٤٣ الفرقة الثانية نصف العام ٢٠١٩

University	Menoufia		Date	26/ 12/2019
Faculty	Electronic Engineering		Time	3 hours
Department	Physics and Engineering Mathematics		No. of pages	1
Academic level	Second year		Full Mark	100 Marks
Course Name	Mathematics (5)		Exam	Final Exam
Course Code	PME 221		Examiner	Prof. Dr. Magdi Kamel

جامعة المنوفية

Part-I (full mark: 50)

Answer three questions only

First question (17 mark)

Find the Fourier series of the periodic function F(x), which is defined as:

$F(x) = (\pi - x)$ for $-\pi < x < 0$

$= (2\pi - x)$ for $0 < x < \pi$,

Deduce which kind of harmonics of the periodic function and sketch a graph of it for $-3\pi < x < 3\pi$.

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Second question (17 mark)

Find in complex form the Fourier series of the function $F(x) = e^x$ for $0 < x < 2\pi$, and $F(x+2\pi) = F(x)$. Find also from the obtained result the real Fourier series expansion of this function.

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Third question (16 mark)

Deduce the amplitude-frequency for p = 8 for the periodic function $f_p(t)$ that defined by:

$f_p(t) = 0$ when $-p \le t < -1$

$= 1 - t^2$ when $-1 < t < 1$

$= 0$ when $1 < t \le p$

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Fourth question (17 mark)

Find the Fourier transform and Fourier integral of the following function

$f(t) = e^{-at}$ if $t \ge 0$, $(a > 0)$

$= 0$ if $t < 0$

Then deduce the value of the sine integral $Si(\infty)$.

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Best wishes and good luck **Prof. Dr\ Magdi Kamel**

Question No 2: **[15 Marks]**

For the circuit shown in Figure 2, the supply voltage is $V_s = 200\,V, 50\,Hz$. The circuit parameters is given as, $C = 0.1\,\mu F$ and $R_1 = 68\,k\Omega$, $R_2 = 150\,k\Omega$. The SBS has a break over voltage of 7.4 V.

a) What do SBS and SCS mean? Draw the *V-I* characteristic curve of (SBS).
b) Calculate the minimum and maximum values of firing angle α.
c) Calculate the average voltage and current for maximum value of firing angle.
d) Sketch the load voltage and the capacitor voltage.
e) Draw a circuit RC full-wave rectifier trigger circuit.
f) Discuss the difference between: Chopper, inverter, rectifier and AC converter.

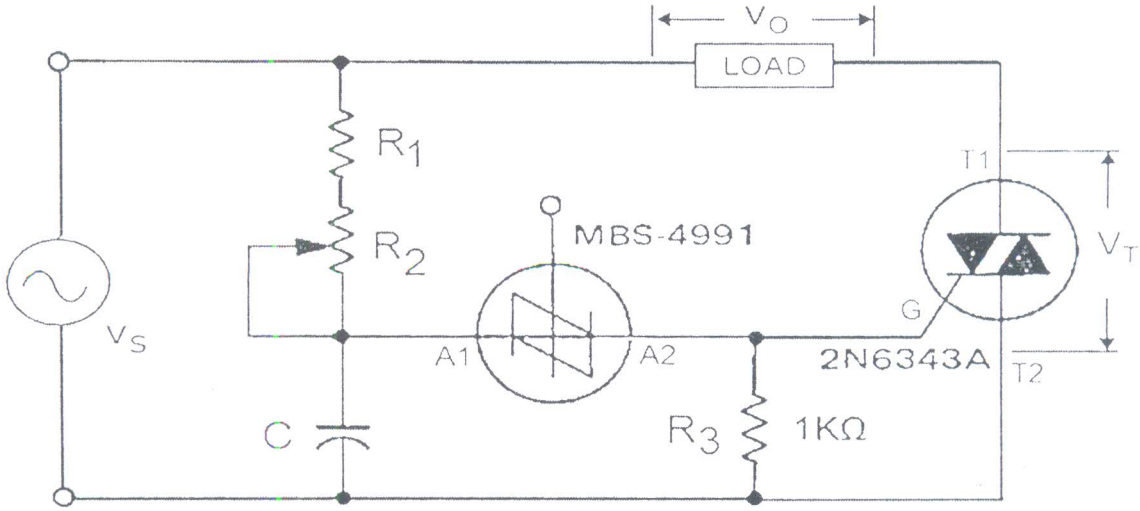

Figure 2

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3. A 300 nF capacitor is connected in series with a 200 kΩ resistor and the circuit is connected to a 100 V, d.c. supply. Determine an expression for the current through, and for the voltage across the capacitor, then calculate (a) the time constant of the circuit (b) the initial value of current flowing, (c) the value of capacitor voltage 50 ms after connection, and (d) the time after connection when the resistor voltage is 50 V. (7 marks)

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4. The circuit of Fig. 1 has V_{CC} =100 V, L=150 mH, R=15 Ω, t_1=20 ms, and T=150 ms. What is the purpose of the resistor in this circuit . Determine (*a*) an expression for the inductor current (*b*) the peak current and peak energy storage in the inductor, (c) the average power absorbed by the resistor, and (d) the peak power supplied by the source.

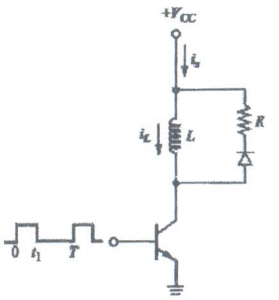

Fig.1
(7 marks)

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5. A half-wave rectifier with resistive inductive load uses a freewheeling diode where R = 5Ω and L = 50 mH, V_m=150 V, and the frequency is 60 Hz. What is the purpose of using a freewheeling diode ?, use sketch to explain your answer. Determine the average load voltage and current, and determine the power absorbed by the resistor . (7 marks)

6.(a) Determine the expressions that can be used to calculate the power factor for controlled half-wave rectifier and for controlled full - wave rectifier with resistive load. (7 marks)

(b) Design a circuit to produce an average voltage of 30 V across a 150-Ω load resistor from a 100-V rms, 60-Hz, ac source. Determine the power absorbed by the resistance and the power factor. (7 marks)

Note : The Fourier series for the half-wave rectified sine wave is given by ;

$$v(t) = \frac{V_m}{\pi} + \frac{V_m}{2}\sin(\omega_0 t) - \sum_{n=2,4,6\ldots}^{\infty} \frac{2V_m}{(n^2-1)\pi}\cos(n\omega_0 t)$$

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Good Luck