B.Sc. Engg.(EE)/HDEE, 3rd Sem. Date: March 13, 2017 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

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

Winter Semester, A.Y. 2016-2017
Time: 90 Minutes
Full Marks: 75

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

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1. a) What is meant by negative feedback? Draw a diagram showing negative feedback to support your answer. What are the advantages and disadvantages of the negative feedback? 8

   b) Briefly explain the gain sensitivity of the negative feedback system. 7

   c) A negative-feedback amplifier has a closed-loop gain of $A_f = 100$ and an open-loop gain of $A = 5 \times 10^4$. Determine the feedback transfer function β. If $\beta = 0.012$ and $A_f = 80$, determine the open-loop gain A. 10

2. a) Draw the op amp output voltage v_0 as a function of the differential input voltage v_d. What are the three main characteristics of an ideal op amp? 8

   b) Derive the expression of output voltage for a non-inverting weighted summer amplifier in case of three input voltages. 10

   c) Find v_O and i_O in the op amp circuit shown in the Fig. 2(c), if $v_1 = 1.5$ V, $v_2 = 2$ V, $v_3 = 1.2$ V, $R_1 = 20$ kΩ, $R_2 = 10$ kΩ, $R_3 = 6$ kΩ, $R_F = 8$ kΩ and $R_o = 4$ kΩ. 7

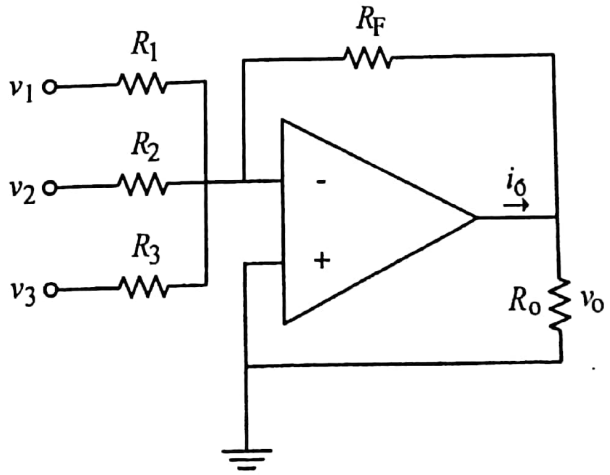

Fig. 2(c)

3. a) Draw the circuit diagram of a unity gain amplifier using an op amp. Write down its applications. 7

b) The Fig. 3(b) shows the inverting amplifier which is used as voltage to current converter. Derive the equation of its load current i_L and design the circuit such that the i_L will be independent of load impedance Z_L. 10

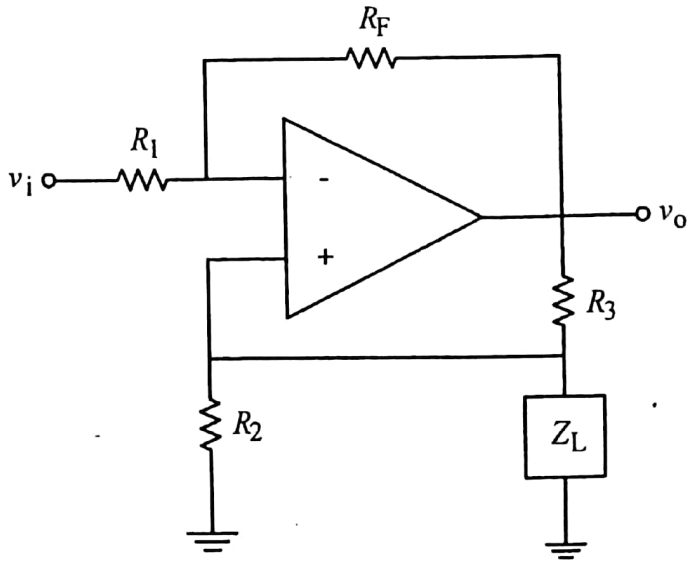

Fig. 3(b)

c) Consider the circuit in Fig. 3(b), Let Z_L = 100 Ω, R_1 = 10 kΩ, R_2 = 1 kΩ, R_3 = 1 kΩ and R_F = 10 kΩ. If v_i = −5 V, determine the load current i_L and the output voltage v_o. 8

4. a) Draw the bode plot of the transfer function, $H(s) = \frac{40000(s+10)}{s(s+50)(s+200)}$. 10

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

c) Design a high pass filter with a high frequency gain of 5 and a corner frequency of 2 kHz. Use a 0.1 μF capacitor in your design. 7

B.Sc. Engg. (EE)/ HDEE, 3rd Sem. 76 Date: March 14, 2017 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

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

Winter Semester, A. Y. 2016-2017
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) Mention four fundamental magnetic field properties derived from Maxwell's equation. [4]
   b) Explain with neat diagram, how the output voltage waveform of a single loop generator is made unidirectional to the external circuit. [5]
   c) Explain hysteresis and eddy current loss of a DC machine with suitable diagram. How they can be eliminated? [5]
   d) Derive the equation of efficiency maximized operating current of DC generator. [4]
   e) A 20 kW compound generator works on full-load with a terminal voltage of 230 V. The armature, series and shunt field resistances are 0.1 Ω, 0.05 Ω and 115 Ω respectively. Calculate the generated E.M.F. when the generator is connected short-shunt. [7]

2. a) What are the mechanical losses involved in a DC machine? [2]
   b) Which type of winding is suitable for high current and high voltage applications and why? [4]
   c) Why spark is generated in a DC generator? Explain in detail the methods to reduce the spark. [2+6]
   d) Explain with suitable diagram, the constrain of constructing wave winding. [4]
   e) A 250 V, 25 kW. 4-pole DC generator has 328 wave connected armature conductors. When the machine is delivering full load, the brushes are given a lead of 7.2 electrical degrees. Calculate the cross-magnetizing amp-turns/pole. [7]

3. a) Signify the importance of critical resistance and critical speed of a DC shunt generator. [4]
   b) Explain with suitable diagram the process of obtaining internal characteristics of a DC shunt generator. [5]
   c) Compare external characteristics of different DC generators. [4]
   d) Explain the basis of calculating the number of series turns in a compound generator. [5]
   e) The magnetization characteristic for a 4-pole, 110-V, 1000 rpm shunt generator is as follows: [7]

Field current (A)	0	0.5	1.0	1.5	2.0	2.5	3
O.C. voltage (V)	5	50	85	102	112	116	120

Armature is lap-connected with 144 conductors. Field resistance is 45 ohms. Determine:

(i) voltage the machine will build up at no-load and
(ii) the critical resistance.

4. a) Explain how the back E.M.F. is generated in a DC motor. Write down the significance of back E.M.F. [5+3]

   b) Derive equation of armature torque of a DC motor. [5]

   c) Draw the power flow diagram of the DC motor. [5]

   d) Determine the induced torque and shaft torque of 220 V, 4 pole series motor with 800 conductors' wave connected supplying a load of 8.2 kW by taking 45A from the mains. The flux per pole is 25 mWb and its armature circuit resistance is 0.6 Ω. [7]

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B.Sc. Engg. (EE)/HDEE, 3rd Sem. Date: March 09, 2017 (Afternoon)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination — Winter Semester, A. Y. 2016-2017
Course No.: EEE 4307 — Time: 90 Minutes
Course Title: Digital Electronics — Full Marks: 75

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

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1. a) Find the value of X. 9
   (i) $(4021)_5 = (X)_{10}$
   (ii) $(110101.101)_8 = (X)_{10}$
   (iii) $(26152.7462)_8 = (X)_{16}$.

   b) Assume an aribitrary number system having a base of *5* and *0, 1, 2, L* and *M* as its independent digits. Determine: 8
   (i) The decimal equivalent of *(12LM. L1)*.
   (ii) The total number of possible three-digit combinations in this arbitrary number system.

   c) (i) Determine the value of base *x* if $(3123)_x = (333)_8$. 8
   (ii) The 7's complement of a certain octal number is 5264. Determine the binary and hexadecimal equivalents of that octal number.

2. a) Design an adder which is capable to add three 4-bit binary numbers A, B and C. 9

   b) Simplify the following expressions using Karnaugh Map and implement them with two-level (i) NAND gate circuits (ii) NOR gate circuits: 9

   $$F = AB' + ABD + ABD' + A'C'D' + A'BC'$$

   c) Design a combinational circuit with four inputs and four outputs. The output generates the 2's complement of the input binary number. 7

3. a) Design an 8×1 multiplexer with three-data select line. 6

   b) Implement the following Boolean function with an 8×1 multiplexer. 7
   $F(w, x, y, z) = \sum(0, 1, 3, 4, 8, 9, 15)$

   c) Design a combinational circuit with four inputs that represent a decimal digit in BCD and four outputs that produce the 9's complement of the input digit. The six unused combinations can be treated as 'don't care' conditions. 12

4. Design a 4-bit BCD subtractor that will subtract B from A as shown in Figure 4. Show the result, S, in BCD. If A > B, the "sign bit" should be equal to 0 which represents the positive number. If A < B, the "sign bit" should be equal to 1 which represents the negative number. 25

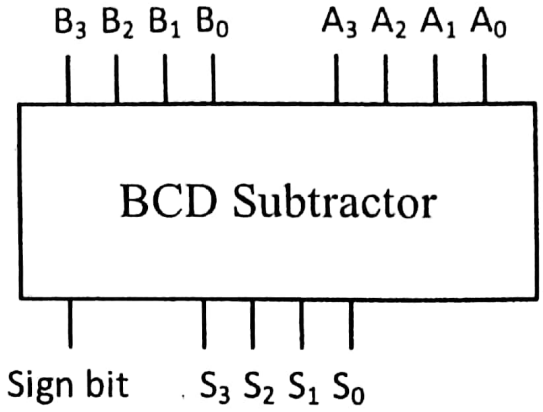

Figure 4

B.Sc.Engg. (EE)/HDEE, 3rd Sem. 82 Date: March 07, 2017 (Afternoon)
B.Sc.TE (2Yr) 1st Sem

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination — Winter Semester, A.Y.2016-2017
Course No.: Math 4321/Math 4529 — Time: 90 Minutes
Course Title: Transform Technique and Linear Algebra — 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 Fourier series of a function f(x) in the interval [-T, T] with period 2T. Write the applications of Fourier series in various science and engineering fields. Also write the Fourier coefficients for full range and half range series considering any periods. 10

   b) Find the Fourier Series of the function having period.2π in the interval $-\pi \le x \le \pi$ such that $f(x) = \begin{cases} -x, -\pi \le x \le 0 \\ x, 0 < x \le \pi \end{cases}$ and sketch the graph. Also show that $\frac{\pi^2}{8} = 1 + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \cdots$ 15

2. a) Find the Fourier Integral of the function$f(x) = e^{-ax}$, where $x > 0$ and a > 0 for two different cases: $f(-x) = f(x)$ and$f(-x) = -f(x)$. 10

   b) Define Fourier transformation of a function. Find the Fourier sine and cosine transforms of the function $f(x) = 2x$ in the interval $0 \le x \le 4$ 15

3. a) Define initial and boundary value problems with examples. 05

   b) Solve the following heat equation by using Fourier transform: 20
   $\frac{\partial H}{\partial t} = \frac{\partial^2 H}{\partial^2 x}$, $H(0,t) = 0$, $H(\pi,t) = 0$, and $H(x,0) = 2x$, where $0 \le x \le \pi$, $t > 0$.

4 a) Define Laplace transform of a function f(x) and write its importance. 06

   b) Find the Laplace transforms for the following functions: 12
   i)$f(x) = cos5x$, ii) $f(x) = e^{-bx}$, iii) $f(x) = x^n e^{bx}$

   c) Find the Laplace transform of $F(x)$, where $F(x) = \begin{cases} 1 + x, & 0 \le x \le 2 \\ 3, & x > 2 \end{cases}$ 07

B.Sc. Eng. (EEE), HDEE / 3rd Semester 90 10, March 2017 (Afternoon)

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

Mid Semester Examination — Winter Semester, A.Y. 2016-2017
Course Code: MCE 4391 — Time : 1½ hours
Course Title: Basic Mechanical Engineering — Full Marks : 75

There are 4 (Four) Questions. Answer any 3 (Three) of them.
Assume any ***reasonable*** data wherever necessary. Marks in the right Margin indicate the full marks.

1. a) What is the difference between intensive and extensive properties? Explain whether the density of a system is an extensive or intensive property. 5
   b) Define and classify "*system*". What is a quasi-equilibrium process? Explain with figures. 5
   c) A Carnot heat pump is to be used to heat a house and maintain it at 25°C in winter. On a day when the average outdoor temperature remains at about 2°C, the house is estimated to lose heat at a rate of 55,000 kJ/h. If the heat pump consumes 4.8 kW of power while operating, determine (i) how long the heat pump ran on that day; (ii) the total heating costs, assuming an average price of 11$/kWh for electricity; and (iii) the heating cost for the same day if resistance heating is used instead of a heat pump. 15

2. a) Why is the Carnot cycle not a realistic model for steam power plants? 5
   b) How can the efficiency of a Rankine Cycle be increased? Explain with necessary diagrams. 8
   c) Consider a coal-fired steam power plant that produces 175 MW of electric power. The power plant operates on a simple ideal Rankine cycle with turbine inlet conditions of 7 MPa and 550°C and a condenser pressure of 15 kPa. The coal has a heating value (energy released when the fuel is burned) of 29,300 kJ/kg. Assuming that 85 percent of this energy is transferred to the steam in the boiler and that the electric generator has an efficiency of 96 percent, determine (i) the overall plant efficiency (the ratio of net electric power output to the energy input as fuel) and (ii) the required rate of coal supply. 12

3. a) Differentiate among heat engine, refrigerator and heat pump. What are the parameters that are used to measure the performance of these engines? Show the relation between the performance parameter of refrigerator and heat pump. 7
   b) At a certain location, wind is blowing steadily at 7 m/s. Determine the mechanical energy of air per unit mass and the power generation potential of a wind turbine with 80 m diameter blades at that location. Also determine the actual electric power generation assuming an overall efficiency of 30 percent. Take the air density to be 1.25 kg/m^3. 8
   c) Water is pumped from a lake to a storage tank 15 m above at a rate of 70 L/s while consuming 15.4 kW of electric power. Disregarding any frictional losses in the pipes and any changes in kinetic energy, determine (i) the overall efficiency of the pump–motor unit and (ii) the pressure difference between the inlet and the exit of the pump. 10

4. a) Draw the ideal and actual *p-v* diagram of Otto-cycle. Draw the p-v and the corresponding T-s diagram of the ideal cycle for gas turbine engine and derive an expression for its efficiency. 11
   c) An ideal Diesel cycle has a compression ratio of 17 and a cutoff ratio of 1.3. Determine the maximum temperature of the air and the rate of heat addition to this cycle when it produces 140 kW of power. Also find out the heat rejection from the system. The state of the air at the beginning of the compression is 90 kPa and 57°C. Use constant specific heats at room temperature. 14

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