كلية الهندسة بحلوان

Dept/Division : Power Eng.
Academic level: Second — Semester: first 2015/16
Course code & title: (ELC 3214) - Electronic circuits-1.
Instructor: Dr. M. el-bably & Dr. Essam shafei
Final Term Exam. — Jan, 2016
Total mark: 90 marks- — Time allowed: 3 hrs

Part -1-

Answer the following questions

1) a) A sample of germanium is doped to the extent of 10^{14} donor atoms/cm^3 and $2x10^{14}$ acceptor atoms/cm^3. At the temperature of the sample the conductivity of pure (intrinsic) germanium is 0.02 $(\Omega\text{-cm})^{-1}$. If the total conduction current density is $0.128 A/cm^2$, find the applied electric field intensity. (μ_p=1800cm^2/V.s and μ_n=3800cm^2/V.s at 300°K). (7 Marks)

b) The diodes shown in figure.1 are ideal. Sketch the transfer characteristics for $0 \le V_i \le +50V$. Indicate the state of each diode (on or off) over each region of the characteristic. (8 Marks)

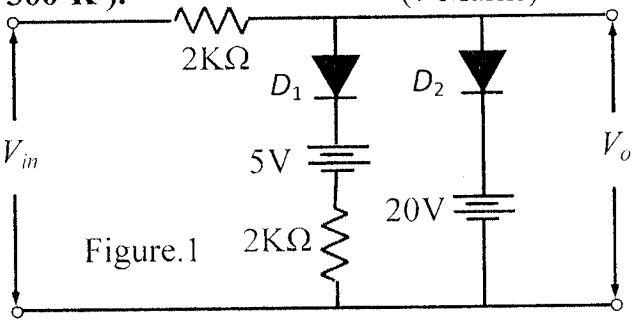


Figure.1

2) a) What PIV rating is required for the diodes in a Full-Wave Center-Tapped Rectifier that produces an average output voltage of 60 V? (3 Marks)

b) i)Draw the piecewise linear volt-ampere characteristic of a p-n diode. (2 Marks)

ii) What is the circuit model for the On state? (1 Marks)

iii) What is the circuit model for the On state? (1Marks)

c) The Zener diode can be used to prevent overloading of sensitive meter movements without affecting meter linearity. The circuit shown represents a dc voltmeter which reads 25V full scale. The meter resistance is 560 Ω, and the full scale current is 0.2 mA. If the diode is a 20V Zener. find R_1 and R_2 so that, when $V_{in} > 25V$, the Zener diode conducts and the overload current is shunted away from the meter. (8Marks)

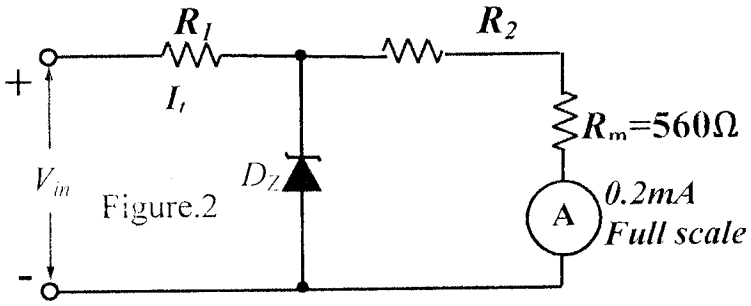
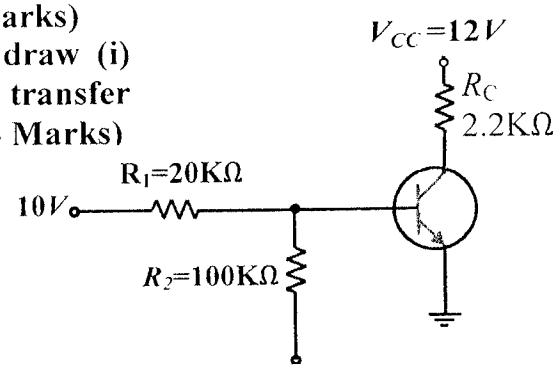


Figure.2

3) a) Define (i) The pinch-off voltage V_P, (ii) Cutoff voltage $V_{GS(off)}$, (iii) transconductance g_m (3 Marks)

b) For an n-channel depletion MOSFET, draw (i) the drain characteristics and (ii) the transfer curve. (4 Marks)

c) For the circuit shown in Figure.3, determine the region of operation (active, saturation or cutoff) and the values of I_B, I_C and V_{CE}. The transistor has β=30 (8 Marks)



Second part:

Answer the following questions: (each part should be in one side separately)

Q_1) **(30 marks)**

a) Design the required circuit to achieve the reading of the following random counts $(11, 0, 3, 5, 7, 5, 7, 15, 10, 11)_{10}$ by one seven segment and also, deduce the outputs of the segment driver (segment "d" and segment "f" only as an example).

b- Design the circuit for the following devices:

i- Encoder 8- 3

ii- Multiplexer 16-1

iii- Full adder

Q_2) **(15 marks)**

Construct the block diagram for memory system (from RAM chips) to achieve the following requirements:

a memory system contains eight groups of RAM chips their outputs are connected to one exit, and each group (contains from four RAM chips) should be selected individually.

Deduce the system function size if each RAM size is 64 K x 16 bits.

With my best wishes

الامتحان من صفحتين – ورقه واحده

كلية الهندسة بحلوان	**Dept/Division : Electrical Power & Machines Engineering** **Academic level:** Second **Semester:** 2015/2016 **Course code & title:** POW 3211 – Energy Conversion **Instructor:** Dr. M Ramadan Ahmed & Dr. Hany Abdu **Total Mark:** 100 Marks **Time allowed:** 3 hrs	

Instructions: Answer the following 6 questions given in 2 pages

Q.1 **(16 Marks)**

a) Define both the equivalence and the replacement ratio. **(6 Marks)**

b) The average consumption of a benzene car is 10 liters/100 km, if the weight of the car is 2 tones, the calorific value of the benzene is 41.8 Mj/kg, the density of benzene is 0.75 kg/liter, total efficiency of the car is 20% , find per 1 km:

I) The average speed of the car expressed in km/h. **(5 Marks)**

II) The consumption of the car in liters/100km if the efficiency is raised to 25% and the weight is decreased to 1.5 tones, and the speed is kept constant. **(5 Marks)**

Q.2 **(16 Marks)**

a) Define both the secondary energy and the final energy. **(6 Marks)**

b) In the Egyptian countryside, it is usual to see a cow rotates and drives a primitive water pump. It is required to irrigate a field of corn during 3 hours. The pump raises 0.5 m3/ minute, the head of water is 3 m. The efficiency of the pump is 70%. Calculate:

I) The power of the cow. **(5 Marks)**

II) If 1kg of special food for cows contains 20 kcal, find the amount of it, the cow must eat to substitute the energy required to irrigate the corn field. **(5 Marks)**

Q.3 **(18 Marks)**

(a) In a hydro power plant, the sweep diameter of a turbine's blades is 6 m and the incident angle of the water is 9^{o}. The water velocity at the surface of the blades is 45 m/s. The turbine has a coefficient of performance of 0.55, Compute the mechanical power of the turbine shaft. **(10 Marks)**

(b) In a thermal power plant, if the thermal energy constant of natural gas = 50.64 MJ/kg, and the condenser extracts 0.035 GJ/kg, calculate:

I) The mechanical energy of the turbine. **(4 Marks)**

II) The ideal efficiency of the turbine. **(4 Marks)**

Q.4 **[15 Marks]**

a) Define the magnetic force applied on a differential current element. **(2 Marks)**

b) A magnetic flux density in a free space region is given as $B = -3xa_x + 5\,y\,a_y - 2za_z$ T. Estimate the magnetic force applied on a rectangular loop of 10 mA lies in the plane $x = 2cm$ and it is bounded by $y = 1cm, y = 3cm, z = 2cm, and\ z = 5cm$. **(8 Marks)**

c) Predict the total magnetic flux linking the rectangular loop. **(5 Marks)**

Q.5 **[15 Marks]**

a) Derive a formula for the induced (emf) as: e = BLV **(2 Marks)**

b) Define the inductance $L(x)$ of the singly-excited system given below. **(3 Marks)**

c) Express the induced back EMF of the coil shown in the system if the supplied current is given as $i = I_p \sin wt$. **(5 Marks)**

d) Predict the magnetic force acting on the plunger under the condition of part (c). **(5 Marks)**

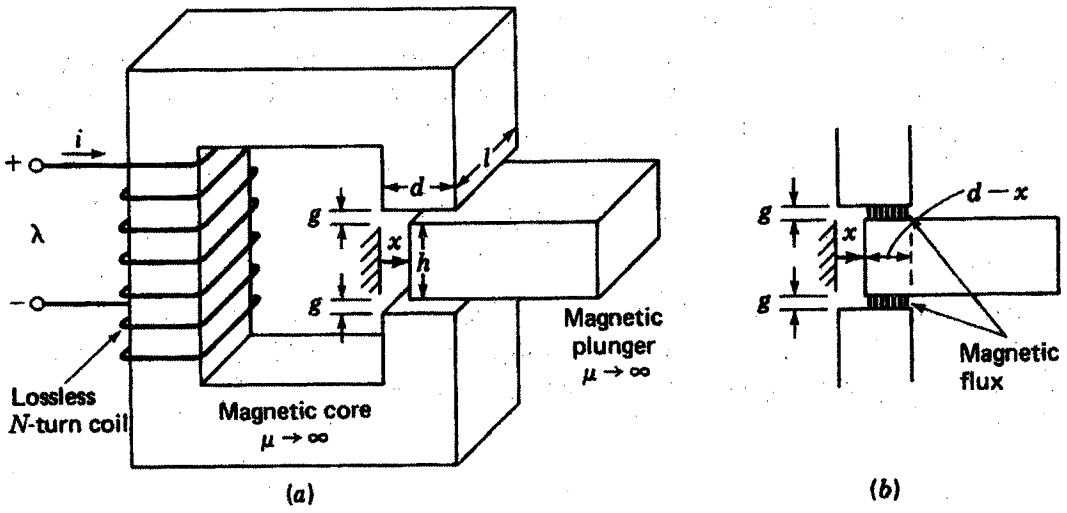


Figure 1

Q.6 **[20 Marks]**

a) Sketch the variation of the winding inductance $L(\theta)$ with respect to the rotor position θ for the singly excited elementary two pole reluctance motor shown in Figure 2. **(2 Marks)**

b) Derive a formula for the instantaneous reluctance torque for the given system in the Figure 2. Consider $i = I_p \cos wt$ where I_p is the peak value of the current, θ_o the angle between the rotor and the stator at time zero and L_d and L_q are the inductances in the d and q axes respectively. Assume the excitation is sinusoidal and the instantaneous rotor position is $\theta = \omega t - \theta_o$ **(6 Marks)**

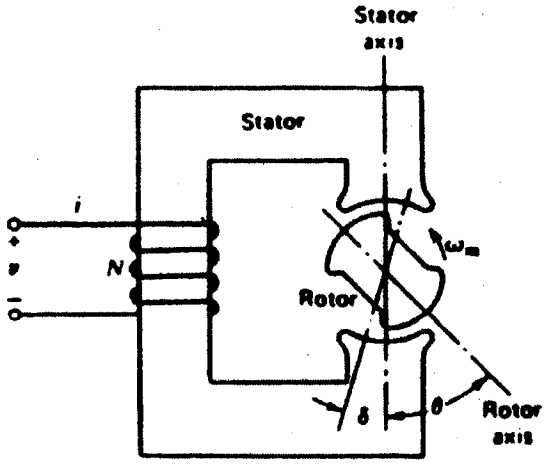


Figure 2

c) Derive a formula for the back induced EMF on the exciting terminal coil shown in the given system. **(6 Marks)**

e) Estimate the time t at which the maximum reluctance torque is occurred. **(6 Marks)**

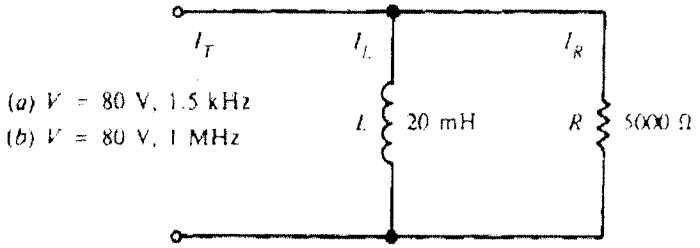
(where t is a fraction of T that is the time of one complete cycle of the *sin*- wave and $w = \frac{2\pi}{T}$)

HELWAN UNIVERSITY ELECTRICAL CIRCUITS-I 2nd Year Students
FACULTY OF ENINEERING First Term – Jan. 2016
ELEC. POWER & MACHINES ENG.DEPT. Time allowed: 3 Hours

ANSWER ALL QUESTIONS

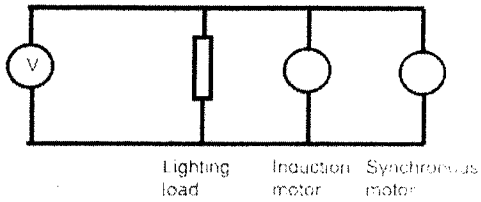
Q-1 [17 Marks]

The purpose of the shown high-pass filter circuit is to permit high frequencies to pass on to the load but to prevent the passing of low frequencies. Find the branch currents, the total current, and the percentage of the total current passing through the resistor for (a) a 1.5-kHz (low) audio-frequency signal and (b) a 1-MHz (high) radio-frequency signal.



Q-2 [17 Marks]

An industrial substation supplies lighting, induction motor, and synchronous motor load as given below:



Lighting load = 40 kW at unity power factor
Induction motor load = 100 kW at 0.7 power factor
Synchronous motor load = 200 kW at 0.9 power factor
Find the kW, kVAR, and power factor of each load. Also find the kW, kVAR, and power factor at the substation level.

Q-3) [17 Marks]

Writ the nodal equations for the circuit shown in Fig. (1), then calculate V1.

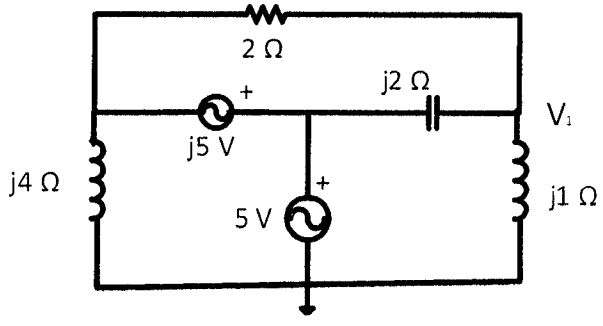


Fig. (1)

Q4 (17 Marks)

For the circuit shown in Fig. (2), find the resonance frequency (w_0) at which E and I in phase. What is the value of Z_T at this frequency? Derive an expression for the quality factor Q for this circuit.

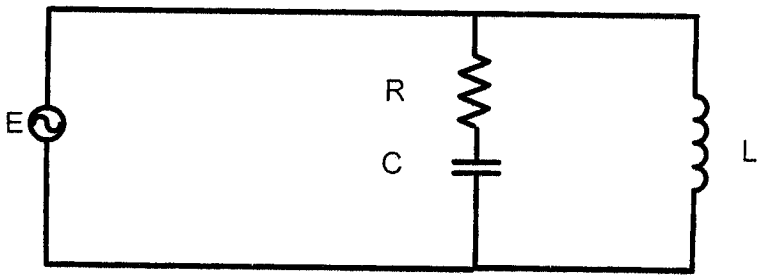


Figure (2)

Q5 (24 Marks)

A 7.5 KW, 0.8 pf lagging balanced 3ϕ Y-connected load of is connected to a 3ϕ Δ-connected load of impedance $10|\underline{30^o}\Omega$ per phase. The loads are connected to a balanced 3ϕ Δ-connected generator through a transmission line that has an impedance per phase of 1+j3Ω.

If the voltage at the load terminals is 300V, find:

a) The across each phase of the generator.

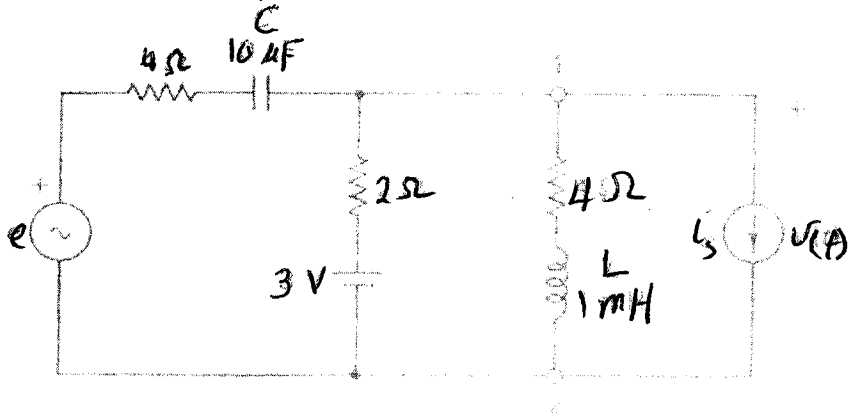
b) The readings of two wattmeters connected to phases A, B at the generator terminals.

Q6 (10 Marks)

For the circuit shown in figure, find the power delivered by the current source if

$e(t) = 2.828 \sin(5000t)$ volt,

$i_s(t) = 1.414 \sin(10000t)$ A,



HELWAN UNIVERSITY

Faculty of Engineering

Final Exam – Jan. 2016 **2nd year Power Department**
Module Title: Math. 4 **Module Code: GEN 321**
Module Instructors: Dr. Adel F. Saadallah
Time allowed: 3 hours
Total mark: 100 marks
Answer *all* of the following questions

Question (1) **[20 marks]**

(a) Use Adams-Bashforth **two-step** method to approximate the solution to the initial value problem $y' = 1 + xy, \quad y(0) = 0, \quad 0 \le x \le 0.6$

Apply the **modified Eular** method to find the starting value. (**Take *h* = 0.2**). **[12]**

(b) Find the normal equations for fitting, by the least squares method, an equation of the form $f(x) = c_1 + c_2 \cos x$ to the points (0,0), $(\pi/6, 1)$ $(\pi/2, 3)$, $(5\pi/6, 2)$. **[8]**

Question (2) **[25 marks]**

(a) From the following data, find an approximation to the first and second derivatives (without obtaining the polynomial) at *x* = 1.55 and *x* = 3.75. **[10]**

x	1.5	2.0	2.5	3.0	3.5	4.0
$f(x)$	3.375	7.0	13.625	24.00	38.875	59.00

(b) Evaluate the integral $\int_1^2 \frac{\ln x}{x} dx$, using Simpson's method (take *h* = 0.25). Compare the result you obtain with the result yielded by using two point Gauss-Lagendre formula. **[15]**

Question (3) **[25 marks]**

(a) Fit the curve $f(x) = a e^{bx}$, to the following data

Table 1

X	0.5	0.8	1.5	2.5	4
$f(x)$	1.1	2.4	5.3	7.6	8.9

by using the **least squares** method to estimate "*a*" and "*b*" and predict the value of $f(1.25)$. **[10]**

(b) Use the value in the above table 1, to construct a second degree Newton's interpolation polynomial to approximate $f(1.25)$. Comment on the result of approximating $f(1.25)$ obtained from (a) and (b), which one do you trust more? **[15]**

Question (4) **[30 marks]**

(1) For the binomial density function $f(x) = \binom{n}{x} p^x q^{n-x}, \quad x = 0, 1, \ldots, n.$

(a) Show that $f(x)$ is a probability distribution. **[2]**

(b) Find the mean and the variance using the moment generating function. **[4]**

(2) A continuous random variable X has the probability density function $f(x) = k\,x^2(3-x),\ 0 \le x \le 3$. Find:

(a) The value of the constant k; **[1]**

(b) The cumulative distribution function; **[2]**

(c) The median, **[2]**

(d) The mean and the variance. **[4]**

(3) According to the U.S. Bureau of the Census, people with a high school diploma earned an average of $1077 a month in 1990. A random sample of 50 high school diploma holders taken recently showed that their mean monthly income is $1112 with a standard deviation of $160. Assuming that the monthly incomes of all high school diploma holders are approximately normally distributed, Test at the 5% significance level whether the mean monthly income of such persons has increased since 1990? **[8]**

(4) Six dice are rolled. Calling a 5 or 6 a success. Find the probability of getting

(a) At most 3 successes, **[3]**

(b) At least 2 failure. **[4]**

Good Luck
Dr. AdeL F. Saadallah

STANDARD NORMAL DISTRIBUTION TABLE

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817