الامـــد (ال)

Tanta University

Faculty of Engineering
Electrical Power and Machines Engineering
First Year - Electrical Engineering

Electric Circuits(1)
Code: EPM1101
Max Marks: 90 Time: 3:00 hrs.
2015/2016 (1st Term - Final Exam)
Date: 17 Jan. 2016

3 QUESTIONS ON 2 PAGES يقع هذا الإختبار فى عدد ٢ صفحة وبه ٣ اسئلة

- **تقع مسئولية التأكد من الحصول على كافة اوراق الأسئلة على الطالب.**
- **برجاء كتابة تفاصيل العمليات التى تجريها**. يحتفظ المصححون بحقهم فى خصم بعض الدرجات إذا لم نستطيع تحديد كيفية التوصل للنتائج (حتى لو كانت النتائج النهائية صحيحة).
- يجب مراعاة ان لا تحتوى الصفحة الواحدة على جزئيات تنتمى لأكثر من سؤال.
- ادعم إجاباتك بالمعادلات والرسومات البيانية بقدر الإمكان.
- ضع خطين اسفل الإجابات النهائية لكل جزئية.

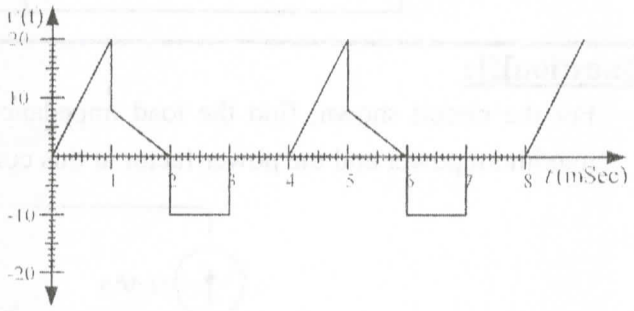
You may use the following relations, if you need to.

- Two port relations $V_1 = a_{11}V_2 - a_{12}I_2$ $\quad V_2 = b_{11}V_1 - b_{12}I_1$
  $I_1 = a_{21}V_2 - a_{22}I_2$ $\quad I_2 = b_{21}V_1 - b_{22}I_1$
- Series resonance half power frequency $f = \frac{1}{2\pi}\left[\pm\frac{R}{2L} + \sqrt{\frac{R^2}{4L^2} + \frac{1}{LC}}\right]$

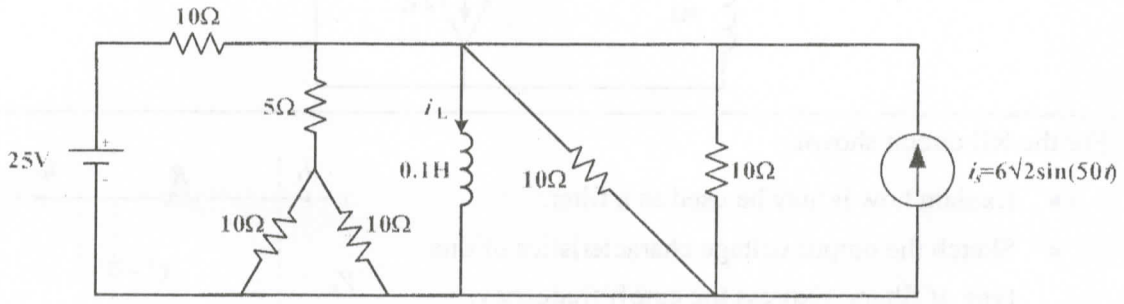
Question I: Marks[3*10]

a- For the voltage waveform shown find:

1- Period and frequancy
2- Average voltage
3- If this voltage is applied to a capacitor of 1μF, Draw the current waveform and find the RMS value of that current.



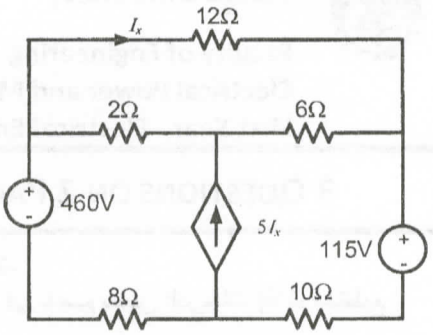
b- For the circuit shown in figure, calculate the inductor current. Express the inductor current as a function of time.



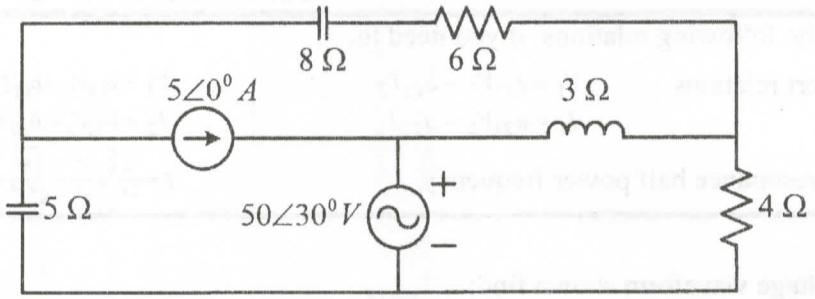
c- Three industrial loads consumes 2KW at 0.80 lagging power factor, 3KW at unity power factor and 5KVA at 0.6 lagging power factor, are connected in parallel to a 220∠0° V, 50Hz supply. Draw the power triangle and find the supply current and the overall power factor. Find the parallel capacitors required to improve the system power factor to unity.

Question II: Marks[2*15]

a- For the circuit shown, determine the number of equations required to solve the circuit using mesh currents and nodal voltage. Write down the mesh current equations and find the current I_x.

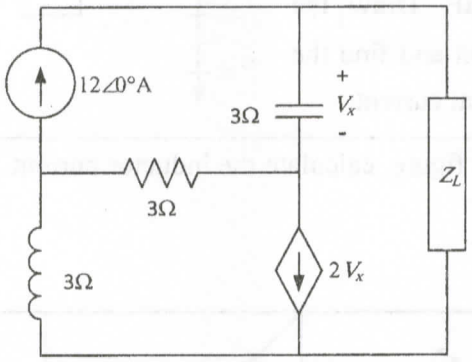


b- Write down the nodal voltage equations for the circuit shown below. Find the power dissipated in the 4Ω resistor.



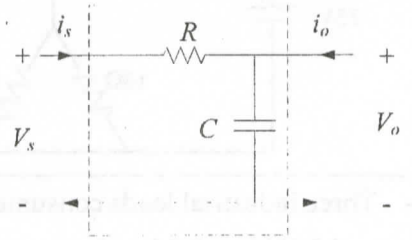
Question III: Marks[2*15]

a- For the circuit shown, find the load impedance Z_L for maximum power transfer. Find the maximum power and the power factor at this condition.



b- For the RC circuit shown,

- Explain how it may be used as a filter.
- Sketch the output voltage characteristics of this type of filters. Express the cutoff frequency.
- If the circuit is considered as two-port system, find its ***a*** parameters.



- If an inductor L is added in series with the resistor, find the capacitor voltage in terms of input voltage at resonant conditions.

(ال) الحسنى

Tanta University

Department: Electronics & Comm. Engineering
Total Marks: 100 Marks

Faculty Faculty of Engineering

Course Title: Electronics (1)	Course Code: EEC1101	Year: First Year
Date: January 2016 (First term)	Allowed time: 3 hrs	No. of Pages: (2)

Remarks: (answer the following questions… assume any missing data… answers should be supported by sketches…etc)

Question number (1) (25 Marks)

1 (a) Choose the right answer :

1. In reverse biased diode, there is a very small current due to minority carriers.
   ( ) ***True*** ( ) ***False***
2. Reverse saturation current of a pn junction is directly proportional to electron and hole diffusion lengths. ( ) ***True*** ( ) ***False***
3. Clampers are circuits that clip the input signal to a different DC level..
   ( ) ***True*** ( ) ***False***
4. Line regulation is determined by changes in load current and output voltage.
   ( ) ***True*** ( ) ***False***
5. In the forward bias region the diode current increases linearly with increase in voltage across the diode . ( ) ***True*** ( ) ***False***
6. The voltage divider bias configuration of a bipolar transistor is used due to its high sensitivity to changes in β. ( ) ***True*** ( ) ***False***
7. In the active region of a transistor, the base-emitter junction is reverse biased where as the collector-base junction is forward-biased. . ( ) ***True*** ( ) ***False***
8. Emitter degeneration is used to increase the voltage gain
   ( ) ***True*** ( ) ***False***
9. A transistor can be operated as an electronic switch in the active region.
   ( ) ***True*** ( ) ***False***
10. Emitter degeneration raises the output impedance of a CE amplifier
    ( ) ***True*** ( ) ***False***

(b) (i) Explain the effect of reverse bias on the junction capacitance of a pn junction.
(ii) A pn junction is doped with $N_A = 2 \times 10^{16}$ cm^{-3} and $N_D = 9 \times 10^{15}$ cm^{-3}. Determine the capacitance of the junction at a reverse bias voltage $V_R = 0$ and $V_R = 1V$. Discuss your results. [Given : $\varepsilon_{si} = 11.7 \times 8.85 \times 10^{-14}$ F/cm , $q = 1.6 \times 10^{-19}$ C.]

(c) Determine the increase in forward bias voltage of a pn junction that cause 10 times increase in the forward current . If we wish to increase the current 100 times, what is the required change in the forward bias voltage? Discuss your results.

Question number (2) (25 Marks)

2 (a) Determine the currents I_1 , I_2 , and I_{D2} for the network of Fig. 1 . (Assume $V_D = 0.7V$)

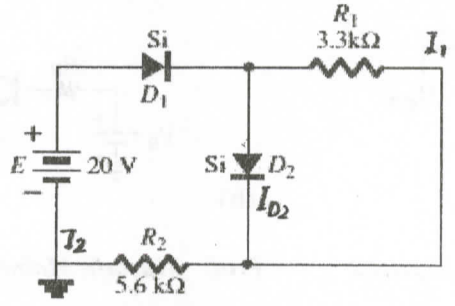


Fig.1

(b) **(i)** Using the small signal model, explain the difference between line regulation and load regulation.

(ii) Sketch v_O for the network of Fig. 2 and determine the dc voltage available.

(c) **(i)** Determine V_L , I_L , I_Z , and I_R for the network of Fig. 3 if $R_L = 180\ \Omega$.

(ii) Determine the value of R_L that will establish maximum power conditions for the Zener diode.

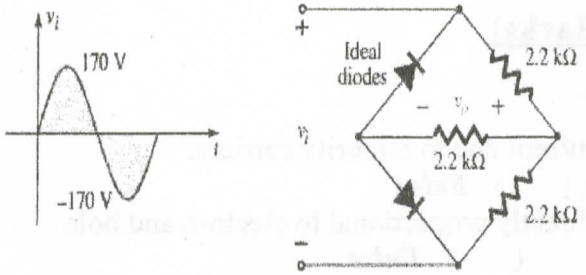


Fig2

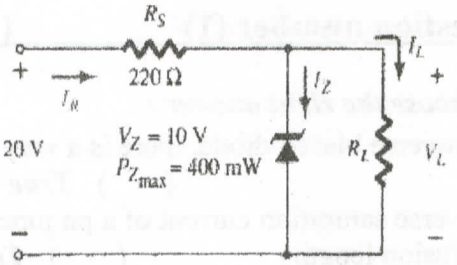


Fig.3

Question number (3) (25 Marks)

(a) Describe the basic operation of a transistor biased for active operation., and determine the collector current

(b) For the circuit shown in Fig.4, determine: I_C , V_E , V_B *and* R_1 (Assume $V_{BE} = 0.7$ V)

(c) For the circuit shown in Fig.5, determine: V_E , I_C , V_C , V_{CE}, I_B and β

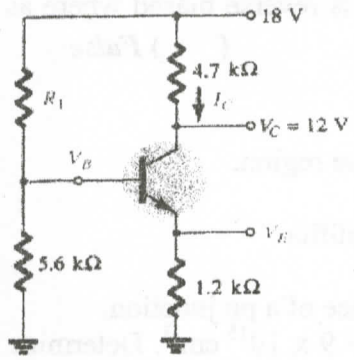


Fig.4

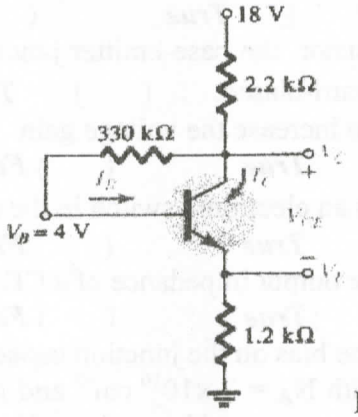


Fig.5

Question number (4) (25 Marks)

(a) The collector voltage of a bipolar transistor varies from 1V to 4V while the base-emitter voltage remains constant. What Early voltage is necessary to ensure that the collector current changes by less than 10 %.

(b) Derive an expression for the input impedance and voltage gain of a CE with emitter degeneration.

(c) Calculate the output resistance of the circuits shown in Fig.6

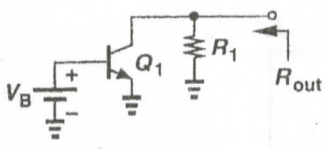
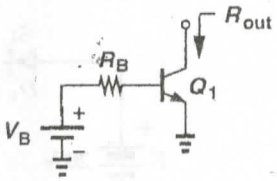


Fig.6 (a).



(b)

Tanta University

Department: Engineering Physics and Mathematics
Total Marks: 85 Marks

Faculty of Engineering

Course Title: Engineering Mathematics(2A) Course Code: PME1106 Year: 1st Electrical Eng.
Date: JAN. 21th 2016 (First term) Allowed time: 3 Hrs No. of Pages: (2)

Remarks: Answer All of The Following Questions

PART ONE : Multi-Variable Calculus (40 MARKS)

Question Number 1 *(20 Marks)*

(a) Determine and sketch the domain of $f(x,y) = \frac{x}{\sqrt{y-x^3}} + \log\left(\frac{x}{y}\right)$. (5 Marks)

(b) Find the limit of $G(x,y) = (x - y^4)/(x^3 - y^4)$ when (x,y) tends to $(1,1)$. (5 Marks)

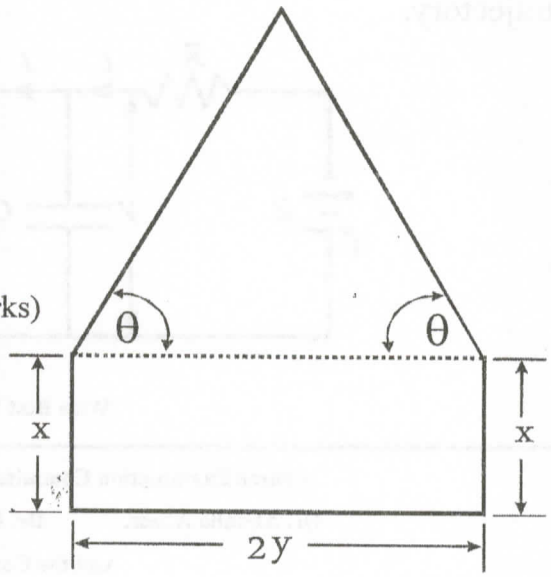
(c) If $w = \log\left(\frac{x^8+xy^7}{x+2y}\right)$, show that: $x\,w_x + y\,w_y = 7$. (10 Marks)

Question Number 2 *(20Marks)*

(a) Evaluate the double integral:

$$\int_0^8 \int_{x=\sqrt[3]{y}}^2 \frac{1}{1+x^4}\,dx\,dy$$ (10 Marks)

(b) A window consists of rectangle and triangle as shown. Find x, y, θ to get a minimum area of this window. Given: the circumference of window equals to 12ft. (10 Marks)



P.T.O.

PART TWO: DIFFERENTIAL EQUATIONS (45 MARKS)

Question Number (3) **(30 Marks)**

a) Find The General Solution of Following Differential Equations

i) $dy = \left((1 + x + x^2) - (1 + 2x)y + y^2\right)dx$, for f(x)=x. (5 Marks)

ii) $x(xy^3 + 1)dy = y(y^2 - 1)dx$, with initial condition $y(1) = 1$. (5 Marks)

ii) $y - x\frac{dy}{dx} = (\frac{dy}{dx})^2 + \frac{x^2}{2}$. (5 Marks)

iv) $y`` + y = 1 + e^x + cosx + xsin3x$. (5 Marks)

v) $y`` - 6y` + 9y = \frac{e^{3x}}{x^2}$. (5 Marks)

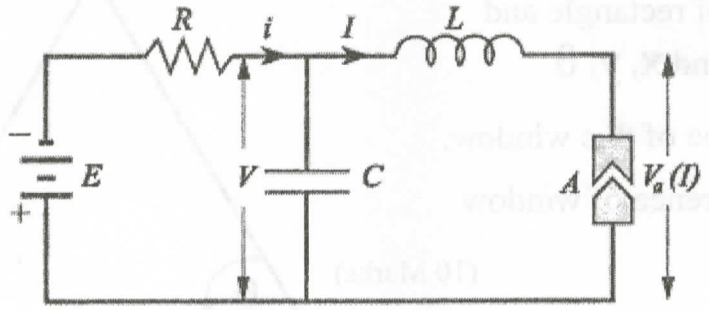
b) Locate and identify the nature of the equilibrium point and sketch the pattern of the trajectories for the following systems. (5 Marks)

i) $\frac{dy}{dx} = 2y - z$, $\frac{dz}{dx} = -3y + 6z$ ii) $\frac{dy}{dx} = -y + 2z$, $\frac{dz}{dx} = -2y - z$

Question Number (4) **(15 Marks)**

The following figure represents a circuit for activating an electric arc A which has the voltage–current characteristic defined by $Va(I) = RI$ with a constant supply (E).

i) Show that the relation between the volt V and the current I is
$$L\frac{dI}{dt} = -V_a(I) + V \quad \text{and} \quad RC\frac{dV}{dt} = -IR + E - V.$$
ii) Find the steady state value of the current (I).
iii) Draw the bifurcation diagram between the parameter E and the current I if the capacitor is out.
iv) Find a condition on C, L and R to reach the system its steady state with spiral trajectory.



With Best Wishes

Course Examination Committee and Course Coordinators

Dr. Abdalla Abass, Dr. Eng. Mohamed Elborhamy

And the Committee

Course Title: Electrical and electronic materials	**Course Code: EEC/EPM1160**	**Year: First year**
Date: 24/1/2016 (First term)	**Allowed time: 3 hrs**	**No. of Pages: (2)**

الإمتحان مكون من 4 أسئلة فى صفحتين

Problem number (1) **(15 Marks)**

a) Use Clausius-Mossotti formula to calculate the polarizability (F/m^2) of a dielectric having a number of molecules per unit volume of 9.2×10^{16} cm^{-3} and a dielectric constant of 6. What is the dielectric constant of a dielectric that has the same polarizability but with a number of molecules per unit volume of 5×10^{16} cm^{-3}. Calculate the percentage error in calculating the new dielectric constant when the approximate relation is used. **(5 Marks)**

b) Define the static dielectric constant and explain the effect of frequency variation on the dielectric constant. **(5 Marks)**

c) An electrical field of 50 kV/cm is applied to a cross-linked polyethylene, XLPE (typical power cable insulator). Calculate the dielectric active and reactive power loss in the dielectric if the angular frequency is 314.1593 rad/sec. Assume that the active and reactive components of the permittivity are, respectively, 4 and 0.015. Explain how you can reduce active power loss of this dielectric. **(5 Marks)**

Problem number (2) **(20 Marks)**

a) Explain the meaning of Ferro Electricity and show how it can be used in real applications. What is meant by Curie temperature? **(5 Marks)**

b) Calculate the total loss per unit volume in a magnetic circuit at a frequency of 50 Hz assuming that the maximum magnetic flux density is 1.0 Tesla and the coercive force is 0.03 AT/m and the lamination thickness is 2 mm and the resistivity of the core is 1000 μΩ.m. If it is required to increase the maximum magnetic flux density to 2 Tesla without increasing the total loss per unit volume, what is the required lamination thickness? **(5 Marks)**

c) Summarize the main properties of Ferromagnetic materials. What are the extreme case of Ferromagnetic materials. **(5 Marks)**

d) Discuss in detail the main applications of superconductors including the Josephson Effect. **(5 Marks)**

Problem number (3) **(18 Marks)**

a) The angular momentum of the electron is quantized and must be an integer multiple of h / 2π where h is the Planks constant. Why this discontinuous nature is not observed? **(3 Marks)**

b) What are the interesting features of semiconductor materials as compared to the good conductivity metals? **(3 Marks)**

c) Prove that the concentration of electrons in *n* type semiconductor is given by: **(3 Marks)**

$$n = \frac{N_D - N_A \pm \sqrt{(N_D - N_A)^2 + 4n_i^2}}{2} \cong N_D - N_A \quad when\ N_D - N_A \ll 2\,n_i$$

d) Show that the relation between the mobility μ and the conductivity σ is given by: **(3 Marks)**

$$\sigma = -q(n\mu_n + p\mu_p)$$

e) There is a phenomena in semiconductor materials results in what is so called Hall Effect:

- When the Hall Effect takes place. **(2 Marks)**
- This phenomena can be used to: (1) ....., (2) ....., (3) ..... **(2 Marks)**
- Show how to determine the type of semiconductor material. **(2 Marks)**

Problem number (4) **(17 Marks)**

a. Define the types of solids and characterization of each type (Answer with net sketches) **(3 Marks)**

b. Define the space lattice. **(3 Marks)**

c. Define the types of crystal structure, draw each type. **(3 Marks)**

d. Find the volume density atoms in a single crystal material that is a body centered cubic with a lattice constant a = 4 A = 4 x 10^{-8} cm. **(4 Marks)**

e. Draw a unit cell of a diamond structure. **(4 Marks)**

Good Luck

Course Examination Committee

Associate Prof. Mahmoud A. A. Ali
Prof. Ahmed Refaat Azmy
Associate Prof. Salah El Dean Khamise
Dr. Amr Husain Husain Abd Alla

Course Title: **Computer Programming1**
Date: **26.01.2016 (First Term)**

Course Code: **CCE1103** - 1st year ElectStudents
Allowed time: **3 hours** No.of pages 2

Answer all the following questions:

Question 1: (20 marks)

1. Draw a **flowchart** and write **a C++ program** to compute the following equation:

$$\textbf{Sum} = 1 + \frac{x}{1!} + \frac{x^3}{3!} + \frac{x^5}{5!} \ldots\ldots + \frac{x^n}{n!}$$

using **three functions**: one to calculate factorial, second to calculate this equation and the third to print the result. Enter the values of **x** and **n** in the main program. The output in the form: Sum of nnn Terms (at x = xx.xx) = xxxx.xxx

2. Write a **C++ program** which asks the user to enter a string consisting of some words (with alert), the program prints the string and its number of letters.

3. Write **a C++ program** to calculate the **factorial** of a positive integer number, **n.** Then, the program **prints** the number n and its factorial. The number will be entered by keyboard making alert. If the user enters a nonpositive or no integer number, print corresponding error message.

Question 2: (20 marks)

1. Write a **C++ program** to calculate **sum** of student`s Degrees and **percentage** of sum and **Grade** of 20 subjects. Entering the Degrees by keyboard. Printing report contains student's **name**, **sum** of Degrees, **percentage**, **Grade**. Grade will be calculated as follows:

percentage	0 - 49	50 - 64	65-74	75 - 84	85 - 100
Grade	Fail	Pass	Good	V.Good	Excellent

2. Write **a C++ program** to calculate the **factorial** of a positive number, **n.** Then, the program **prints** the number n and its factorial. The number will be entered by keyboard making alert. If the user enters a nonpositive or no integer number, print error message.

3. Draw a flowchart and write a **C++ program** to display the Average of First Ten Odd Numbers.

4. Draw a flow **chart** and write a **C++ program** program to calculate and print the values of function y between 4 and (- 4) with differences 0.2 of the equation $y = 6x^2 + 5x + 1$

Question 3:

(20 marks)

1. Write **a C++ program** to compute and print the **roots** of the second ordered equation:

$$ax^2 + bx + c = 0$$

Note that:

1) If "a" =0 , then the root is x = - c/b

2) If "a" not equal 0 , then first calculate the discriminant d as:
   d = b*b – 4a*c , and the roots will be:
   a) If d is less than zero: there is (no real root)
   b) If d is equal or greater than zero: there are two roots
   x1 = (-b - square root (d)) / (2a) , x2 = (-b + square root (d)) / (2a)
   Use one function at least.

2. Draw a flow chart and write a **C++ program** to initialize one dimensional array with 10 integer elements. Then multiply each element by 2 , and print the original array and its multiplication by 2.

3. Write **a C++ program** to determine the maximum and minimum values from a five numbers entered by user using **a function** to calculate the maximum and **another function** to calculate the minimum. Finally, print the result showing these two values.

4. Write **the outputs** from the following C++ programs:

1.
```
#include <iostream.h>
int main()
{  int i =10;
 int *i_ptr =&i ;
cout<< "\n value of  i  = "<< i ;
cout<< "\n value of  i +20 = "<< i +20;
 cout<< "\n value of &i+20 = "<<&i + 20 ;
cout<<"\n value of * i_ptr = "<<*i_ptr + 20 ;
 cout<< "\n value of i_ptr = "<<i_ptr + 20 ;
 return 0;
}
```

2.
```
#include <iostream>
using namespace std;
void main()
{
 int y, x =  1, total =0  ;
 while ( x <=10   )
   {    y = x * x;
        cout << y << endl;
        total  + = y;
        ++x;
   }
 cout << "Total  is " << total <<
 endl;
 return 0  ;
}
```

With my best wishes,
Prof. Dr. Elsayed Sallam