

Fig. 4 (c)

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B.Sc. Engg. (EE), 4th Sem.
DTE, 2nd Sem.

Date: August 29, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Semester Final Examination
Course No.: EEE 4401/EEE 4495
Course Title: Power System II

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 in the 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) In the three phase system shown in Fig. 1(a), phase a is on no load and phase b and c are short circuited to ground. The following currents are given: $I_b = 91.65\angle 160.9^\circ$, $I_n = 60 \angle 90^\circ$. Find the symmetrical components of current I_a^0, I_a^1 and I_a^2. 6×3

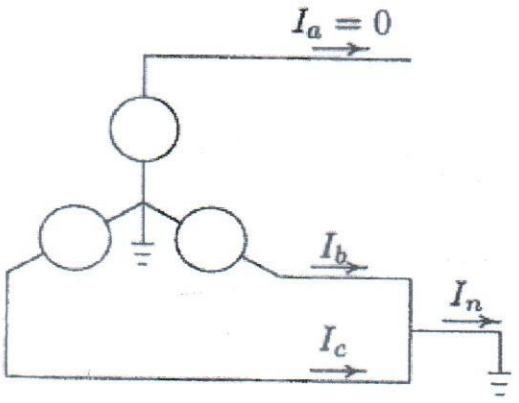

Fig. 1(a)

b) A 600 V, 8 kVA load has a per unit impedance of 0.2 with its own rating as base. It is to be placed in a system with a base of 10 kVA and 800 V. Calculate the load per unit impedance in the new system. 07

2. a) Show that for a 3-phase unbalanced system, the sequence currents can be represented as the followings: 13

$$\begin{bmatrix} I_{a0} \\ I_{a1} \\ I_{a2} \end{bmatrix} = \frac{1}{3}\begin{bmatrix} 1 & 1 & 1 \\ 1 & a & a^2 \\ 1 & a^2 & a \end{bmatrix}\begin{bmatrix} I_a \\ I_b \\ I_c \end{bmatrix}$$

b) A balance three phase load connected in delta consists of 6+ j8 Ω impedance in each phase. It is connected to a three phase supply of 400 V with 50 Hz. Find the followings: 3×4

i) Phase current,
ii) Line current,
iii) Per phase power and
iv) Total power.

3. a) For the load flow study in the power sytem find a root of the following equation using the **Gauss- Seidel method**. Perform ***seven iterations*** and show the effect graphically. Start with an initial estimate of $x^{(0)} = 2$. 08

$$f(x) = x^3 - 6x^2 + 9x - 4 = 0$$

b) A fourth order polynomial equation is given by: 08

$$x^4 - 21x^3 + 147x^2 - 379x + 252 = 0$$

Use **Newton –Raphson method** and hand calculations to find one of the roots of the polynomial equation. Start with the initial estimate of $x^{(0)} = 0$ and continue until $\varepsilon < 0.001$.

c) Determine Z_{bus} for the following admittance matrix: 09

$$Y_{bus} = \begin{matrix} -j8.75 & j1.25 & j2.5 \\ j1.25 & -j\,6.25 & j\,2.5 \\ j2.5 & j2.5 & -j5.0 \end{matrix}$$

4. a) A 3-wire d.c. distributor AE 600 m long is supplied at end A at 500/250 V and is loaded as under : 13
Positive side : 60A, 200 m from A ; 40 A, 360 m from A
Negative side : 20A, 100 m from B ; 60A, 260 m from B and 15A, 600 m from B
The resistance of each outer is 0·02 Ω per 100 metres and the cross-section of the neutral wire is the same as that of the outer. Find the voltage across each load point.

b) Draw an impedance diagram for the electric power system shown in Fig. 4(b) showing all impedances in per unit on a 100 MVA base. Choose 20 kV as the voltage base for generator. The three phase power and line-line ratings are given below. 12

G_1 :	90 MVA	20 kV	$X = 9\%$
T_1 :	80 MVA	20/200 kV	$X = 16\%$
T_2 :	80 MVA	200/20 kV	$X = 20\%$
G_2 :	90 MVA	18 kV	$X = 9\%$
Line:		200 kV	$X = 120\ \Omega$
Load:		200 kV	$S = 48$ MW $+j64$ Mvar

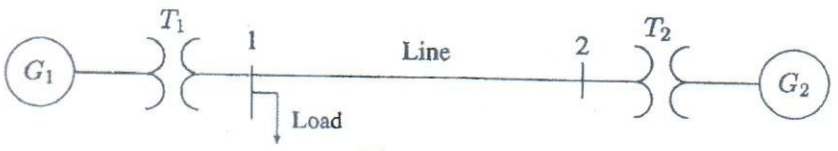

Fig. 4(b)

B.Sc. Engg. (EE)/HDEE, 4th Sem. Date: August 27, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid Semester Examination
Course No.: EEE 4403
Course Title: Communication Engineering 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 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) Define modulation index and modulation efficiency for amplitude modulation (AM). When is a 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(ω) by $\pm\omega_c$. 4+3+6

   b) An audio frequency signal $10\sin 1000\pi t$ is used to amplitude modulate a carrier of $50\sin 2\pi 10^5 t$. Calculate: 12
   i) Modulation index,
   ii) Sideband frequencies,
   iii) Amplitude of each sidebands,
   iv) Bandwidth required,
   v) Total power delivered to the load of 500 Ω and
   vi) Modulation efficiency

2. a) What makes DSB-LC a better choice for broadcast system but not for point-to-point communication? Why is Vestigial Sideband (VSB) modulation scheme termed as a clear compromise between DSB and SSB? What are the problems faced by SSB if used for television broadcasting system? 3+3+3

   c) Design a DSB-SC modulator for generating a modulated signal $km(t)\cos\omega_c t$; where m(t) is a signal band-limited to B Hz and the carrier generator generates $\cos^3\omega_c t$. Explain how you can generate the desired signal including filter type, signal spectra before and after filtering. Also find whether this scheme will work if the carrier generator produced $\cos^2\omega_c t$ in place of $\cos^3\omega_c t$ and measure the minimum usable value of ω_c. 16

3. a) Explain the process of frequency mixing. Define up and down conversions. Name the basic schemes for improving spectral efficiency of AM. 6+3+2

   b) 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. 14

4. a) Express frequency and phase modulated signals in terms of their deviation constants. Also find out a measure of their instantaneous frequency. 8+4

   b) Mention the design criterion for discharge time constant RC for a simple envelope detector circuit. How do we properly select it? 2+4

   c) Show that the fourier spectrum of an angle modulated signal is not related to the message signal spectrum in any simple way as AM. 7

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B.Sc. Engg. (EE) / HDEE, 4th Sem. Date: August 30, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination — Summer Semester, A.Y. 2018-2019
Course No.: Math 4421 — Time: 90 Minutes
Course Title: Random Signals and Processes — 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) Define sample space and event space. Explain their differences with appropriate example. 5

b) A student's test score T is an integer between 0 and 100 corresponding to the experimental outcomes S_0, ..., S_{100}. A score of 90 to 100 is an A, 80 to 89 is a B, 70 to 79 is a C, 60 to 69 is a D, and below 60 is a failing grade of F. Given that all scores between 51 and 100 are equally likely and a score of 50 or less never occurs, find the following probabilities: 10

i. $P[\{S_{79}\}]$
ii. $P[\{S_{100}\}]$
iii. $P[A]$
iv. $P[F]$
v. $P[T \geq 80]$
vi. $P[T < 90]$
vii. P [a C grade or better]
viii. P [student passes]

c) You have a shuffled deck of three cards: 2, 3 and 4 and you deal out the three cards. Let E_i denote the event that i-th card dealt is even numbered. 10

i. What is $P[E_2|E_1]$, the probability the second card is even given that the first card is even?
ii. What is the conditional probability that the first two cards are even given that the third card is even?
iii. Let O_i represent the event that the i-th card dealt is odd numbered. What is $P[E_2|O_1]$, the conditional probability that the second card is even Given that the first card is odd?
iv. What is the conditional probability that the second card is odd given that the first card is odd?

2. a) Let X be a random variable with CDF 6

$$F_X(x) = \begin{cases} 0 & x < -1, \\ x/3 + 1/3 & -1 \leq x < 0, \\ x/3 + 2/3 & 0 \leq x < 1, \\ 1 & 1 \leq x. \end{cases}$$

Sketch the CDF and find the following:

i. $P[X < -1]$ and $P[X \leq -1]$,
ii. $P[X < 0]$ and $P[X \leq 0]$,
iii. $P[0 < X \leq 1]$ and $P[0 \leq X \leq 1]$.

b) The probability density function of random variable Y is 9

$$f_Y(y) = \begin{cases} 1/10 & 0 \le y < 10, \\ 0 & Otherwise \end{cases}$$

Find the following:

i. P [Y ≤ 6]
ii. the conditional PDF $f_{Y|Y\le 6}(y)$
iii. P [Y > 8]
iv. the conditional PDF $f_{Y|Y>8}(y)$
v. E [Y |Y ≤6]
vi. E [Y |Y > 8]

c) The time between telephone calls at a telephone switch is an exponential random variable T with expected value 0.01. Given T > 0.02, What is E [T|T > 0.02], the conditional expected value of T? 10

3. a) Determine the expected value of Poisson random variable. 5

b) The number of buses that arrive at a bus stop in T minutes is a Poisson random variable B with expected value $T/5$. 10

i. What is the PMF of B, the number of buses that arrive in T minutes?
ii. What is the probability that in a two-minute interval, three buses will arrive?
iii. What is the probability of no buses arriving in a 10-minute interval?
iv. How much time should you allow so that with probability 0.99 at least one bus arrives?

c) Let X have the binomial PMF 10

$$P_X(x) = \binom{5}{x}\left(\frac{1}{2}\right)^5$$

i. Find the standard deviation of the random variable X.
ii. What is $P[\mu_X - \sigma_X \le X \le \mu_X + \sigma_X]$, the probability that X is within one standard deviation of the expected value?

4. a) Prove that $Var[X] = E[X^2] - \mu_X{}^2$. 5

b) Random variable X and Y have joint PDF 10

$$f_{X,Y}(x,y) = \begin{cases} \frac{x+y}{3} & 0 \le x \le 1, \quad 0 \le y \le 2, \\ 0 & otherwise. \end{cases}$$

i. What are $E[X]$ and $Var[X]$?
ii. What are $E[Y]$ and $Var[Y]$?
iii. What is $Cov[X,Y]$?
iv. What is $E[X+Y]$?
v. What is $Var[X+Y]$?

c) The joint PDF of X and Y is 10

$$f_{X,Y}(x,y) = \begin{cases} \frac{5y}{4} & -1 \le x \le 1, x^2 \le y \le 1, \\ 0 & otherwise. \end{cases}$$

Find the marginal PDFs $f_X(x)$ and $f_Y(y)$.

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B.Sc. Engg. (EE), 4th Semester
HDEE, 4th Sem.

Date : August 26, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: Phy 4421
Course Title: Semiconductor Devices

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) Using suitable diagram, explain the formation of energy bands in solid Si. 13

   b) Define direct bandgap and indirect bandgap semiconductors with examples. Explain the concept of effective mass of charge carriers (for conductivity calculation) in semiconductors. 8+4

2. a) Explain how Fermi function varies with electron energy for T = 0 K and T > 0 K in intrinsic and extrinsic semiconductors. 13

   b) A Si sample is doped with 5×10^{16} phosphorus atoms per cm^3. Find the equilibrium electron and hole concentrations at 300 K. Also, locate equilibrium Fermi level, E_F relative to conduction band edge, E_C. Intrinsic carrier density in Si at 300 K, $n_i = 1.5\times10^{10}$ cm^{-3} and Boltzmann's constant, $k = 8.62\times10^{-5}$ eV/K. 8+4

3. a) Using diagram explain how extrinsic carrier concentration in semiconductor varies with temperature. Also, explain the variation of carrier mobility with temperature with the help of suitable diagram. 8+5

   b) A Si sample is doped with 8×10^{16} boron atoms/cm^3. What is the resistivity of the sample at 300 K? Mobilities of electron and holes in Si are 1350 cm^2/V-s and 480 cm^2/V-s, respectively and intrinsic carrier density in Si at 300 K, $n_i = 1.5\times10^{10}$ cm^{-3}. What Hall voltage would you expect in the same sample of 100 μm thickness if $I_x = 1$ mA and $B_z = 10^{-5}$ Wb/cm^2? 12

4. a) Using drift-diffusion current density equation for electron or hole, derive the Einstein relation. 13

   b) For steady-state hole injection in a semiconductor, deduce the equations for steady-state excess hole concentration and hole diffusion current as a function of distance from the injection point using the diffusion equation for holes. 12

B.Sc. Engg. (CSE)/HD(CSE), 4th Sem. Date: August 30, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4483
Course Title: Digital Electronics and Pulse Techniques

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 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) Mentioning differential and common inputs applied to an op-amp, derive the following equation, where A_d and A_c have their usual meanings. Draw relevant diagrams that are helpful to explain the steps of derivation. 8

$$\text{CMRR (log)} = 20 \log_{10} \frac{A_d}{A_c}$$

b) What is quantization error? Explain how successive approximation ADC works. 2+6

c) What is the difference between std_logic and bit? 2

d) Implement the equation using op-amps: 7

$$11x_1 - 7x_2 - 20\frac{d^2}{dt^2}x_3 + \iint 12x_4 dt - 5\iint y = 0$$

Where x_1, x_2, x_3 and x_4 are the inputs and y is the output.

2. a) Show the capacitor charging and discharging path drawing the internal block diagram of a 555 Timer. 5

b) Derive the design equations from the circuit schematics from 2(a). From the derived design equations find the period, frequency and duty cycle. Draw the timing diagram of capacitor voltage, comparator outputs (set and reset), output from the flip-flop and transistor voltage. 8+3

c) Draw the pin diagram of LM741 IC. 3

d) With relevant equations and diagrams explain the operation of OpAmp as Differentiator and Integrator. 2+1

e) Why anti-aliasing filter is used? 3

3. 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) What is the significance of process statement in VHDL? Explain with example. 3

d) Design a VHDL testbench for a full-adder circuit. 12

80

4. a) Determine the output voltage of the circuit in Fig. 4(a). 4

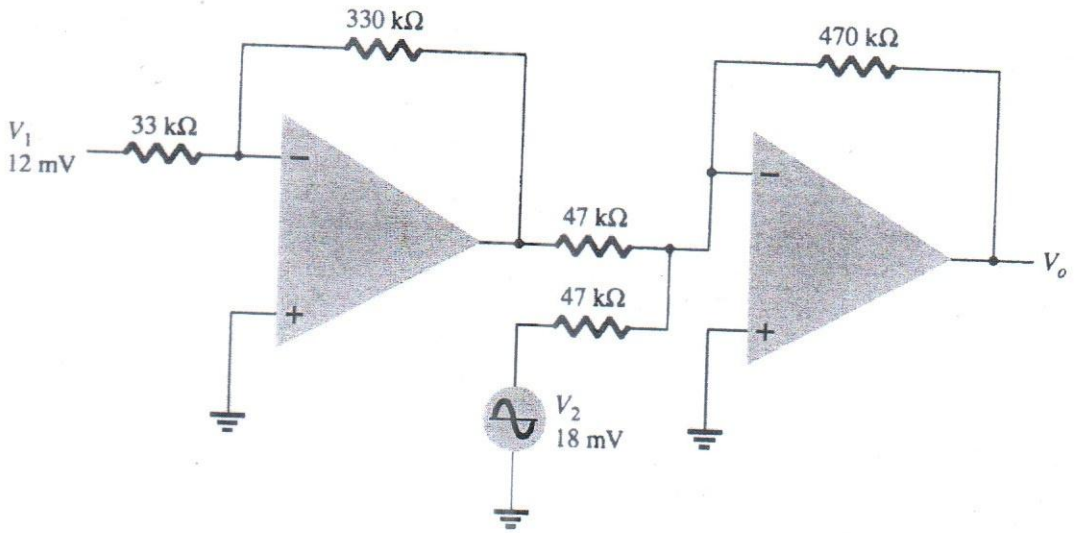

Fig. 4(a)

b) What are the disadvantages of binary-weighted input digital-to-analog converter (DAC)? How to overcome the disadvantages by using R-2R ladder DAC? 5

c) What are the different types of PWM signals? Explain their difference with necessary figures. 5

d) Explain the operation of a sample and hold (S/H) circuit. Draw the generic block diagram of S/H circuit. Assuming sinusoidal signal as input, draw the output from the switching gate, sampled output and final version of the signal from the S/H circuit. 6

e) Mention at least 5 libraries while writing a VHDL program. 3

f) What is the significance of high input impedance in operational amplifiers? 2

B.Sc. Engg.(EE)/ HDEE, 6th Sem. Date: August 29, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4601
Course Title: Signals and Systems

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 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 meant by a linear time invariant (LTI) system? Show that for a system described by the operator H to be time invariant, the system operator H and the time shift operator S^{t_0} must commute with each other for all t_0. 5

   b) A CT signal $x(t) = A\cos(\omega t)$ is always periodic; but the DT version of the signal $x[n] = A\cos(\Omega n)$ is not always periodic. Why? 10
   Determine whether each signal is periodic, and if it is, find its fundamental period.
   i) $5\sin(n)$, *ii)* $10\sin(6\pi n/35)$, *iii)* $x(t) = \sum_{k=-\infty}^{\infty}(-1)^k \delta(t-2k)$ and *iv)* $\cos(2t)+\sin(3t)$

   c) Refer to Fig. 1(c) below show that for continuous time (CT) case the signal $x(t)$ will be compressed in time for $a>1$ and expanded for $a<1$ and for discrete time (DT) case the signal $x[n]$ will be downsampled for $\alpha>1$ and upsampled for $\alpha<1$. Illustrate the cases with suitable examples. 10

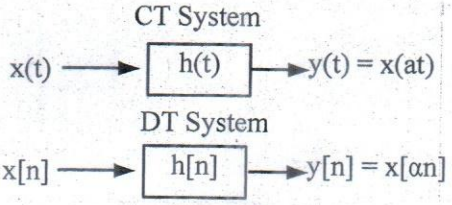


Fig. 1(c)

2. a) What is difference between a CT unit impulse $\delta(t)$ and a DT unit impulse $\delta[n]$. Show that a DT signal $x[n]$ can be expressed as a weighted sum of impulses as 5

$$x[n] = \sum_{k=-\infty}^{k=\infty} x[k]\delta[n-k].$$

   b) What is meant by impulse response of a system? The impulse response of a four point moving averaging system is given as, 10

$$h[n] = \frac{1}{4}(\delta[n]+\delta[n-1]+\delta[n-2]+\delta[n-3]).$$

   Find the output of the system for the input $x[n] = u[n]-u[n-8]$.

   c) An LTI system has the impulse response $h(t)$ depicted in Fig. 2(c). Use linearity and time invariance to determine the system output $y(t)$ if the input $x(t)$ is (i) $x(t) = 2\delta(t+2)+\delta(t-2)$ and (ii) $x(t) = \delta(t-1)+\delta(t-2)+\delta(t-3)$. Sketch the output for each case. 10

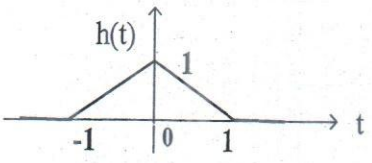


Fig. 2(c)

3. a) Use the method of inspection to determine the DTFS coefficients for the following signals: 10

(i) $x[n]=1+\sin(n\pi/12+3\pi/8)$

(ii) $x[n]=\cos(n\pi/30)+\sin(n\pi/90)$

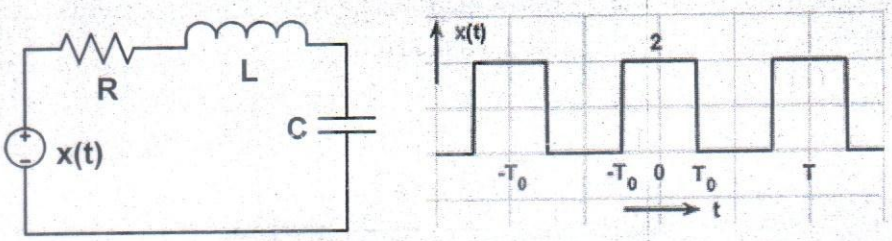
b) Find the Inverse DTFT and plot both the time and frequency domain representation for the following signals: 10

(i) $x(e^{j\Omega})=\delta(\Omega), \quad -\pi<\Omega<\pi$

(ii) $x(e^{j\Omega})=\begin{cases}1, & |\Omega|<2\\ 0, & 2<|\Omega|<\pi\end{cases}$

c) Explain uncertainty principle for Time-Bandwidth Product and duality property of FT. 05

4. a) Consider the series RLC circuit depicted in Fig. 4(a)(i). Let the output be the voltage across the capacitor, $y_c(t)$. Determine the input-output relationship of the system and find the frequency response. Determine $y_c(t)$ for square wave input depicted in the Fig. 4(a)(ii) where $T=2$ and $T_0=1/8$. 10



(i) (ii)

Fig. 4(a)

b) Find the FT of the signal 07

$$x(t)=\frac{d^2}{dt^2}\left[\left(e^{-5t}u(t)\right)*\left(e^{-2t}u(t-5)\right)\right].$$

c) Express $z(t)$ in terms of $x(t)$ and find FT of $z(t)$ using FT properties. $z(t)$ and $x(t)$ are given as follows. 08

$$x(t)=\begin{cases}1, & |t|<1\\ 0, & |t|>1\end{cases} \quad \text{and} \quad z(t)=\begin{cases}e^{-j15t}, & |t|<0.5\\ 0, & |t|>0.5\end{cases}$$

B.Sc. Engg. (EE)/ HDEE, 6th Sem.
BScTE (2-Yr), 2nd Sem.

Date: August 27, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4603 / EEE 4693
Course Title: Measurement and Instrumentation

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 in the margin indicate full marks. Programmable calculators are not allowed. Do not write on this question paper. Symbols represent their usual meanings.

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1. a) Draw a block diagram showing the basic functional elements of a generalized measurement system. Explain the functions of the various blocks and give an analogous example. 08

   b) Derive the equations for the balance condition of Maxwell bridge. Explain the problems associated with this bridge while measuring inductance of high quality factor and low quality factor. 12

   c) Write short notes on gas filled photocells. 05

2. a) Derive the expression for bridge sensitivity for a Wheatstone bridge with equal arms. Also find the expression for current through the galvanometer for a small unbalance. 12

   b) An RTD forms one arm of the Wheatstone bridge as shown in Fig. (1). The RTD has resistance of $R_3 = 50\ \Omega$ at 25^0C and has a temperature co-efficient of $0.003925\ ^oC^{-1}$. The bridge is arranged such that $R_1 = R_2 = 100\ \Omega$. The value of R_4 is chosen such that the bridge remains at balance condition at 25^0C. The galvanometer has resistance of $50\ \Omega$ and current sensitivity of 4 mm/μA. The battery voltage is 5 V. 09

      i. Calculate the output voltage and galvanometer current when the temperature rises to 30^0C.

      ii. Suppose, the previous galvanometer is replaced by a galvanometer with resistance of $100\ \Omega$ and current sensitivity of 5 mm/μA. Which galvanometer will be more sensitive to a small unbalance due to the change in temperature?

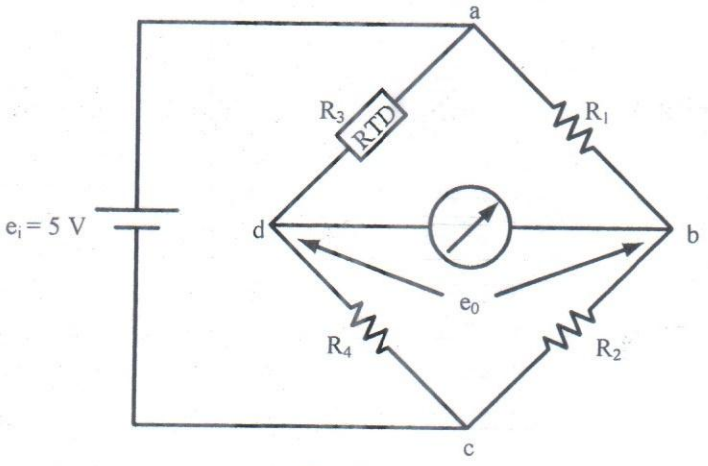

Fig. (1)

   c) Describe the problem associated with the measurement of insulation resistance of a cable and how the problem can be minimized in the direct deflection method. 04

3. a) What do you understand by quantization? What is quantization error? 04

   b) Draw the circuit diagram of a 3-bit flash A/D converter circuit and discuss its operating principle. If the reference voltage for this 3-bit flash A/D converter is V_{REF} = 15 V, what will be the corresponding digital output for an input voltage of V_{IN} = 10 V. 13

   c) A 1 MHz clock generator and a 5-bit counter are used in a dual slope A/D converter. The reference voltage is set to, V_{REF} = - 7.75 V. What will be the number of clock pulses counted by the counter and the binary form of the digital output, when the analog input voltage is V_{IN} = 3.15 V, and when it is 1.25 V? 08

4. a) Briefly discuss the construction and working principle of RVDT. 05

   b) Briefly discuss about photodiodes. Draw the circuit diagram of an IR proximity sensor using photodiodes and explain its working principle. 12

   c) With neat diagrams describe the single capacitor design and differential capacitor design of capacitive pressure transducers. 08

85

B.Sc. Engg.(EE)/ HDEE, 6th Sem.
B.Sc.TE (2Yr), 2nd Sem.

Date: August 22, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4605/EEE 4689
Course Title: Microcontroller Based System Design

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

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1. a) Discuss in brief, in which applications microcontroller is preferred over microprocessor. 3

   b) Which segment of the RAM is known as Bit-Addressable RAM? How to access them and what is the advantage of having them? 3

   c) Write a program to count number of 1 available in five bytes of unknown data available in ROM memory location 300H-304H. Save your result in RAM memory location 60H. 8

   d) Write a program to convert an 8-bit hex number coming from port 1 to ASCII characters and send it to port 2. 11

2. a) Explain how port 0 is different than other ports of 8051. 3

   b) Design a time delay of 5 sec using a crystal oscillator of 12 MHz frequency. Write the corresponding subroutine for the delay 7

   c) Draw the flowchart of scanning 4x4 keyboard and write corresponding program. 15

3. a) Draw the simplified internal architecture of 8051 microcontroller. 05

   b) Briefly explain different addressing modes of 8051 with example. 05

   c) Write a program to multiply two unknown 16-digit hex numbers stored into RAM memory location 40H – 43H. The result of the multiplication has to be saved in RAM memory location 50H – 53H. The details of data and result are shown in Table: 01. 15

Table: 01

Input				Output			
Location of Number 2		Location of Number 1		Location of Highest Byte	Location of Next Byte	Location of Next Byte	Location of Lowest Byte
Higher Byte	Lower Byte	Higher Byte	Lower Byte				
43H	42H	41H	40H	53H	52H	51H	50H

4. a) Write a program to compare the temperature (T) coming from the port 2. Generate appropriate PWM signal to P3.5 according to Table: 02. 10

Table: 02

Temperature	PWM signal in P3.5
$T \geq 32^0$	80%
$30^0 > T > 32^0$	60%
$28^0 > T \geq 30^0$	40%
$T < 28^0$	20%

b) Write a program to send the following data to the LCD connected to 8051 according to Table 03. The functions of the LCD pins are given in Table: 04. Basic LCD initialization commands are given in Table:05. 15

Table: 03

8051 Microcontroller	16x2 LCD
Port 3	D0-D7
P2.0	RS
P2.1	RW
P2.2	E

Table:04

RS	0	Command Register
	1	Data Register
RW	0	Write
	1	Read
E	H-to-L	Write
	L-to-H	Read

Table: 05

Code	Command
38	2 line, 5x7 matrix
01	Clear display screen
0E	Display on, cursor not blinking
06	Increment Cursor

Data to be displayed: "Waiting time is Over…"

8051 Instruction Set Summary

Rn Register R7-R0 of the currently selected Register Bank.
Data 8-bit internal data location's address. This could be an internal Data RAM location (0-127) or a SFR [i.e. I/O port, control register, status register, etc. (128-255)].
@Ri 8-bit Internal Data RAM location (0-255) addressed indirectly through register R1 or R0.
#data 8-bit constant included in instruction.
#data16 16-bit constant included in instruction.
addr16 16-bit destination address. Used by LCALL and LJMP. A branch can be anywhere within the 64k byte Program Memory address space.
addr11 11-bit destination address. Used by ACALL and AJMP. The branch will be within the same 2k byte page of Program Memory as the first byte of the following instruction.
rel Signed (two's component) 8-bit offset byte. Used by SJMP and all conditional jumps. Range is –128 to +127 bytes relative to first byte of the following instruction.
bit Direct Addressed bit in Internal Data RAM or Special Function Register.

Instruction	Flag			Instruction	Flag		
	C	OV	AC		C	OV	AC
ADD	X	X	X	CLR C	O		
ADDC	X	X	X	CPL C	X		
SUBB	X	X	X	ANL C,bit	X		
MUL	O	X		ANL C,/bit	X		
DIV	O	X		ORL C,bit	X		
DA	X			ORL C,/bit	X		
RRC	X			MOV C,bit	X		
RLC	X			CJNE	X		
SETB C	1						

Note that operations on SFR byte address 206 or bit addresses 209-215 (i.e. the PSW or bits in the PSW) will also affect flag settings.

Mnemonic		Description	Byte	Cycle
Arithmetic operations				
ADD	A,Rn	Add register to accumulator	1	1
ADD	A,direct	Add direct byte to accumulator	2	1
ADD	A,@Ri	Add indirect RAM to accumulator	1	1
ADD	A,#data	Add immediate data to accumulator	2	1
ADDC	A,Rn	Add register to accumulator with carry flag	1	1
ADDC	A,direct	Add direct byte to A with carry flag	2	1
ADDC	A,@Ri	Add indirect RAM to A with carry flag	1	1
ADDC	A,#data	Add immediate data to A with carry flag	2	1
SUBB	A,Rn	Subtract register to accumulator with borrow	1	1
SUBB	A,direct	Subtract direct byte to A with carry borrow	2	1
SUBB	A,@Ri	Subtract indirect RAM to A with carry borrow	1	1
SUBB	A,#data	Subtract immediate data to A with carry borrow	2	1
INC	A	Increment accumulator	1	1
INC	Rn	Increment register	1	1
INC	direct	Increment direct byte	2	1
INC	@Ri	Increment indirect RAM	1	1
DEC	A	Decrement accumulator	1	1
DEC	Rn	Decrement register	1	1
DEC	direct	Decrement direct byte	2	1
DEC	@Ri	Decrement indirect RAM	1	1
INC	DPTR	Increment data pointer	1	2
MUL	AB	Multiply A and B -> [B hi]:[A lo]	1	4
DIV	AB	Divide A by B -> A=result, B=remainder	1	4
DA	A	Decimal adjust accumulator	1	1
CLR	A	Clear accumulator	1	1
CPL	A	Complement accumulator	1	1
RL	A	Rotate accumulator left	1	1
RLC	A	Rotate accumulator left through carry	1	1
RR	A	Rotate accumulator right	1	1
RRC	A	Rotate accumulator right through carry	1	1
SWAP	A	Swap nibbles within the accumulator	1	1
Logic operations				
ANL	A,Rn	AND register to accumulator	1	1
ANL	A,direct	AND direct byte to accumulator	2	1
ANL	A,@Ri	AND indirect RAM to accumulator	1	1
ANL	A,#data	AND immediate data to accumulator	2	1
ANL	direct,A	AND accumulator to direct byte	2	1
ANL	direct,#data	AND immediate data to direct byte	3	2
ORL	A,Rn	OR register to accumulator	1	1
ORL	A,direct	OR direct byte to accumulator	2	1
ORL	A,@Ri	OR indirect RAM to accumulator	1	1
ORL	A,#data	OR immediate data to accumulator	2	1
ORL	direct,A	OR accumulator to direct byte	2	1
ORL	direct,#data	OR immediate data to direct byte	3	2
XRL	A,Rn	Exclusive OR register to accumulator	1	1
XRL	A,direct	Exclusive OR direct byte to accumulator	2	1
XRL	A,@Ri	Exclusive OR indirect RAM to accumulator	1	1
XRL	A,#data	Exclusive OR immediate data to accumulator	2	1
XRL	direct,A	Exclusive OR accumulator to direct byte	2	1
XRL	direct,#data	Exclusive OR immediate data to direct byte	3	2
Boolean variable manipulation				
CLR	C	Clear carry flag	1	1
CLR	bit	Clear direct bit	2	1
SETB	C	Set carry flag	1	1
SETB	bit	Set direct bit	2	1
CPL	C	Complement carry flag	1	1
CPL	bit	Complement direct bit	2	1
ANL	C,bit	AND direct bit to carry flag	2	2
ANL	C,/bit	AND complement of direct bit to carry	2	2
ORL	C,bit	OR direct bit to carry flag	2	2
ORL	C,/bit	OR complement of direct bit to carry	2	2
MOV	C,bit	Move direct bit to carry flag	2	1
MOV	bit,C	Move carry flag to direct bit	2	2
Program and machine control				
ACALL	addr11	Absolute subroutine call	2	2
LCALL	addr16	Long subroutine call	3	2
RET		Return from subroutine	1	2
RETI		Return from interrupt	1	2
AJMP	addr11	Absolute jump	2	2
LJMP	addr16	Long jump	3	2
SJMP	rel	Short jump (relative address)	2	2
JMP	@A+DPTR	Jump indirect relative to the DPTR	1	2
JZ	rel	Jump if accumulator is zero	2	2
JNZ	rel	Jump if accumulator is not zero	2	2
JC	rel	Jump if carry flag is set	2	2
JNC	rel	Jump if carry flag is not set	2	2
JB	bit,rel	Jump if bit is set	3	2
JNB	bit,rel	Jump if bit is not set	3	2
JBC	bit,rel	Jump if direct bit is set and clear bit	3	2
CJNE	A,direct,rel	Compare direct byte to A and jump if not equal	3	2
CJNE	A,#data,rel	Compare immediate to A and jump if not equal	3	2
CJNE	Rn,#data,rel	Compare immed. to reg. and jump if not equal	3	2
CJNE	@Rn,#data,rel	Compare immed. to ind. and jump if not equal	3	2
DJNZ	Rn,rel	Decrement register and jump in not zero	2	2
DJNZ	direct,rel	Decrement direct byte and jump in not zero	3	2
NOP		No operation	1	1
Data transfer				
MOV	A,Rn	Move register to accumulator	1	1
MOV	A,direct*)	Move direct byte to accumulator	2	1
MOV	A,@Ri	Move indirect RAM to accumulator	1	1
MOV	A,#data	Move immediate data to accumulator	2	1
MOV	Rn,A	Move accumulator to register	1	1
MOV	Rn,direct	Move direct byte to register	2	2
MOV	Rn,#data	Move immediate data to register	2	1
MOV	direct,A	Move accumulator to direct byte	2	1
MOV	direct,Rn	Move register to direct byte	2	2
MOV	direct,direct	Move direct byte to direct byte	3	2
MOV	direct,@Ri	Move indirect RAM to direct byte	2	2
MOV	direct,#data	Move immediate data to direct byte	3	2
MOV	@Ri,A	Move accumulator to indirect RAM	1	1
MOV	@Ri,direct	Move direct byte to indirect RAM	2	2
MOV	@Ri,#data	Move immediate data to indirect RAM	2	1
MOV	DPTR,#data16	Load data pointer with a 16-bit constant	3	2
MOVC	A,@A+DPTR	Move code byte relative to DPTR to accumulator	1	2
MOVC	A,@A+PC	Move code byte relative to PC to accumulator	1	2
MOVX	A,@Ri	Move external RAM (8-bit addr.) to A	1	2
MOVX	A,@DPTR	Move external RAM (16-bit addr.) to A	1	2
MOVX	@Ri,A	Move A to external RAM (8-bit addr.)	1	2
MOVX	@DPTR,A	Move A to external RAM (16-bit addr.)	1	2
PUSH	direct	Push direct byte onto stack	2	2
POP	direct	Pop direct byte from stack	2	2
XCH	A,Rn	Exchange register to accumulator	1	1
XCH	A,direct	Exchange direct byte to accumulator	2	1
XCH	A,@Ri	Exchange indirect RAM to accumulator	1	1
XCHD	A,@Ri	Exchange low-order nibble indir. RAM with A	1	1

*) MOV A,ACC is not a valid instruction

```
jne  A,#data,@          cjne   A,#data,@
 (jump if A ! = data)

je   A, #data,@         add    A,#low(–data)   or      cjne   A,#(data),ne
 (jump if A == data)    jz     @                       jmp    @
                                                ne:     ...

ja, jnbe  A,#data,@     add    A,#low(–data–1) or      cjne   A,#(data+1),ne
 (jump if A > data)     jc     @                ne:    jnc    @

jae, jnb  A,#data,@     add    A,#low(–data)   or      cjne   A,#(data),ne
 (jump if A >= data)    jc     @                ne:    jnc    @

jb, jnae  A,#data,@     add    A,#low,(–data)  or      cjne   A,#(data),ne
 (jump if A < data)     jnc    @                ne:    jc     @

jbe, jna  A,#data,@     add    A,#low(–data–1) or      cjne   A,#(data+1),ne
 (jump if A <= data)    jnc    @                ne:    jc     @

switch  A <,==,> #data  cjne   A,#data,ne
 (no A modification)                                    ; execute code if A==data
                  ne:   jc     is_below                ; jump if A<data
                        jnc    is_above                ; jump if A>data or exec. code
```

B.Sc. Engg.(EE)/ HDEE, 6th Sem. Date: August 26, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination — Summer Semester, A. Y. 2018-2019
Course No.: EEE 4625 — Time: 90 Minutes
Course Title: Utilization of Electrical Energy — 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 represent their usual meanings.

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1. a) Explain economical limits of power factor correction for constant kW demand of a consumer with proper mathematical equation. 8

   b) Define diversity factor, utilization factor. "D.C. series motor is used in heavy duty application"- prove this statement with proper mathematical explanation. 7

   c) IUT substation has to meet the following demand: 10
   Academic Building: 200 kW between 8 a.m. and 6 p.m.
   Female Hall: 100 kW between 6 a.m. to 10 a.m.
   Machine Lab: 50 kW between 6 a.m. to 10 a.m.
   North Hall: 100 kW between 10 a.m. and 6 p.m. and between 6 p.m. and 6 a.m.
   Plot the daily load curve and determine (i) average demand, (ii) units generated per day, (iii) diversity factor and (iv) load factor.

2. a) What are the different types of tariffs? Explain each of them in detail. 9

   b) Explain speed control methods of D.C. series and D.C. shunt motors with proper diagram. 6

   c) A consumer has an annual consumption of 1,76,400 kWh. The charge is Tk. 120 per kW of maximum demand plus 4 paisa per kWh consumption. (i) Find the annual bill and overall cost per kWh if the load factor is 36%. (ii) What is the overall cost per kWh if the consumption were reduced by 25% with same load factor? (iii) What is the overall cost per kWh if the load factor is 27% with same 1,76,400 kWh consumption? 10

3. a) Derive the expression for change in the speed of a motor-drive system following a small disturbance either in the motor side or in the load side. 10

   b) A motor-driven pulley system is carrying a cage of 5 kg at one end of a rope and the other end is counter balanced by a weight of 10 kg. Determine the operating mode of the motor-driven pulley if the cage is loaded with 3 kg and it is desired to move the cage (i) up and (ii) down by the motor. Draw the figure and show the direction of movement (speed) of the motor, the torque directions and the quadrant of operation in these two cases. 06

   c) A d.c. series motor drives a load and torque of that load varies as the square of the speed. The motor current in 25 A when the speed is 600 r.p.m. Calculate the speed and current when the motor field winding is shunted by a resistor (diverter) of the same resistance as the field winding. Neglect all motor losses and assume the magnetic circuit to be unsaturated. 09

4. a) What are the different types of motor loads used in industries? Define load equalization and explain importance of flywheel in load equalization. Derive the following expression for flywheel decelerating where all the terms have their usual meaning: 15

$$T_m = T_L\{1 - exp\left(\frac{-tg}{IK}\right)\}$$

b) The following temperature variations are observed in the temperature rise test of a d.c. motor. 10

After 1 hour : 15° C

After 3 hours : 25° C

Find out (i) the final steady temperature rise and rise time constant of the motor (ii) the steady temperature rise after 1 hour at 60% overload, from cold.

Assume that the final temperature rise on 50% overload is 70° C.

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B.Sc. Engg.(EE)/ HDEE, 6th Sem. Date: August 23, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination — Summer Semester, A.Y. 2018-2019
Course No.: EEE 4635 — Time: 90 Minutes
Course Title: Power Plant Engineering and Economy — 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) Illustrate the operation of a combined cycle power plant using a proper layout . 10

   b) Describe base load power plants. Which Hydro-type power plants are used for base load ? 8

   c) Write short notes on Cooling *water system, Deaerator, Economizer and Air Preheater.* 7

2. a) A generating station has the following daily load cycle: 10

Time (hours)	0-6	6-10	10-12	12-16	16-20	20-24
Load (MW)	20	25	-	25	-	20

If the maximum demand is 35 MW, Draw the load curve and find
   i) Units generated per day
   ii) Average load
   iii) Load factor

   b) A generating station has the following daily load duration cycle: 15

Time (t) in hours	0-6	6-12	12-18	18-24
Load (y) in MW	40-t	30	40-t	10

Draw the Load Duration Curve and find
   i) Units generated per day
   ii) Average load
   iii) Load factor
   iv) Choose suitable generator units from 5 MVA, 10 MVA, 15 MVA, 20 MVA. Assume similarity between load cycle and load duration cycle. Adjust the operation schedule for the machines selected. Choose a suitable power factor.

3. a) Concisely illustrate the Performance Curves of a power plant. Derive the original constraint for an economic generation of scheduling; neglecting losses and generator limit. 10

b) The fuel cost of two units are given by 5
$F_1 = 1.5 + 20\ P_{G1} + 0.1P_{G1}^2$ BDT/h
$F_2 = 1.9 + 30\ P_{G2} + 0.1P_{G2}^2$ BDT/h

P_{G1}, P_{G2} are in MW. Find the optimal Schedule neglecting losses, when the demand is 200 MW.

The fuel cost in BDT / h for two 800 MW plants is given by 10
$F_1 = 400 + 6\ P_{G1} + 0.004P_{G1}^2$ BDT/h
$F_2 = 500 + b_2\ P_{G2} + c_2P_{G2}^2$ BDT/h
where P_{G1}, P_{G2} are in MW, Assume approximate conversion rates.

i) The incremental cost of power is \$0.095 /MWh when total demand is 550 MW. Determine optimal generation schedule neglecting losses.
ii) The incremental cost of power is \$0.12 /MWh when total demand is 1300 MW. Determine optimal generation schedule neglecting losses.
iii) Find the coefficient b_2 *and* c_2.

4. a) From the following T-S Curve, obtain the P-V Curve and the corresponding Gas Turbine Power Plant layout. Also obtain the additional work done from the P-V curve. 12

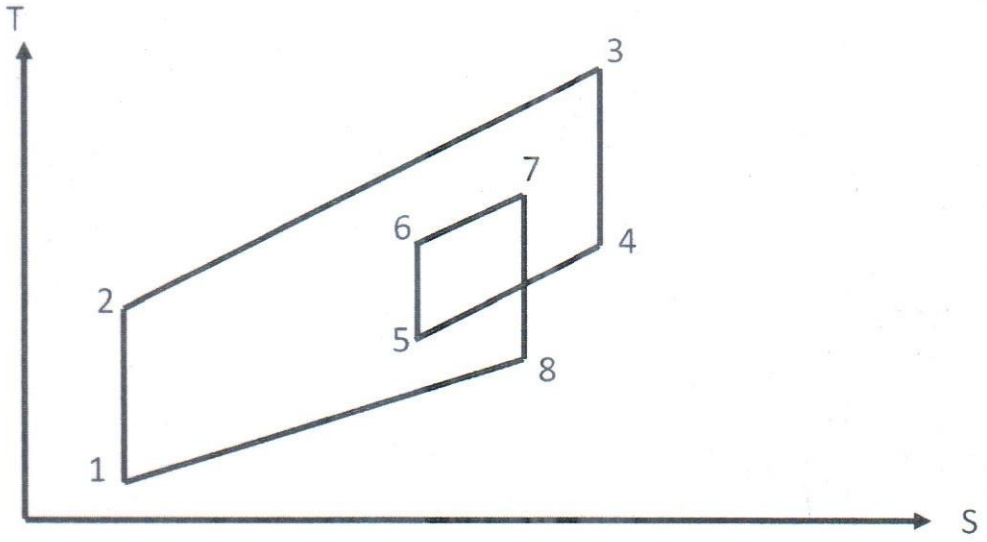

Figure 4(a): Temperature-Entropy Curve

b) Briefly describe the methods of meeting loads and interconnected grid system. As a Power Plant Engineer, Which Power plants will you choose as base load and peak load? Why is it necessary to install large number of units with lower capacity in any Power Plant? 13

B.Sc.Engg. (EE)/HDEE, 6th Sem. 92 Date: August 26, 2019 (Morning)
B.Sc.TE (2 Yr), 2nd Sem.

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4641/ EEE 4697
Course Title: Cellular Communication

Summer Semester, A. Y. 2018-2019
Time: 3 Hours
Full Marks: 150

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 advantage of correlation in frequency domain compared to correlation in time domain during downlink synchronization? Mention the location of Primary Synchronization Signal (PSS) and Secondary Synchronization Signal (SSS) in time and frequency in LTE. Explain how different types of information are determined using Primary Synchronization Signal (PSS) and using Secondary Synchronization Signal (SSS). 10

   b) Write down any four OVSF codes with spreading factor 8. 5

   c) Assume that the whole OVSF code tree is used for the data transfer and there are 147 users in the cell in total. Among them, 144 users are using spreading factor (SF) 256. The rest three persons are using three different spreading factors. Determine the spreading factors of those three persons. 10

2. a) How many Physical Cell Identity (PCI) are available in LTE? What would be the problem if a much higher or much lower number was used? 5

   b) What is the maximum permissible value of timing offset that the eNodeB can command when an uplink synchronization is established? Why is this value used? 7

   c) A user changes his position in the cell. He moves 78 m further away from the eNodeB. How much adjustment in the timing offset will be commanded by the eNodeB? 8

   d) What is the purpose of PCFICH? What is the advantage of the variable size of the control region? 5

3. a) For both uplink and downlink data transfer, write down the names of the physical channels which carry HARQ ACK/NACK. How many HARQ operations can run in parallel and why is this number of parallel operations chosen? 8

   b) Explain how semi-persistent scheduling is used, which applications are suitable for it and how the PDCCH instance indicates that it has been used. 7

   c) The radio frames are numbered using SFN and the subframes are numbered from 0 through 9. On subframe 2 of a radio frame with SFN 480, the PDCCH allocates both uplink and downlink resources. Because of the poor radio link, all three HARQ retransmissions have occurred for both uplink and downlink. For downlink data transfer, all retransmissions have used the gap of 5 subframes instead of 4. For both uplink and downlink, determine the subframe number and radio frame SFN, on which the last retransmissions have occurred. 10

4. a) Mention the purposes of Tracking Area (LA). State how the UE can determine that a Tracking Area Update (TAU) is required. Explain the advantage of overlapping of areas covered by different tracking area identity (TAI) lists. 10

   b) Why does the paging message include S-TMSI instead of IMSI? 4

   c) For paging in a cell, the value of NB is set to 1/8. How many groups of users are created in the cell? Consider grouping only within radio frames and not within subframes. 6

   d) Explain why both short cycles and long cycles are used for discontinuous reception (DRX) in RRC_CONNECTED state. 5

B.Sc. Engg.(EE) / HDEE, 6th Sem. Date: 23 August 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 4651 — Time: 90 Minutes
Course Title: Data Communication and Networking II — 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) For wireless connectivity, WiFi, IR, Zigbee and Bluetooth technologies are mostly used. Mention and discuss the suitable practical applications for each of the technology with illustrations. 5

   b) You want to design a universal remote control for controlling electronic appliances. You are given WiFi, IR, Zigbee and Bluetooth technologies for wireless connectivity. Which technology will you use? Justify your answer mentioning the comparison among technologies with suitable illustration and example. 9

   c) What are the design issues/challenges for wireless technology? How do you overcome them? Justify your answer with suitable illustrations and examples. 5

   d) You want to send an email, an audio file, and a video file to your friend through 802.11 technology. How will you manage the "channel sharing" and "load balancing" of access point (AP) depending on the priority of the files? Justify your answer with suitable illustration and example. 6

2. a) Why 802.11 (WiFi) is suitable for WLAN (wireless local area network) standard? What are the features of WiFi that help adopt wireless technology in LAN. 5

   b) Piconet is the best solution for small device to device PAN (personal area network) network. Discuss the characteristics of a Piconet with suitable diagram. 9

   You want to build a Piconet among the devices of your small textile industry. Piconet can handle up to 7 active slaves and up to 255 parked slaves. Design with suitable diagram, your textile Piconet system and describe the working principle.

   c) For different power management in wireless networking, describe the followings modes of operations with suitable examples: i) Standby, ii) Park, iii) Sniff, iv) Hold, and v) Sleep. 5

   d) Explain the functions with suitable illustration for the following three special frames: i) Acknowledgement (ACK), ii) Request To Send (RTS), and iii) Clear To Send (CTS). 6

3. 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 explaining each of them briefly. 13

b) Different IEEE 802 wireless technologies are used for different applications in the wireless networking. For the IEEE 802 wireless networking technologies, draw the followings: 12
i) classification diagram according to the Area Network (AN),
ii) comparison graph for Range vs Data Rate (for 0.01 Mbps to 1000 Mbps).
iii) comparison graph for Mobility vs Data Rate (for 0.01 Mbps to 1000 Mbps).

4. a) You and your friend want to share data between two wireless enabled devices with the help of Bluetooth. Write down the basic characteristics and parameters of Bluetooth communication. 13

At the beginning of the data transferring, how does the Bluetooth device create connection with another Bluetooth device?

How does Bluetooth operate during data transferring? Briefly explain the operation state with suitable flow chart.

What is spread-spectrum frequency hopping of Bluetooth? Briefly explain with examples.

b) What is Zigbee? In what kind of application do you use Zigbee? Why is Zigbee suitable for remotely located sensor networks? Why is it not suitable for LAN design? Design and explain Zigbee Star network and Zigbee Mesh Network with suitable illustration. 8

c) For scanning operation in 802.11 wireless networking, how do Probe responses and Beacon frames work in active scanning and passive scanning? 4

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B.Sc. TE (2 yr), 2nd Sem. Date: August 23, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4691
Course Title: Industrial Electronics II

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 in the margin indicate full marks. Programmable calculators are not allowed. Do not write on this question paper. Symbols represent their usual meanings.

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1. a) Describe the operation of SCR using two transistor model. 15

   b) Define latching current and holding current of SCR. 3

   c) Draw snubber circuits of SCR for overcurrent and overvoltage protection and explain their operations. 7

2. a) Define SOA for TRIAC, MOSFET and BJT. 3

   b) Find the expressions for the conduction loss and switching loss of a power electronics switch. 10

   c) If we connect several SCR in parallel and in series, what will be the problem associated with it and how to overcome it? 12

3. a) What is a dual converter? Draw a dual converter circuit and explain its operation with necessary waveshapes. 13

   b) If the converter of Fig. 3(b) has a purely resistive load of R and the delay angle is $\alpha = \pi/2$, determine the (i) rectification efficiency; (ii) form factor, FF; (iii) ripple factor, RF; (iv) transformer utilization factor, TUF; (v) the peak inverse voltage (PIV) of thyristor T_1. 12

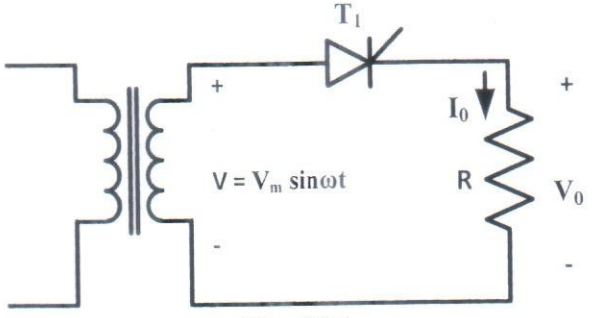

Fig. 3(b)

4. a) Explain the operation of a single-phase controllers with inductive loads. Also, discuss the problems associated with the circuit and how to overcome the problems. 15

b) A single phase full-wave ac voltage controller in Fig. 4(b) has a resistive load of R = 10 Ω and the input voltage is V_s = 120 V (rms), 50 Hz. The delay angle of thyristor T_1 and T_2 are equal: $\alpha_1 = \alpha_2 = \pi/2$. Determine (i) the rms output voltage V_0, (ii) the input PF, (iii) the average current of thyristors and (iv) the rms current of thyristors. 10

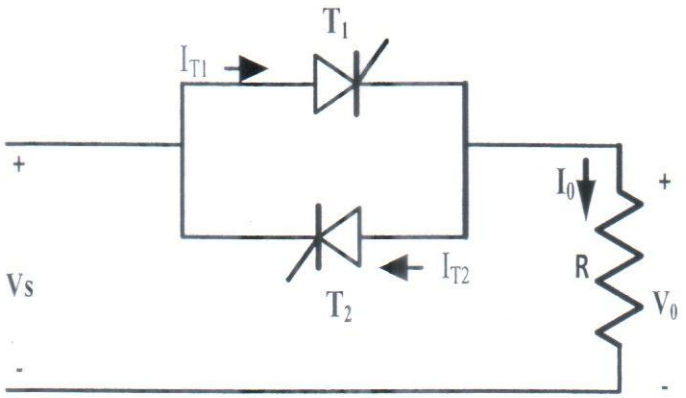

Fig. 4(b)

B.Sc. Engg.(EE), 8th Sem. Date: August 23, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4801
Course Title: Power Generation

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 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) Why is electrical energy preferred over other forms of energy? 5

   b) What is a steam power station? What factors are taken into account while selecting the site for a steam power station? 10

   c) A diesel engine power plant has one 700 kW and two 500 kW generating units. The fuel consumption is 0·25 kg per kWh and the calorific value of fuel oil is 10000 kcal/kg. Estimate (i) the fuel oil required for a month of 30 days and (ii) overall efficiency. Plant capacity factor is 40%. 10

2. a) Explain the terms load factor and diversity factor. 5

   b) Discuss the advantages of interconnected grid system. 10

   c) A generating station is to supply four regions of load whose peak loads are 10 MW, 5 MW, 8 MW and 7 MW. The diversity factor at the station is 1·5 and the average annual load factor is 60%. Calculate: (i) the maximum demand on the station, (ii) annual energy supplied by the station and (iii) suggest the installed capacity and the number of units. 10

3. a) What are the effects of high load factor on the operation of power plant? 5

   b) Discuss the diminishing value method of determining the depreciation of the power plant equipment. 10

   c) The equipment in a power station costs Tk 15,60,000 and has a salvage value of Tk 60,000 at the end of 25 years. Determine the depreciated value of the equipment at the end of 15 years using (i) straight line method, (ii) diminishing value method and (iii) sinking fund method at 5% compound interest annually. 10

4. a) Explain with a neat sketch the various parts of a nuclear reactor. 10

   b) The daily load duration curve for a typical heavy load being served by a combined hydro-steam system may be approximated by a straight line; maximum and minimum loads being 60,000 kW and 20,000 kW, respectively. The hydro power available at the time of minimum regulated flow is just sufficient to take a peak load of 50,000 kWh per day. It is observed that it will be economical to pump water from tail race to the reservoir by utilizing the steam power plant during the off-peak periods and thus running the station at 100% load factor. Determine the maximum capacity of each type of plant. Assume the efficiency of steam conversion to be 60%. 15

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B.Sc. Engg. (EE), 8th Sem. Date: August 30, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Mid-Semester Examination — Summer Semester, A. Y. 2018-2019
Course No. : Hum 4821 — Time : 1.5 Hours
Course Title : Business Communication Skill — 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.

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1. a) "No one can know exactly what occurs inside the minds of communicators when they undertake to create a message, but researchers generally agree that the communication process includes some specific steps". Draw a communication model with explanation of every steps of communication process. 10

   b) Why do we fail to communicate efficiently? Give some aspects of verbal and non-verbal communication. 8

   c) Make a hypothetical example of Business communication. Then relate your example with the concept of 'Communication Pyramid' and explain how proper understanding of this theory might help you in effective communication. 7

2. a) A team leader wants his group to accept a new roster. The leader knows the new system will benefit all concerned, but to begin with, nobody will agree. How far should the leader use power of persuasion to make the group cooperate and accept the plan? Identify three oppositions of communication when people don't want to cooperate with each other. 10

   b) Like every kinds of communication, cross cultural communication involves people and people are unpredictable. In every culture, some persons are uncooperative, deceitful, prejudiced or insensitive. While others are respectful, welcoming, sincere, and harmony-seeking. You can only make sure that you are as prepared as possible. Describe what one can do to enhance one's cross-cultural communications skills. 10

   c) On a recent trip to India, Mr. Yang a prominent Chinese executive dined with his client Himanshu Jain. Mr. Yang commented that the food was spicy which Mr. jain interpreted as an opportunity to discuss Indian cuisine. After lengthy explanations, Mr. Yang commented again that the food was spicy. What barrier is likely getting in the way of clear communication? 5

3. a) You call a meeting to try to convince your boss and peers that your company needs to make an important move for instance, funding a risky but promising venture. Your argument is impassioned, your logic unassailable, your data bulletproof. Two weeks later, though, you learn that your brilliant proposal has been tabled. What went wrong? 10

b) Every business, even a one-person business, is actually an economic and social system. To produce and sell goods and services, any business must coordinate the activities of many groups of people, employees, suppliers, customers, legal advisors, community representatives, and government agencies that might be involved in business. These connections are achieved through communication. Discuss the significance of communication skill in business sector. 5

c) If you want to know why so many organizations sink into chaos, look no further than their leaders' mouths. Leadership, at any level, certainly isn't easy—but unclear, vague, roller-coaster pronouncements make many top managers' jobs infinitely more difficult than they need to be. 10

What are the five recommendations from Professor Dr. Hamm for crystal-clear communication of managers? Discuss.

4. a) Brother International is a leading manufacturer of office equipment, including printers, photocopiers, and fax machines. The company has a centralized structure, with the bulk of its marketing and sales operations located at corporate headquarters. Ryan Warsaw, the executive vice president of sales and marketing, knows she must restructure her operations to become more customer focused. Specifically, she needs to form major-account teams at the regional level instead of at the corporate level. All national accounts and targeted marketing would be based in one of five regions (Northeast, Southeast, Midwest, Southwest, and West), each run by a different vice president. In Ryan Warsaw's plan, account executives for Brother's major customers (clients with revenues over $50 million) would relocate near the headquarters of those companies and would report directly to their respective regional VP. Each region would have its own marketing team and distribution channels, leaving corporate marketing responsible just for brand development. Ryan Warsaw needs to persuade George, Brother's CEO, to approve these changes. 15

Consider this fictional scenario: Sales and Marketing VP Ryan Warsaw knows her company must become more customer focused. She recommends decentralizing her operations into regional account teams—but needs her CEO's support. How she'd argue her case, if her CEO's decision-making style is 'Charismatic' and/or 'Thinker'?

b) Dr. Robert wrote a book on persuasion, it's been widely hailed as a seminal book. The most significant aspect of this book was the highlighting of Cialdini's six principles of persuasion. Explain these principles with business applications. 10

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B.Sc.Engg. (EE), 8th Sem. Date: August 22, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: Phy 4821
Course Title: Engineering Materials

Summer Semester, A.Y. 2018-2019
Time: 90 Minutes
Full Marks: 50

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) Explain the typical resistivity versus temperature behavior of annealed and cold-worked (deformed) copper, containing various amounts of Ni as shown in Fig.1. (8)

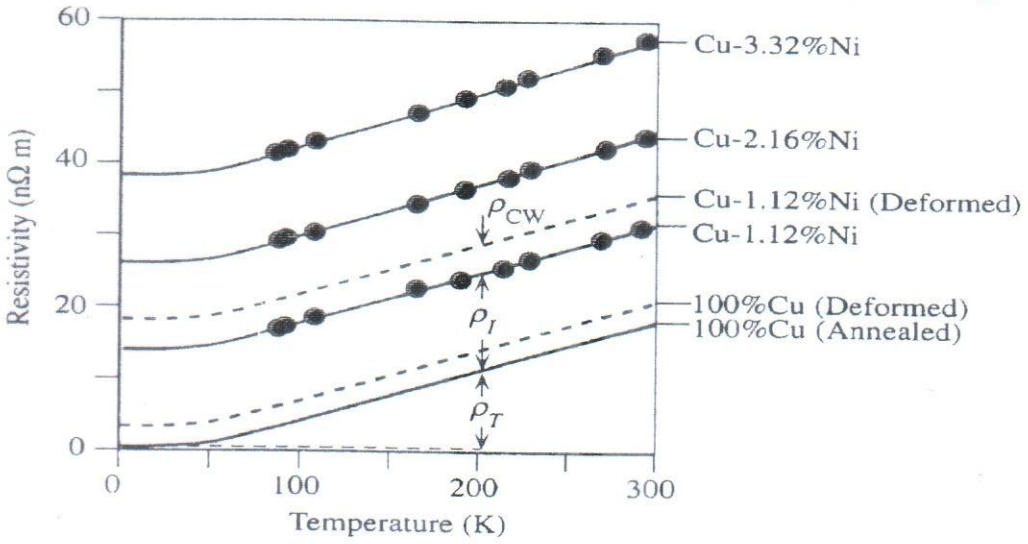

Fig. 1

b) Find the specific heat capacity c_s of GaAs at room temperature. It has a Debye temperature $T_D = 344$ K so that at a room temperature of 300 K, $T/T_D = 0.87$. If the temperature is -40^0 C, what is the percentage change in c_s? (8.67)
(M_{Ga}=69.72 g mol^{-1}, M_{As}=74.92 g mol^{-1} and R=8.31 JK^{-1}mol^{-1})

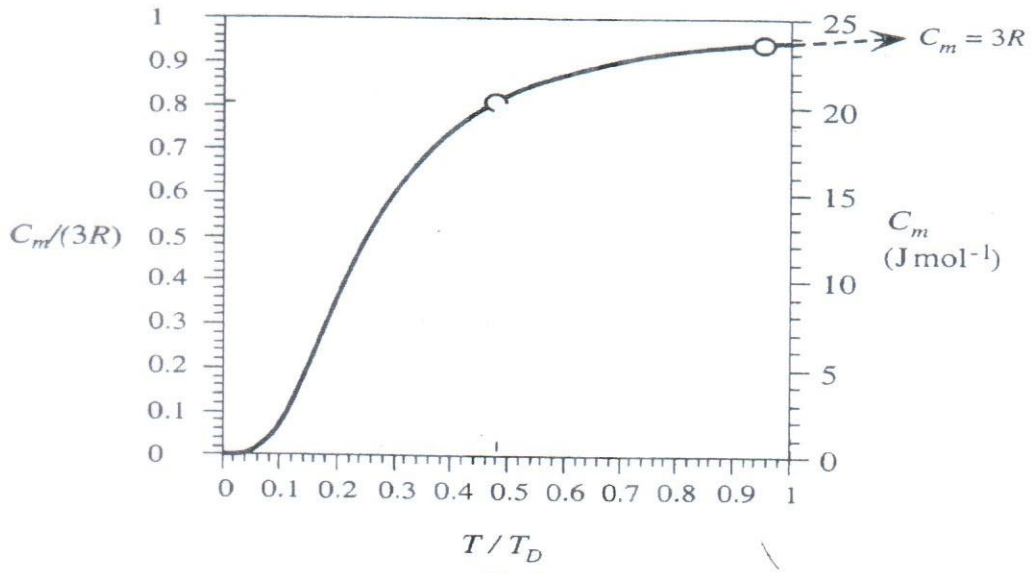

Fig.2

2. a) Define the following: - (6)
   I. Schrodinger Equation
   II. Eigenfunction
   III. Eigenenergy
   IV. Quantum number
   V. Normalization condition
   VI. Node of a wavefunction

   b) Consider an electron in an infinite potential well of size 0.1 nm. What is the ground energy of the electron? What is the frequency associated with this energy? What is the energy required to put the electron at the third energy level? How can this energy be provided? (10.67)
   ($h = 6.6 * 10^{-34}$ Js, $m_e = 9.1 * 10^{-31}$ kg, 1 eV $= 1.6 * 10^{-19}$ J and c$= 3 * 10^{8}$ ms^{-1})

3. a) Define the following: - (6)
   I. Heisenberg uncertainty principle
   II. Quantum leak
   III. Degeneracy
   IV. Scanning tunneling microscope

   b) Consider two copper wires only by their surface oxide layer (CuO). Is there any possibility of current passing through two copper wires classically? (10.67)

   Suppose that for the free electrons in copper, the surface oxide layer looks like a potential energy barrier of height 10 eV. Consider an oxide layer thickness of 5 nm and evaluate the transmission coefficient for free electrons in copper, which have a kinetic energy of about 7 eV. Is there any chance of electron tunneling?

   Now if the layer thickness reduces by 5 times, what is the transmission probability?
   ($h = 6.6 * 10^{-34}$ Js, $m_e = 9.1 * 10^{-31}$ kg and 1 eV$= 1.6 * 10^{-19}$ J)

4. a) What are Fermi-Dirac function and Fermi energy? Show that 'all electrons have energies below Fermi energy at absolute temperature'. When will some energy states above Fermi energy be occupied by electrons? Explain everything in terms of Fermi-Dirac function for different temperatures. (8.67)

   b) Assume that the Fermi energy level for a particular material is 6.25 eV and that the electrons in this material follow the Fermi-Dirac distribution function. Calculate the temperature at which there is a 1 percent probability that a state at 5.95 eV energy level will not contain an electron. ($k = 1.38 * 10^{-23}$ JK^{-1}) (8)

B.Sc. Engg. (EE), 8th Sem.

Date: August 26, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4835
Course Title: Power System Operation and Control

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 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 loss coefficients for economic dispatch problem. Could these be treated as constants? Justify your answer. 05

   b) Why is it necessary to include transmission loss for solving the economic load dispatch problem of a large power system? 05

   c) The fuel cost in \$/h of three thermal power plants are 15

$$C_1 = 200 + 7.0P_1 + 0.008P_1^2 \quad \$/h$$

$$C_2 = 180 + 6.3P_2 + 0.009P_2^2 \quad \$/h$$

$$C_3 = 140 + 6.8P_3 + 0.007P_3^2 \quad \$/h$$

   where, P_1, P_2 and P_3 are in MW. Plant outputs are subject to the following limits

$$10MW \le P_1 \le 85MW$$

$$10MW \le P_2 \le 80MW$$

$$10MW \le P_3 \le 70MW$$

   The real power loss is given by the simplified expression

$$P_L = 0.000218P_1^2 + 0.000228P_2^2 + 0.000179P_3^2 MW$$

   Determine the optimal dispatch of generation when the total system load is 150 MW. Assume the initial value of $\lambda^{(1)} = 7.8$.

2. a) Discuss the difference between *economic load dispatch* and *optimal unit commitment* in power system operation. 05

   b) Define the following terms associated with unit commitment: i) Crew constraint, ii) Minimum down time, iii) Spinning reserve, iv) Banking cost, and v) Priority ordering. 10

   c) The data of four thermal units to be committed is presented in the following table. 10

Unit no.	Max. (MW)	Min. (MW)	Inc. Heat Rate (BTU/ kWh)
1	85	35	10500
2	280	50	9300
3	325	80	8900
4	55	25	11300

   The fuel cost for all the units is 2.1 \$/MBTU. i) Calculate the incremental cost (\$/MWh) for each of the units, and ii) Prepare a capacity ordering table for the possible combinations among the units.

3. The detail of three thermal units to be committed are listed in the following table. 25

Unit	P_{min} (MW)	P_{max} (MW)	Min. up (h)	Min. down (h)	No- load cost ($)	Marginal cost ($/MWh)	Start-up cost ($)	Shut-down cost ($)
A	150	250	3	3	0	10	800	300
B	50	100	2	1	0	12	500	150
C	10	50	1	1	0	18	200	50

Assume unit A is in operation initially. The hourly load demand is shown in the following table.

Hour	1	2	3
Load (MW)	150	300	200

i) Identify the feasible states for each hour. ii) Find out the infeasible state transitions due to minimum up time and minimum down time constraints. iii) Calculate the operating costs and accumulated costs for each feasible combinations and transitions. iv) Determine the optimal solution.

4. a) Mention the major functions in *power system security*. Discuss any *one* of them in brief. 05

b) The line data and bus data of a four-bus power system are presented in the following tables. 20

Line data

From Bus	To bus	R (pu)	X (pu)	B_{shunt} (pu)
1	2	0.08	0.9	0.06
1	3	0.06	0.55	0.03
2	3	0.01	0.43	0.002
2	4	0.005	0.8	0.01
3	4	0.03	0.75	0.03

Bus data

Bus no.	Bus type	V_{sch} (pu)	P_g (pu)	P_{load} (pu)	Q_{load}(pu)
1	Swing	1.05			
2	Gen.	1.07	0.9		
3	Gen.	1.01	0.85		
4	Load			0.8	0.5

i) Find out the B' matrix for the system. ii) Calculate generation shift factors for all the lines if there is a generation outage at bus 2 and at bus 3.

B.Sc. Engg.(EE), 8th Sem. Date: August 29, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4841
Course Title: Microwave Engineering

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

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1. a) Derive the following expressions for voltage v and current i on an ideal transmission line with characteristic impedance, Z_0 and phase velocity, v_p. 13

$$v(z,t) = f_1\left(t - \frac{z}{v_p}\right) + f_2\left(t + \frac{z}{v_p}\right)$$

$$i(z,t) = \frac{1}{Z_0}\left[f_1\left(t - \frac{z}{v_p}\right) - f_2\left(t + \frac{z}{v_p}\right)\right].$$

b) A transmission line with characteristic impedance 50 Ω has its end short-circuited. The reflected current is $I_- = 0.2\ \angle 30^0$ A at a point 2 cm away from the point of short circuit. Determine the incident voltage and the reflected current at a point 4 cm away from the point of short circuit. The operating frequency is 5 GHz. 12

2. a) An ideal transmission line with characteristic impedance, $Z_0 = \frac{1}{Y_0}$ and phase constant β is connected to the load impedance, $Z_L = \frac{1}{Y_L}$. Show that the input admittance, Y_i at a distance l away from the load is given as follows. 12

$$Y_i = Y_0 \frac{Y_L \cos\beta l + j\, Y_0 sin\beta l}{Y_0 \cos\beta l + j\, Y_L sin\beta l}$$

b) A transmission line has characteristic impedance 50 Ω. The amplitude of the incident voltage is 10 V and the amplitude of the reflected current is 0.1 A. The angle of reflection coefficient is -60^0 at a point 2.5 cm away from the load. The operating frequency is 6 GHz. Determine the shortest distance from the load in cm for which the impedance is purely resistive. Also, determine the insertion loss (IL) at the point of load. 13

3. a) Prove that the same Smith chart can be alternately used as either impedance Smith chart or admittance Smith chart by simply rotating halfway (180^0) on SWR circle. 8

b) The minimum voltage amplitude is 5 V on a transmission line with characteristic impedance 50 Ω. Determine the minimum current amplitude. 7

c) The characteristic impedance of a transmission line is 50 Ω. Design a quarter-wave transformer in order to match a load impedance 100 + j65 Ω. The characteristic impedance of the quarter-wave transformer needs to be resistive. Find all lengths in terms of λ. 10

4. a) What are the best and worst positions on Smith chart? Explain why computer simulations are performed to check the variation of return loss around the design frequency. 8

   b) Design a single-stub series tuner for matching a load $Z_L = (30 - j40)\ \Omega$. The characteristic impedance of the transmission line is 50 Ω. Use short circuited stubs. The line is filled in with a material, which has dielectric constant $\varepsilon_r = 1.4$. The operating frequency is 10 GHz. Show distances and lengths in cm. 17

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B.Sc. Engg. (EE), 8th Sem. Date: 26 August, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4851
Course Title: Advanced Communication Techniques

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

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1. a) Define the following with respect to a satellite: 9
   i) Eccentricity,
   ii) Ascending node and
   iii) Mean anomaly.

   b) A satellite is orbiting at 28300 km apogee with an eccentricity of 0.3. What is the perigee distance and average orbiting period? Assume gravitational coefficient $g = GM = 3.98\times10^5\ km^3/s^2$. 6

   c) Discuss various schemes of optical generation of mm-waves. 10

2. a) Mention the challenges of a phased array antenna in respect of beamforming network. Compare beamformer with an omnidirectional antenna. 5+7

   b) Derive an expression of the ratio of bit energy to noise density (E_b/N_0) for a satellite link-power budget. 6

   c) For ASTRA satellite operated at 9.75 GHz having 33 MHz bandwith and 37938 km from earth surface, calculate the carrier to noise ratio (C/N) of the received signal. [Assume, clear sky attenuation, receiver directional error and polarisation error of 0.5 dB each, satellite EIRP = 52.0 dBW, Antenna gain = 37 dB, Noise figure of the LNB = 1 dB, Boltzmann's constant = - 228.6 dBW/K/Hz and operating temperature 25^0 C]. 7

3. a) Discuss various categories of spreading sequences. Explain direct sequence spread spectrum (DSSS) using BPSK. 5+5

   b) A microwave transmitter with an output of 0.5 W at 2 GHz is used in a transmission system, where both the transmitting and receiving antennas are parabolas, each 1 m in diameter. Suppose the two antennas are directionally aligned and are 10 km apart. 5+5
   i) What is the effective radiated power of the transmitted signal, in Watt and dB?
   ii) What is the available signal power at the receiving antenna?

   c) Compare single-mode and multi-mode fiber. 5

4. Consider an MFSK scheme with carrier frequency f_c equal to 250 kHz, difference frequency f_d equal to 25 kHz and M equal to 8 (L equal to 3 bits). 25

i) Make a frequency assignment for each of the eight possible 3-bit data combinations. We wish to apply FHSS to this MFSK scheme with k = 2; that is, the system will hop among four different carrier frequencies. Suppose the data rate is R bps, so the duration of a bit is $T = 1/R$ seconds.

ii) Consider a slow FHSS with T_c (the period at which the MFSK carrier frequency changes) being $2T_s$, where T_s is the duration of a signal element. Show the sequence of frequencies used and the times the frequency changes occur for transmitting the bit string 011110001.

iii) Consider a fast FHSS with T_s being $4T_c$. Show the sequence of frequencies used, and the times the frequency changes occur for transmitting the bit string 011110001.

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B.Sc. Engg. (EE), 8th Sem. Date: August 29, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE4865
Course Title: Digital Filter Design

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 in the margin indicate full marks. Programmable calculators are not allowed. Do not write on this question paper. Related formulas are attached with the question.

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1. a) Prove that a first-order RC low-pass filter will produce an attenuation of -20 dB/decade. 10

   b) Assume that you have been assigned to design a low-pass Butterworth filter with the following specifications: 15
      i) Pass-band gain must not less than 0.89.
      ii) Pass-band gain will remain almost stable up to 25 Hz.
      iii) Stop-band gain must not more than 0.215.
      iv) Attenuation must start from 75 Hz.

   Derive the transfer function of the filter that satisfies aforementioned specifications.

2. a) Develop an analog computer set-up to solve the differential equation: 10

$$\frac{d^5y}{dt^5} - 6\frac{d^4y}{dt^4} + \frac{d^3y}{dt^3} + 3\frac{d^2y}{dt^2} - 2\frac{dy}{dt} + 7y = 12x$$

   b) Derive the transfer function of a Chebyshev low-pass filter that satisfies the following specifications: 15
      i) Pass-band gain is -1.5 dB,
      ii) the cut-off frequency is 150 rad/s,
      iii) required attenuation is -30 dB and
      iv) attenuation band starts from 300 rad/s.

3. a) Write a short note on *Frequency Transformation*. 7

   b) Using impulse-invariant design method, derive the filter transfer function in z-domain and draw the DSP set-up of a second-order filter, given by: 18

$$H(s) = \frac{1}{[s + 1/\sqrt{2} + j(1/\sqrt{2})][s + 1/\sqrt{2} - j(1/\sqrt{2})]}$$

4. a) Design an inverse Chebyshev digital low-pass IIR filter for unity pass-band gain, 180 rad/s cut-off frequency, 0.0316 attenuation, 600 rad/s as attenuation starting frequency and 1000 rad/s sampling frequency. 20

   b) Compare a Chebyshev low-pass filter with a Butterworth low-pass filter. 5

Formula table:

Laplace Transform	Time function	z-Transform
$\frac{1}{s}$	$u_s(t)$	$\frac{z}{z-1}$
$\frac{1}{s^2}$	t	$\frac{Tz}{(z-1)^2}$
$\frac{2}{s^3}$	t^2	$\frac{T^2z(z+1)}{(z-1)^3}$
$\frac{1}{s+a}$	e^{-at}	$\frac{z}{z-e^{-aT}}$
$\frac{1}{(s+a)^2}$	te^{-at}	$\frac{Tze^{-aT}}{(z-e^{-aT})^2}$
$\frac{a}{s(s+a)}$	$1-e^{-at}$	$\frac{z(1-e^{-aT})}{(z-1)(z-e^{-aT})}$
$\frac{1}{(s+a)(s+b)}$	$\frac{1}{(b-a)}(e^{-at}-e^{-bt})$	$\frac{1}{(b-a)}\left(\frac{z}{z-e^{-aT}}-\frac{z}{z-e^{-bT}}\right)$
$\frac{a}{s^2(s+a)}$	$t-\frac{1}{a}(1-e^{-at})$	$\frac{Tz}{(z-1)^2}-\frac{(1-e^{-aT})z}{a(z-1)(z-e^{-aT})}$
$\frac{a}{s^2+a^2}$	$\sin(at)$	$\frac{z\sin(aT)}{z^2-2z\cos(aT)+1}$
$\frac{s}{s^2+a^2}$	$\cos(at)$	$\frac{z(z-\cos(aT))}{z^2-2z\cos(aT)+1}$
$\frac{b}{(s+a)^2+b^2}$	$e^{-at}\sin bt$	$\frac{z\sin(bT)e^{-aT}}{z^2-2z\cos(bT)e^{-aT}+e^{-2aT}}$
$\frac{s+a}{(s+a)^2+b^2}$	$e^{-at}\cos bt$	$\frac{z(z-\cos(bT)\,e^{-aT})}{z^2-2z\cos(bT)\,e^{-aT}+e^{-2aT}}$

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B.Sc.TE, 4th Sem.(2-Yr)/ 2nd Sem.(1-Yr) Date: 22 August, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4891
Course Title: Medical Electronics

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

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1. a) Design a hypothetical blood flow measurement system using maximum two sensors. 10

   b) With proper example, explain the following terms for a medical instrument: 15
   i) Specificity,
   ii) Accuracy and
   iii) Precision.

2. a) Explain the effect of bias current on output voltage for an Op-Amp. How to reduce the effect due to bias current? 13

   b) What is the effect of input offset voltage for the adder circuit? How to minimize the effect? 12

3. a) What is Young's modulus and Poisson's ratio? 10

   b) What are the practical problems to use a strain gauge as a sensor? How can you overcome those problems? 15

4. a) Explain the steps to initiate and propagation of Action Potential. 12

   b) Write short note on medical electrical safety. 13

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B.Sc.TE (1-Yr/2-Yr), 2nd Sem/4th Sem. Date: August 27, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4895
Course Title: Power Station

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 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 meant by *maximum demand* of a plant? Can it be higher than the plant capacity? How would you supply power to the loads if the demand goes beyond the plant capacity? 05

   b) An electrical system experiences changes in load such that its daily load curve is described as in Table 1 (b). 20

Table 1(b): Hourly load variation for a day

Time	MW	Time	MW
00:00 / 12:00 (Midnight)	20	12:30 P.M.	40
2 A.M.	10	1 P.M.	50
6 A.M.	10	5 P.M.	50
8 A.M.	50	6 P.M.	70
11 A.M	50	00:00 / 12:00 (Midnight)	20

   i) Plot the chronological load curve and load-duration curve for the system.
   ii) Plot the load-energy curve for the system.
   iii) Find the load factor.
   iv) Calculate the utilization factor of the plant serving this load if its capacity is 100 MW.

2. a) The input-output curve of a 50 MW generating station is defined by $I = 25 + 0.8L + 0.55L^2$, where I is in millions of BTU per hour and L is in megawatts. Consider that the station was operating at a load of 50 MW for 16 hours and 10 MW for the remaining hours of the day. 20

   i) Calculate the load factor, capacity factor and utilization factor.
   ii) Draw the input-output curve with loading of 0, 10, 20, 30, 40 and 50 MW.
   iii) Draw the corresponding heat rate curve, efficiency curve and incremental rate curves.
   iv) What is the input at zero loading? Is it zero? If not, why?

   b) Mathematically show that at the minimum heat rate of a station the numerical values of incremental rate and heat rate become equal. 05

3. a) Prove that, between two load points relationship of average input (millions of BTU/hr) to average output (MW) can be represented by a straight line. 15

   b) Prove that, when two generating stations are working together load division between them for having minimum input consumption will be such that their incremental rates are equal 10

4. a) Define maximum *protected* demand and *spinning reserve* of a power station. 05

   b) The capacities and order of efficiency of a six unit power station is presented in Table 4 (b). Prepare a capacity scheduling chart for the power station considering the system should be able to maintain the continuity of supply even with the failure of the highest unit in operation. What is the maximum protected demand for the station? 20

Table 4 (b): Unit capacities and order of efficiency

Unit No.	Capacity, MW	Order of Efficiency
1	5	6
2	10	5
3	20	3
4	40	2
5	30	1
6	50	4

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Ph. D/M.Sc. Engg.(EE) Date: August 30 , 2019(Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination — Summer Semester, A. Y. 2018-2019
Course No.: EEE 6105 — Time: 90 Minutes
Course Title: Advanced Engineering Analysis — Full Marks: 75

There are **4 (four)** questions. Answer **any 3 (three)** questions. All questions carry equal marks. Figures in the margin indicate full marks. Programmable calculators are not allowed. Do not write on this question paper.

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1. (a) Define Green's function(GF). What are the properties of GF of a second order causal system? How is GF related to the impulse response and hence the transfer function of an LTI system? 10

   b) The output of the following electrical circuit is the current through the inductor. Derive the input/output relation and find the causal GF for the circuit. 15

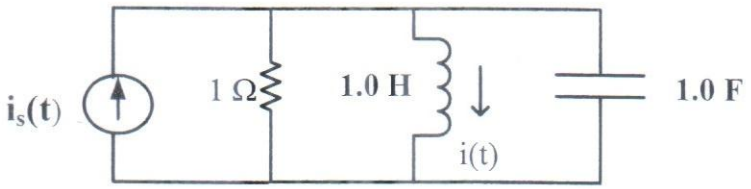

Fig. 1(b).

2. a) What are meant by fixed point (equilibrium point) and phase portrait of a dynamical system? Describe the geometrical way of examining the nature of fixed points of a 1-D dynamical system using an example. 10

   b) For the following dynamical system, sketch the vector field on the real line, find all the fixed points, classify their stability and sketch the qualitative solutions for initial values of x_0 that lies in regions (i) $x_0 < 0$, (ii) $0 < x_0 < 1$ and (iii) $1 < x_0 < 2$. 15

$$\frac{dx}{dt} = x^3 - 3x^2 + 2x \ .$$

3. a) What is meant by bifurcation? What type of bifurcation might occur in the following 1-D non-linear system when the parameter 'r' is varied? Find the critical value of r at which bifurcation occurs. Draw the bifurcation diagram. 13

$$\frac{dx}{dt} = r + x^2 \ .$$

b) Find the eigen values of the following linear dynamical systems and draw the phase portrait. 12

$$\begin{bmatrix} \frac{dx}{dt} \\ \frac{dy}{dt} \end{bmatrix} = \begin{bmatrix} 5 & 2 \\ -17 & -5 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} \text{ and } \begin{bmatrix} \frac{dx}{dt} \\ \frac{dy}{dt} \end{bmatrix} = \begin{bmatrix} -3 & 4 \\ -2 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}.$$

4. a) Find the equilibrium points of the following nonlinear dynamical system. Linearize the stem at the vicinity of the fixed points and hence find the stability of the equilibrium points, 15

$$\frac{dx}{dt} = y + x - x^3$$
$$\frac{dy}{dt} = -y$$

b) Find the expression for Gradient g(**x**) and Hessian H(**x**) of a multidimensional objective function. How can they be used to classify the stationary points of an objective function? 10

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M.Sc. TE, 2nd Sem. Date: August 22, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination — Summer Semester, A.Y. 2018-2019
Course No.: EEE 6293 — Time: 90 Minutes
Course Title: Power System Stability — 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) Explain the advantage of rotating reference frame over stationary reference frame in measuring the rotor position of a synchronous machine with neat diagram. 05

   b) State the major differences between small disturbance and large disturbance stability study. Provide practical examples for each of them. 10

   c) Establish the relation between electrical angle and mechanical angle for a 32-pole synchronous machine. 10

2. a) A synchronous generator is supplying power to an infinite bus as shown in Fig. 2 (a). Obtain the expression of real power supplied to the infinite bus. Also find out the expression of the maximum power. 15

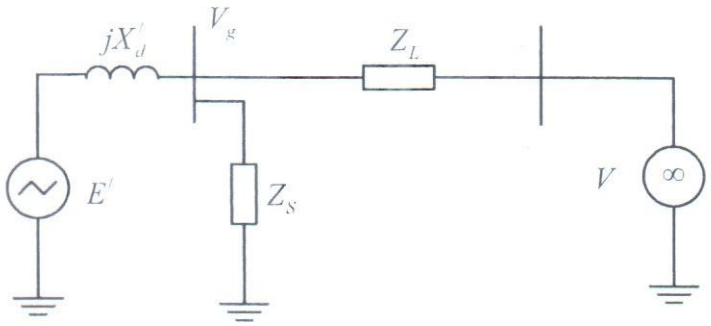

Fig. 2(a)

   b) The maximum power transfer by the synchronous generator of Fig. 2 (a) is 1.5 p.u while the infinite bus voltage magnitude $V = 1.0$ p.u. Calculate the magnitude of generator internal voltage E' if $X_d' = 0.5$ p.u. and $Z_L = 0.25$ p.u. 10

3. a) Draw the phasor diagram of a synchronous machine under steady state considering the rotor is having salient pole configuration. Also, derive the expression of rotor angle, δ. 12

   b) Obtain the expressions of q-axis transient internal voltage (E_q') and d-axis component of current (I_d) for a salient pole synchronous machine running under the transient condition. 13

4. a) Explain the concept of synchronizing power coefficient (P_s) for a synchronous machine. How does the polarity of P_s determine the stability of the power system? Discuss with the help of power-angle diagram. 12

   b) Prove that the swing equation of a synchronous generator can be expressed as $\frac{d^2\delta}{dt^2} = \frac{\pi f}{H}(P_m - P_e)$. 13

M.Sc. Engg.(EE)/Ph.D. (EE) Date: August 22, 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

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 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 double 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 and antenna bandwidth. 5

   b) Derive the expression for radiation resistance of a half-wave dipole. 10

   c) Find the directivity of a half-wave dipole. 10

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

   b) Define first side lobe ratio (SLR) and show that the SLR for uniform array is -13.5 dB. 10

   c) Two dipoles of gain 1.64 each are used for transmitting and receiving purposes. They are separated by a distance of 10 m. The radiated power by the transmitting antenna is 15 W at a frequency 60 MHz. Determine the receiving power. 10

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

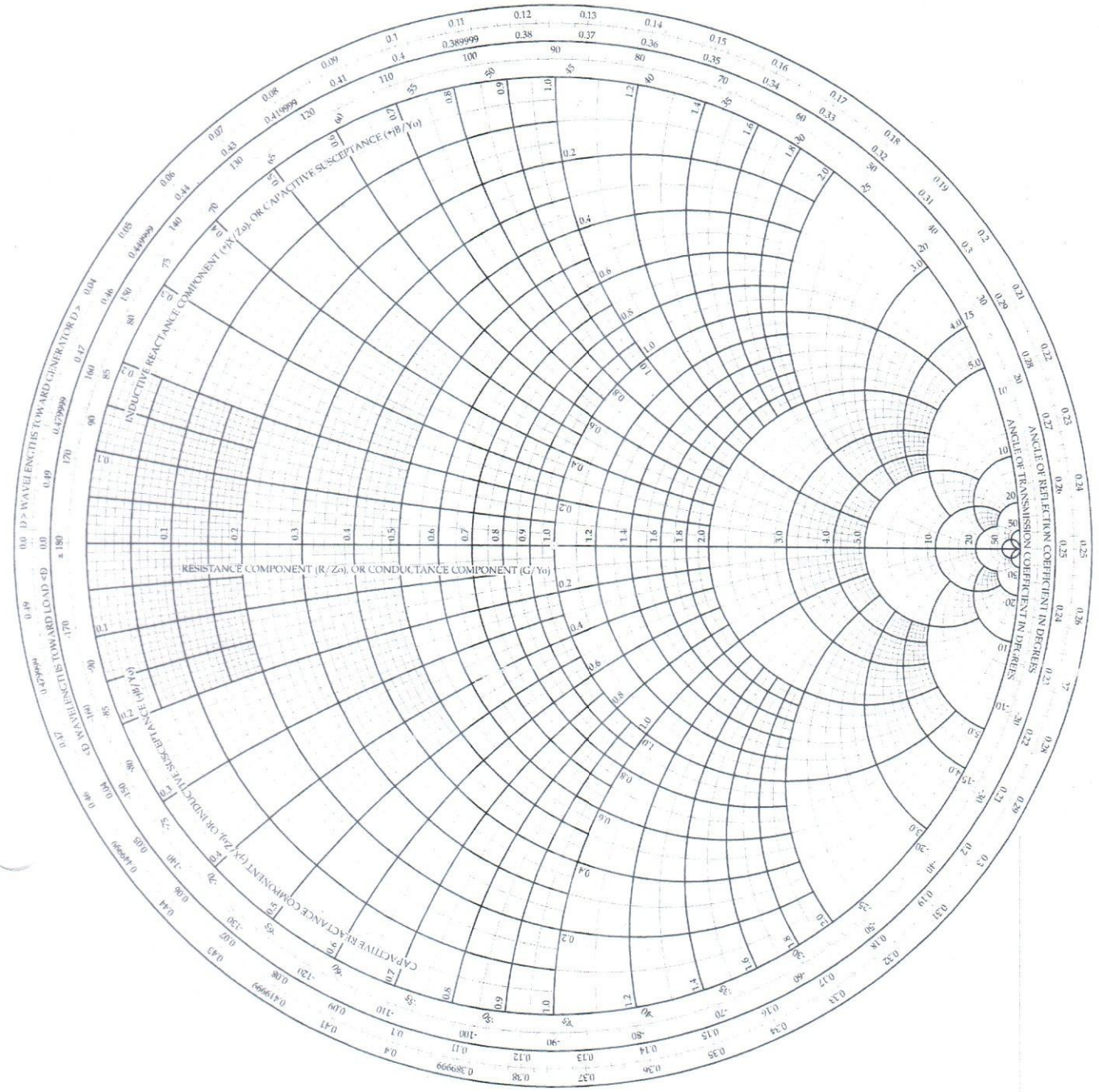
   b) Derive the equation of line source design by Fourier Transform method. 10

   c) Design a line source to obtain a radiation pattern given by 10

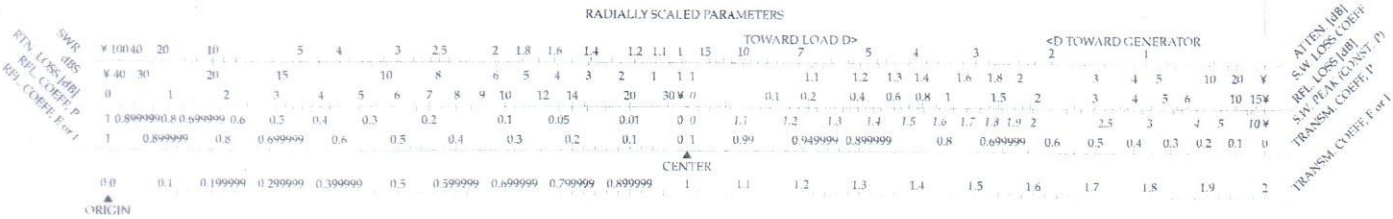
   $E(\phi) = 1$ for $45° \leq \phi \leq 135°$ and
   $E(\phi) = 0$ outside this angular region.

IMPEDANCE SMITH CHART

Introduction to RF Circuit Design



RADIALLY SCALED PARAMETERS



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M.Sc. TE, 2nd Sem. Date: August 27, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 6295
Course Title: Advanced Electronics

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

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1. a) In Fig. 1.a, the op-amp has an open-loop voltage gain of 2×10^5, input resistance of $2M\Omega$, and output resistance of 50Ω. 2+4+4 =10

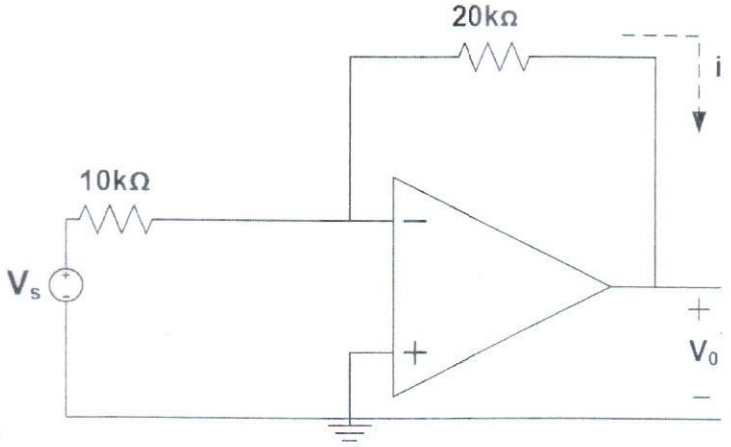

Figure:1.a

For non-ideal model of op-amp:

i. Draw the equivalent Circuit diagram.
ii. Find the closed-loop gain ($\frac{v_0}{v_s}$).
iii. Determine current i for $V_s = 2V$.

b) Consider the ideal model for op-amp of Fig. 1.(a): 4+4= 8

i. Find the closed-loop gain ($\frac{v_0}{v_s}$).
ii. Determine current i for $V_s = 2V$.

c) Based on the calculation of question 1(a) and 1(b), comment which type of model is preferable and why? Also point out the assumptions that are made to consider the model of an op-amp as ideal. 2+5= 7

2. a) Design and verify a three channel inverting amplifier with op-amp. The gains for each channel have been listed in Table 2.a. Select a 10 kΩ resistor for the input resistance of the channel with the highest gain. 8+7=15

Table: 2.a

Channel number	Voltage gain
1	-10
2	-5
3	-2

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b) Design an averager with the op-amp circuit having four input voltages. 10

3. a) The digital-to-analog converter (DAC) transforms digital signals into analog form. A typical example of a four-bit DAC is illustrated in Fig. 3.a. Now, in the op-amp circuit of Fig. 3.a, let $R_f = 10\ k\Omega, R_1 = 10\ k\Omega, R_2 = 20\ k\Omega, R_3 = 40\ k\Omega$, and $R_4 = 80k\Omega$. Obtain the analog output for binary inputs [0000], [0001], [0010], . . . , [1111]. 20

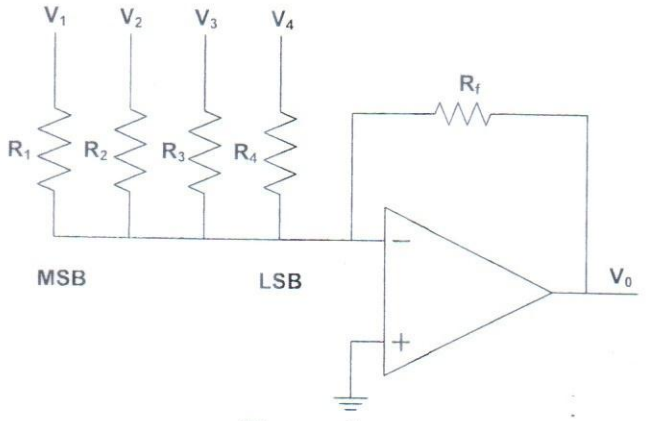

Figure: 3.a

b) Construct a single stage op-amp circuit that allows to add a dc voltage to triangular wave. 5

4. a) An instrumentation amplifier shown in Fig. 4.a is an amplifier of low-level signals used in process control or measurement applications and commercially available in single-package units. Show that 15

$$v_0 = \frac{R_2}{R_1}\left(1 + \frac{2R_3}{R_4}\right)v_2 - v_1.$$

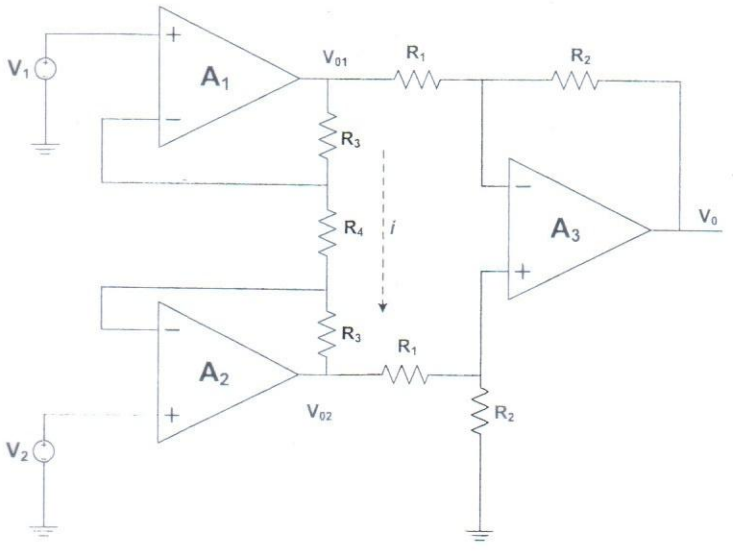

Figure: 4.a

b) Design an operational amplifier circuit with inputs v_1 and v_2 such that $v_0 = -5v_1 + 3v_2$. Use only one op-amp in the design. 10

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M.Sc. Engg./Ph.D. (EEE) Date: August 27, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No. : EEE 6401
Course Title : Optical Fiber Communication

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

There are **4 (four)** questions. Answer **any 3 (three)**. Marks for each part of the questions are indicated on the right margin. Symbols have their usual meanings. Programmable calculators are not allowed. Do not write on this question paper.

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1. a) Describe the evolution of lightwave communication system. Clearly explain how the fifth generation lightwave system attempts to extend the usable wavelength range. 10+6

   b) Draw the fiber attenuation (loss) versus optical wavelength diagram and identify different optical bands with their names and wavelength ranges. 3+6

2. a) What are the requirements to be satisfied by a suitable optical fiber material? Show how the refractive index of glass varies with increasing concentrations of four dopants. Mention the advantages and disadvantages of plastic over silica as optical fiber material. 3+4+3

   b) Using suitable diagram(s) and ray optics approach, explain why graded-index fibers are better than step-index fibers in terms of numerical aperture and optical confinement. Write down the BL product equations of step-index and graded-index fibers and explain (from the equations) which fiber offers greater BL product and why. 6+4

   c) What do you understand by the 'mode's of a guided wave? What is the condition for a mode to become leaky? What is the significance of V parameter in single mode fibers? 2+1+2

3. a) It is given that $n_1 = 1.45$ and $\Delta = 0.003$ in a single mode fiber carrying optical signal having $\lambda = 1.55$ μm. Calculate: 5+5
   (i) the maximum core radius of the fiber and
   (ii) the maximum value of mode index of the guided mode.
   The following expression, obtained from curve fitting, may be used for calculation:

$$b(V) = \left(1.1428 - \frac{0.996}{V}\right)^2.$$

   b) What are the different types of loss mechanisms present in optical fibers? Describe all the mechanisms. 3+12

4. a) Using diagram, describe how dispersion parameter, D can be engineered to obtain different dispersion managed fibers (DSF, DFF etc.). 5+4
   An SMF has D = 1 ps/(km-nm) and a spectral width corresponding to $\Delta\lambda = 2$ nm. Determine the maximum BL product attainable from that SMF.

   b) Explain how Stimulated Brillouin Scattering (SBS) and Stimulated Raman Scattering (SRS) occur in optical fibers. 8+8

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M.Sc. Engg. (EE) / PhD (EE) Date: August 29, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 6407
Course Title: Digital Communication

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 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. 04

   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 $-\infty < t < \infty$,

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

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

   $iv)\ x(t) = \cos t + 5\cos 2t$ for $-\infty < t < \infty$.

   c) Given the spectrum 09

   $$G_x(f) = 10^{-4}\left\{\frac{\sin[\pi(f-10^6)10^{-4}]}{\pi(f-10^6)10^{-4}}\right\}^2$$

   find the value of the signal bandwidth using the following bandwidth definitions:
   i) Half-power bandwidth.
   ii) Noise equivalent bandwidth.
   iii) Null-to-null bandwidth.

2. a) The analog signal recovered from the sampled, quantized, and transmitted pulses will contain corruption from several sources. Explain different corruptions. 10

   b) Draw the block diagram of formatting and transmission of baseband signals. Explain message, character and symbol for 8-ary and 32-ary digits. 08

   c) Human speech is characterized by unique statistical properties. How does it affect quantization of signals? 07

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. 10

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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. 08

c) Consider an audio signal with spectral components limited to the frequency band 300 to 3300 Hz. Assume that a sampling rate of 8000 samples/s will be used to generate a PCM signal. Assume that the ratio of peak signal power to average quantization noise power at the output needs to be 30 dB. 07

i) What is the minimum number of uniform quantization levels needed, and what is the minimum number of bits per sample needed?

ii) Calculate the system bandwidth (as specified by the main spectral lobe of the signal) required for the detection of such a PCM signal.

4. a) What is correlative coding? Explain Duobinary Coding and Decoding with a demonstration. Also explain precoding with an illustration. 15

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. 10

i) How many quantization levels of the analog signal are needed for $\left(\frac{S}{N_q}\right)_{peak} = 96dB$?

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?

Appendix : Table for Q(x)

x	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0000	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641
.1000	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
.2000	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
.3000	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
.4000	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
.5000	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
.6000	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
.7000	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
.8000	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
.9000	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
1.000	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
1.100	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
1.200	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.9853E-01
1.300	.9680E-01	.9510E-01	.9342E-01	.9176E-01	.9012E-01	.8851E-01	.8691E-01	.8534E-01	.8379E-01	.8226E-01
1.400	.8076E-01	.7927E-01	.7780E-01	.7636E-01	.7493E-01	.7353E-01	.7215E-01	.7078E-01	.6944E-01	.6811E-01
1.500	.6681E-01	.6552E-01	.6426E-01	.6301E-01	.6178E-01	.6057E-01	.5938E-01	.5821E-01	.5705E-01	.5592E-01
1.600	.5480E-01	.5370E-01	.5262E-01	.5155E-01	.5050E-01	.4947E-01	.4846E-01	.4746E-01	.4648E-01	.4551E-01
1.700	.4457E-01	.4363E-01	.4272E-01	.4182E-01	.4093E-01	.4006E-01	.3920E-01	.3836E-01	.3754E-01	.3673E-01
1.800	.3593E-01	.3515E-01	.3438E-01	.3362E-01	.3288E-01	.3216E-01	.3144E-01	.3074E-01	.3005E-01	.2938E-01
1.900	.2872E-01	.2807E-01	.2743E-01	.2680E-01	.2619E-01	.2559E-01	.2500E-01	.2442E-01	.2385E-01	.2330E-01
2.000	.2275E-01	.2222E-01	.2169E-01	.2118E-01	.2068E-01	.2018E-01	.1970E-01	.1923E-01	.1876E-01	.1831E-01
2.100	.1786E-01	.1743E-01	.1700E-01	.1659E-01	.1618E-01	.1578E-01	.1539E-01	.1500E-01	.1463E-01	.1426E-01
2.200	.1390E-01	.1355E-01	.1321E-01	.1287E-01	.1255E-01	.1222E-01	.1191E-01	.1160E-01	.1130E-01	.1101E-01
2.300	.1072E-01	.1044E-01	.1017E-01	.9903E-02	.9642E-02	.9387E-02	.9137E-02	.8894E-02	.8656E-02	.8424E-02
2.400	.8198E-02	.7976E-02	.7760E-02	.7549E-02	.7344E-02	.7143E-02	.6947E-02	.6756E-02	.6569E 02	.6387E-02
2.500	.6210E-02	.6037E-02	.5868E-02	.5703E-02	.5543E-02	.5386E-02	.5234E-02	.5085E-02	.4940E-02	.4799E-02
2.600	.4661E-02	.4527E-02	.4396E-02	.4269E-02	.4145E-02	.4025E-02	.3907E-02	.3793E-02	.3681E-02	.3573E-02
2.700	.3467E-02	.3364E-02	.3264E-02	.3167E-02	.3072E-02	.2980E-02	.2890E-02	.2803E-02	.2718E 02	.2635E-02
2.800	.2555E-02	.2477E-02	.2401E-02	.2327E-02	.2256E-02	.2186E-02	.2118E-02	.2052E-02	.1988E-02	.1926E-02
2.900	.1866E-02	.1807E-02	.1750E-02	.1695E-02	.1641E-02	.1589E-02	.1538E-02	.1489E-02	.1441E-02	.1395E 02
3.000	.1350E-02	.1306E-02	.1264E-02	.1223E-02	.1183E-02	.1144E-02	.1107E-02	.1070E-02	.1035E-02	.1001E-02
3.100	.9676E-03	.9354E-03	.9043E-03	.8740E-03	.8447E-03	.8164E-03	.7888E-03	.7622E-03	.7364E-03	.7114E-03
3.200	.6871E-03	.6637E-03	.6410E-03	.6190E-03	.5976E-03	.5770E-03	.5571E-03	.5377E-03	.5190E-03	.5009E-03
3.300	.4834E-03	.4665E-03	.4501E-03	.4342E-03	.4189E-03	.4041E-03	.3897E-03	.3758E-03	.3624E-03	.3495E-03
3.400	.3369E-03	.3248E-03	.3131E-03	.3018E-03	.2909E-03	.2802E-03	.2701E-03	.2602E-03	.2507E-03	.2415E-03
3.500	.2326E-03	.2241E-03	.2158E-03	.2078E-03	.2001E-03	.1926E-03	.1854E-03	.1785E-03	.1718E-03	.1653E-03
3.600	.1591E-03	.1531E-03	.1473E-03	.1417E-03	.1363E-03	.1311E-03	.1261E-03	.1213E-03	.1166E-03	.1121E-03
3.700	.1078E-03	.1036E-03	.9961E-04	.9574E-04	.9201E-04	.8842E-04	.8496E-04	.8162E-04	.7841E-04	.7532E-04
3.800	.7235E-04	.6948E-04	.6673E-04	.6407E-04	.6152E-04	.5906E-04	.5669E-04	.5442E-04	.5223E-04	.5012E-04
3.900	.4810E-04	.4615E-04	.4427E-04	.4247E-04	.4074E-04	.3908E-04	.3747E-04	.3594E-04	.3446E-04	.3304E-04
4.000	.3167E-04	.3036E-04	.2910E-04	.2789E-04	.2673E-04	.2561E-04	.2454E-04	.2351E-04	.2252E-04	.2157E-04
4.100	.2066E-04	.1978E-04	.1894E-04	.1814E-04	.1737E-04	.1662E-04	.1591E-04	.1523E-04	.1458E-04	.1395E-04
4.200	.1335E-04	.1277E-04	.1222E-04	.1168E-04	.1118E-04	.1069E-04	.1022E-04	.9774E-05	.9345E 05	.8934E 05
4.300	.8540E-05	.8163E-05	.7801E-05	.7455E-05	.7124E-05	.8807E-05	.6503E-05	.6212E-05	.5934E-05	.5668E-05
4.400	.5413E-05	.5169E-05	.4935E-05	.4712E-05	.4498E-05	.4294E-05	.4098E 05	.3911E-05	.3732E-05	.3561E-05
4.500	.3398E-05	.3241E-05	.3092E-05	.2949E-05	.2813E-05	.2682E-05	.2558E-05	.2439E-05	.2325E-05	.2216E-05
4.600	.2112E-05	.2013E-05	.1919E-05	.1828E-05	.1742E-05	.1660E-05	.1581E-05	.1506E-05	.1434E-05	.1366E-05
4.700	.1301E-05	.1239E-05	.1179E-05	.1123E-05	.1069E-05	.1017E-05	.9680E-06	.9211E-06	.8765E-06	.8339E-06
4.800	.7933E-06	.7547E-06	.7178E-06	.6827E-06	.6492E-06	.6173E-06	.5869E-06	.5580E-06	.5304E-06	.5042E-06
4.900	.4792E-06	.4554E-06	.4327E-06	.4111E-06	.3906E-06	.3711E-06	.3525E-06	.3448E-06	.3179E 06	.3019E-06
5.000	.2867E-06	.2722E-06	.2584E-06	.2452E-06	.2328E-06	.2209E-06	.2096E-06	.1989E-06	.1887E-06	.1790E-06
5.100	.1698E-06	.1611E-06	.1528E-06	.1449E-06	.1374E-06	.1302E-06	.1235E-06	.1170E-06	.1109E-06	.1051E-06

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M.Sc. Engg.(EE) / Ph.D. (EE) Date: 26 August, 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) 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

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)? 7
   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?

3. 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). 5+5=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

4. 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. 6+2=8
What is spread-spectrum frequency hopping of Bluetooth? Briefly explain with examples.

c) At the beginning of the data transferring, how does the Bluetooth device create connection with another Bluetooth device? 4+4+4 =12
Briefly discuss Bluetooth Piconets.
How does Bluetooth operate during data transferring? Briefly explain the operation state with suitable flow chart.

M.Sc. TE., 4th Sem. Date: 27 August, 2019 (Morning)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination — Summer Semester, A. Y. 2018-2019
Course No.: EEE 6499 — Time: 90 Minutes
Course Title: Laser Theory and Optical 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) Discuss the advantages of optical fiber over coaxial fiber. Draw a schematic diagram of an optical fiber link consisting of transmitter and receiver systems. 5+5

   b) Discuss the operation principle of a laser and a p-n photodiode. 15

2. a) Discuss different kinds of attenuation occurred in an optical fiber operation. 10

   b) A graded- index fiber with a core diameter d = 50 μm and NA = 0.2 is to be operated at a wavelength of λ = 1 μm. How many modes are capable of propagation in this fiber? 10

   c) To obtain single mode, discuss what one must do in relation to the V parameter and how to do that. 5

3. a) Compare single-mode and multi-mode fiber. 7

   b) Using Snell's law for air-core media, derive the maximum acceptance angle in an optical fiber. What is the fiber numerical aperture when $n_1 = 1.46$ and $n_2 = 1.44$? 8

   c) Draw the loss curve of an optical fiber for various wavelengths and explain the reasons of various peaks occurred. 10

4. Discuss the following: 25
   i) Material dispersion,
   ii) MZM and
   iii) Distribution network.

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M.Sc. Engg. (EE)/ PhD (EE) Date: August 23, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 6701
Course Title: Nonlinear Control System

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 in the margin indicate full marks. Programmable calculators are not allowed. Do not write on this question paper. Symbols have their usual meanings.

1.a) Why is the study of nonlinear control needed? (05)

b) Briefly explain some common nonlinear behaviors. (05)

c) Find the transfer function, $V_L(s)/V(s)$, for the electrical network shown in Fig. 1(c), which contains a nonlinear resistor whose voltage-current relationship is defined by $i_r = 2e^{0.1v_r}$, where i_r and v_r are the current through the resistor and voltage across it, respectively. Also $v(t)$ is a small-signal source. (15)

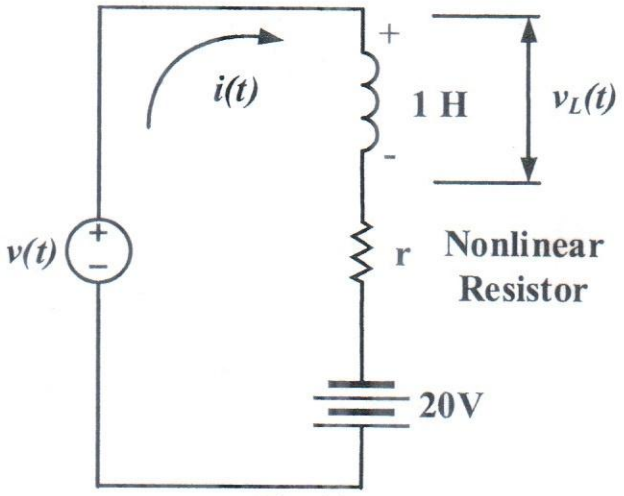

Fig. 1(c)

2.a) Show that the time domain solution of state equations can be expressed as, (15)

$$X(t) = e^{At}X(0) + \int_0^t e^{A(t-\tau)}Bu(\tau)\,d\tau$$
$$= \Phi(t)X(0) + \int_0^t \Phi(t-\tau)Bu(\tau)\,d\tau .$$

b) For the system represented in the following state space equations, find its similar diagonal system. (10)

$$\dot{X} = \begin{bmatrix} -3 & 1 \\ 1 & -3 \end{bmatrix} X + \begin{bmatrix} 1 \\ 2 \end{bmatrix} u$$
$$y = \begin{bmatrix} 2 & 3 \end{bmatrix} X .$$

3.a) Define controllability? What information it actually provides to the design engineers? What is controllability matrix? How the controller is designed for system represented in forms other than phase-variable form? (12)

b) For the plant represented in the transfer function below, design the phase-variable gains to yield 9.5% overshoot and a settling time of 0.74 second. (13)

$$G(s)=\frac{20(s+5)}{s(s+1)(s+4)}$$

4.a) Design an observer for the plant *G(s)* represented in cascade form. The closed-loop performance of the observer is governed by the characteristic polynomial $s^3+120s^2+2500s+50000$. (12)

$$G(s)=\frac{1}{(s+1)(s+2)(s+5)}$$

b) Draw the phase portrait of the system represented by the following equations, (13)

$$\dot{X}=4X-3Y,$$
$$\dot{Y}=6X-7Y.$$

Where X, Y are state variables.

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M.Sc. Engg. (EE)/Ph.D

27 August, 2019 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 6801
Course Title: Power Electronics

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

There are **4 questions**. Answer **any 3 questions**. All questions carry equal marks. Programmable calculators are not allowed. Do not write on this question paper.

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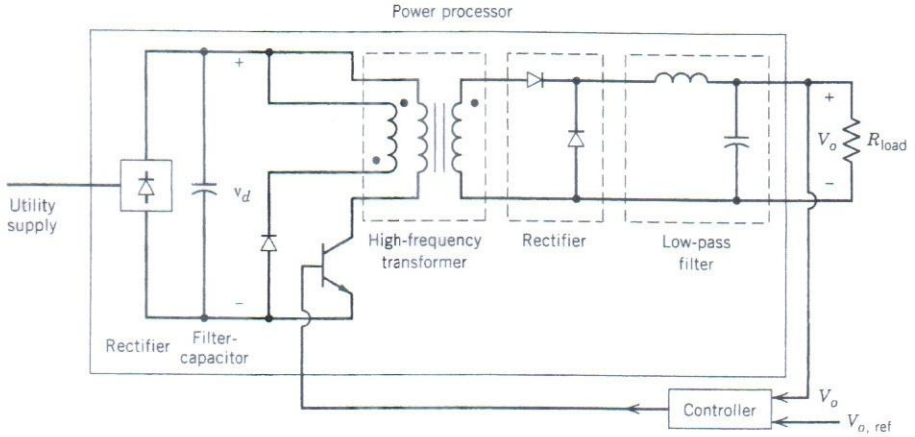
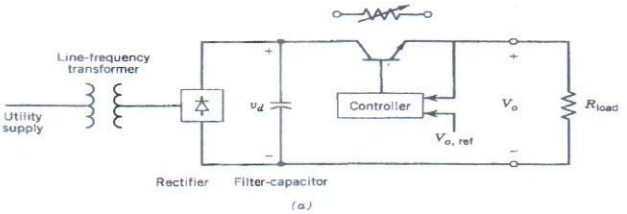
1. a) Discuss how a power electronic industry can contribute to the socio-economic development of a developing country. In your answer, give practical examples.

b)

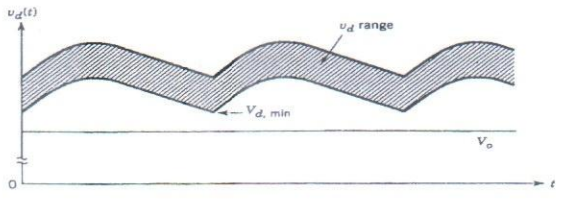


The above figure demonstrates the use of power electronic system for SMPS. Clearly explain the roles of the transistor switch and high frequency transformer of the circuit.

c) Consider a linear regulated power supply as shown in the following figure of (a). The instantaneous input voltage corresponding to the lowest waveform in Fig. (b), where $V_{d,min}$ = 20 V and $V_{d,max}$ = 30 V. Approximate this waveform by a triangular wave consisting of two linear segments between the above two values. Let V_O = 15 V and assume the output load is constant. Calculate the energy efficiency in this part of the power supply due to losses in the transistor.



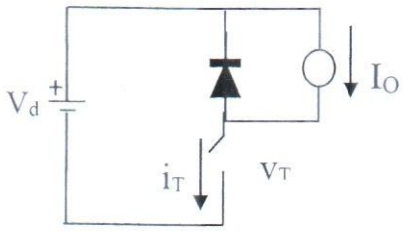
(a)



(b)

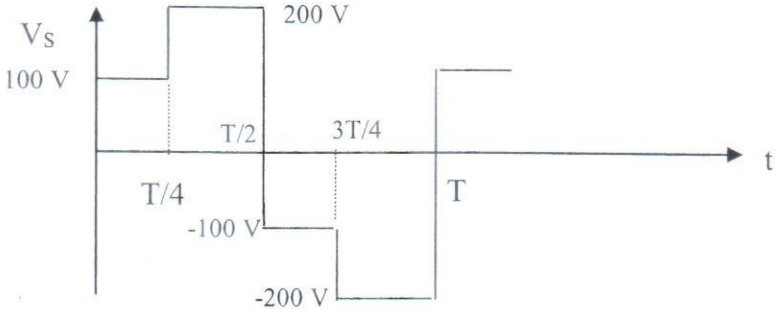
2. a) Describe the desired characteristics of a controllable switch in a power electronic system.

   b) The data sheets of a switching device specify the following switching times corresponding to the linearized characteristics of a clamped-inductive switching as shown in the following figure: $t_{ri} = 100$ ns, $t_{fv} = 50$ ns, $t_{rv} = 100$ ns, $t_{fi} = 200$ ns. Calculate and plot the switching loss as function of frequency. Assume $V_d = 300$ V and $I_o = 4$ A.



   c) By drawing a half wave rectifier with a source inductance and a free-wheeling diode, (i) describe the current commutation between diodes for a constant current load (ii) derive the expression of the average value of the output voltage.

3. a) A single-phase bridge rectifier with a finite source inductance L_S =5 mH has a load of constant current of 10 amp. It has a frequency of 50 Hz. The input voltage has the following wave-shape.



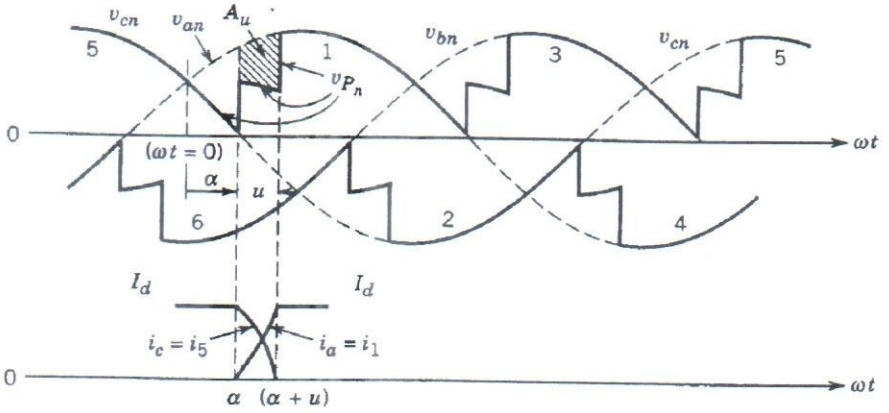
   (i) Draw the wave shapes of source current and output voltage. (ii) Calculate the commutation angle and average value of the output voltage.

   b) An ac to dc converter is used to charge a battery. The converter has a source inductance L_S. Draw the wave-shape of the load current for a discontinuous mode of operation. Also draw the wave-shape of the voltage drop across the source inductance. The output current can be determined by the following expression:

$$i_d(\theta) = \frac{1}{\omega L_S} \int_{\theta_b}^{\theta} (\sqrt{2} V_S \sin \omega t - V_d)\, d(\omega t)$$

   How can you determine initial and final values of θ? Find the expression of the average value of the output current.

4. a) Describe the current commutation process of a three-phase rectifier with finite source inductance and a constant dc current. Derive the expression of the commutation angle and dc output voltage. You can use the following figure to find out the expression.



b) For the following three phase rectifier, assume the ac-side inductance L_S to be negligible. Instead, an inductance L_d is placed between rectifier output and the filter capacitor. Derive the minimum value of L_d in terms of V_{LL}, ω, and I_d that will result in a continuous i_d, assuming that the ripple in v_d is negligible.