Q.1)

A) A heater develops a power of (1 kW) when run on (230 V) supply. If the resistance wire of the heater has a diameter of (0.5 mm) and resistivity of \(( 60 \times 10^{-8} \, \Omega \cdot m)\). Find the mean length of the wire required?

B) The no load voltage of a small battery is (1.5 V). When a (2 K-ohm) resistor is connected across the battery terminals, the current is (0.4 mA). Find the load voltage when a (900) ohm resistor is connected to the battery?

Q.2) For the following circuit diagram find the resistance (R)?

Q.3) For the following circuit diagram, using the Superposition theorem to find all unknown branch currents?
Q.4) For the following circuit diagram, if \([e_1(t) = 311.127 \sin(\omega t + 120)]\), and \([e_2(t) = 311.127 \sin(\omega t)]\), find \(I_A, I_B, I_C\).

Q.5) A (5 hp) motor with 0.6 lagging P.F. and an efficiency of (92 %), is connected to a (208 V) and (60 Hz) supply. What level of capacitance in parallel with the motor will raise the P.F. of the combined system to unity? Find also the percentage reduction in the supply current.

Q.6)

A) The load taken from a supply consists of:

1) Lamp load of (12 KW) at unity power factor.
2) Motor load of (70 KVA) at (0.7) lagging power factor.
3) Motor load of (50 KVA) at (0.8) leading power factor.

Calculate the total load taken from the supply in (KW) and (KVA) and the power factor of the combined load?

B) An iron ring of circular cross section area of (3 cm²) and mean diameter of (20 cm) is wound with (500 turn) of wire and carries a current of (2 A) to produce the magnetic flux of (0.5 mWb) in the ring. Determine the permeability of the material?

(Good Luck)
ملاحظة: لا تضع ابتداع على الرسم ولا ترسم قائمة الأجزاء.

س:1: رسم المسقط الأساسي للشكل رقم (1) بقياس رقم 1:1 (20 درجة).

س:2: رسم المسقط الأساسي نصف مقطوع للشكل المجمع للاجزاء المبينة في الشكل رقم (2) بقياس رقم 1:1 (30 درجة).
1. A (10 KN) cylinder is supported by beam A B and a cable as shown in (fig.1). Determine the reaction at (A) on the beam and the forces exerted by the cylinder on the beam A B.

2. Knowing that (μ = 0.3) at all surface of contact, Determine the magnitude of the force (P) required to move the block (B) shown in (fig.2).

3. Locate the centroid of the shaded area shown in (fig.3).

4. The window is held open by chain A B (fig.4). If the tension in the chain is (100 N), Find the moment of the tension about point (O).

5. The particle moved from the rest along straight way has velocity defined by equation \( V = 12t^2 - 12t - 8 \) Find the position, velocity and acceleration of the particle after (2 sec). The unit of velocity is m/sec.

6. The projectile is fired vertically upward with initial velocity (290 m/sec). Calculate the maximum height (h max) to which the projectile rises and total time after going up and drop down.
Answer Five Questions

**Q1/ (a)** what are the most common types of thermal equilibrium diagrams?
   Draw each type with all their details.
   (b) What is the difference between crystalline & non-crystalline structure.
   (c) Classify common engineering materials. (Diagram)

**Q2/ (a)** Explain the bonding in material, and give an example for each bond, (draw all bonds). And how does the metallic bond different from other bonds.
   (b) Draw the cooling curve of pure metal.
   (c) Define the metallurgy sciences, and what the importance of materials.

**Q3/ (a)** Name two important copper alloys and give their typical compositions. What is the variation of ductility of brass with % of zinc?
   (b) Explain the imperfection in crystals. (Draw all kinds).
   (c) How are plain carbon steel designated? (Draw Fe-C diagram).

**Q4/ (a)** State at least six (6) important mechanical properties of materials to be considered in Engineering Materials.
   (b) For a Medium carbon steel alloy, calculate by using the lever rule, all % of phases could exist.
   (c) How is the % of carbon affected the mechanical properties and the microstructure of steels. (Draw figure).

**Q5/** The following results indicate the temperatures associated with discontinuities in the cooling curves of the alloys indicated:

<table>
<thead>
<tr>
<th>%B . .</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>35</th>
<th>50</th>
<th>55</th>
<th>60</th>
<th>75</th>
<th>90</th>
<th>95</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>°C . .</td>
<td>600</td>
<td>545</td>
<td>495</td>
<td>410</td>
<td>330</td>
<td>300</td>
<td>315</td>
<td>365</td>
<td>415</td>
<td>430</td>
<td>450</td>
</tr>
<tr>
<td>°C . .</td>
<td>-</td>
<td>450</td>
<td>300</td>
<td>300</td>
<td>-</td>
<td>300</td>
<td>300</td>
<td>300</td>
<td>370</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

If the maximum and minimum percentage solubilities of the two metals are 20B in A, 10B in A, and 10 A in B, 5A in B, sketch and label the equilibrium diagram. (Assume solubility lines are straight).
(a) Describe the cooling of an alloy containing 35% B and sketch typical microstructures.
(b) What properties of α and β would you expect in the eutectic alloy at the eutectic temperature and at 0°C?
(c) The ratio of phases present of 5% B at 30°C (assuming equilibrium to have been attained).

Q6/ (a) Two metals, A and B, have melting points 750°C and 500°C respectively. They form eutectic at 75% B which melts at 400°C. Their solubilities are, at eutectic temperature, 20% B in A and 10% A in B; and at 0°C, 5% B in A and 10% A in B. From the above information draw the equilibrium diagram for the system, clearly marking all phases present. From the diagram determine what structures would be obtained in slowly cooled alloys of the following compositions: 10% B; 40% B; 75% B; 85% B; 95% B.

(b) Fill in the blanks with suitable words & figures.
1. Pearlite is ________ (draw the structure)
2. The types of thermal equilibrium diagrams are many such as ________ (draw all kinds)
3. These are the reactions in Fe-C diagram:- ____ (3 equations)
4. The structure of tungsten is ________ while the structure of zinc is ________
5. The bond of molecule of methane is ________ while the bond of table salt is ________
6. Advanced material is ________ such as ________
7. Ferrous metals such as ________ and ________ are different from non ferrous such as ________ and ________ with many properties such as:
   1____ 2____
8. Mechanical properties related with selection of material for example
   1____ 2____ 3____ 4____ 5____
9. Plastics are ________ such as ________
10. Stainless steels contain ________ while Cast Iron types: 1____
    2____ 3____ 4____ 5____.

GOOD LUCK
Answer 7 of the following questions

Q-1: List and explain simply the Important principles of learning skills?

Q-2: classify and discuss the Seven Habits of Highly Effective Readers

Q-3: Put (at), (of), (in), (on), in the following sentences.

1- Which is the longest river ... the world?
2- This is the finest picture ... them all.
3- I always meet him ... 6 o'clock.
4- He is the best boxer ... our town.

Q-4: Translate this paragraph to the Arabic?

An overview on note-taking

Few students skill are more valuable – or more underdeveloped - than that of taking good notes. Class or text book notes not only provide you with a way to capture and hold onto valuable information ; they also serve other functions. First they help keep you focused and active during the class itself. Giving your brain the task of listening digesting the teachers thoughts and putting them into your own words is very much preferable to taking passive role in the class and letting your mind get distracted or drift from through to through. Secondly taking notes increases the likelihood that you will remember the material even if you do not review it again.

Q-5: There is 7 Rules for Excellent English Speaking, write them in a simple way according to your understanding.

Q-6:

A) Which sentence is correct?

- Peter wanted his mother to help him.
- Peter wanted his mother to helps him.
- Peter wanted that his mother helps him.

B) Which sentence is wrong?

- He went to school yesterday.
- He go yesterday to school.
- Yesterday he has gone to school.
Q-7:
A) Which number is spelled wrongly?
   - fourteen
   - forty-four
   - four

B) What is the answer to this question? Have you seen her?
   - Yes, I did.
   - Yes, I have.
   - Yes, I saw.

Q-8:
Fill the spaces in the following sentences by these words.
( ) Communication ( ) change ( ) place ( ) worse ( ) moved
( ) programming ( ) continued ( ) words ( ) different
( ) many

Modern English
Since the time of Shakespeare, English has ...............to change. Settlers from Britain ...............across the world—to the USA, Australia, New Zealand, India Asia and Africa and in each, ...............the language changed and developed, and took in ...............from other local languages. With the increase in ...............travel, radio and television, all these ...............types of English have mixed. So in Britain now, because of American and Australian TV ...............they used many parts of Australian and American English. And words from ...............other languages—French, German, Spanish, Arabic, even Nepali—have been borrowed. So English continuous to ...............and develop, with hundreds of new words arriving every year. For better or ...............it has truly become the world’s international language.

Yassin Ahmed Khalaf
Assistant Professor

Abdullah Hassan Abdullah
Lecturer
Answer Five Questions only

(Q-1) (A) Use the structure of a pure Ge crystal to show how to get a P- material, and N- Material.  

(Q-2) (A) Determine over what range of input voltage zener - regulation circuit shown in Figure (1) that will result in $V_{RL}$ maintained= 10 Volt across the 2 kΩ resistor assuming that $R_s = 1$ kΩ and the range of zener current is $0 - 25$ mA and Determine the maximum wattage rating.  

(Q-3) A Half -Wave Rectifier circuit with diode resistance $1000 \, \Omega$ is shown in Figure (2) is used to supply power of $200 \sin 100\pi t$ to $10$ kΩ load. Determine (1) The maximum load current, (2) The mean load current, (3) The rms alternating load current, (4) The D.C power supplied to the load, (5) The input power to the anode circuit, (6) The rectification efficiency, (7) The percentage regulation, (8) The ripple current.  

(Q-4) (A) Use the structure of a pure Ge crystal to show how to get a P- material, and N- Material.  

(Q-5) A Half -Wave Rectifier circuit with diode resistance $1000 \, \Omega$ is shown in Figure (2) is used to supply power of $200 \sin 100\pi t$ to $10$ kΩ load. Determine (1) The maximum load current, (2) The mean load current, (3) The rms alternating load current, (4) The D.C power supplied to the load, (5) The input power to the anode circuit, (6) The rectification efficiency, (7) The percentage regulation, (8) The ripple current.  

Figure (1)  

Figure (2)  

GOOD LUCK
Q4/(14 degrees)

a) Design the half adder circuit using NAND gates only?

b) Minimize the four-variables logic function using Karnaugh-map

\[ F = (W, X, Y, Z) \Sigma(0, 1, 2, 3, 7, 8, 9, 10, 11, 12, 13) \]

Q5/(14 degrees)

a) The following word \((110111)_2\) is to be sent using even parity, what is the value of the parity bit and implement the parity generator & checker circuits?

b) Proof the rule \((A+B)(A+C) = A+BC\) by using truth table and draw the logic circuit before and after simplification?

Q6/(14 degrees)

a) Find the results (adder and subtracter) for two words \((1110)\) and \((0111)\) by using 2's complement Adder/subtracter and draw the circuit?

b) Design 2-Bit digital comparator by using simple gates?

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**Good Luck**
Q1: (A) For the logical circuit shown below:
1. Draw the flow chart to perform the function (G) of the circuit.
2. Write the outputs for all input possibilities.

(B) Do as following:
   1. Convert \((20.4)_{16}\) to Decimal.
   2. Convert \((15)_4\) to binary.
   3. Convert \((641)_{10}\) to Hexadecimal.

(C) What is the difference between ListBox and ComboBox?

Q2: (A) Write a program to solve the following equations:
\[ Y = \frac{\sqrt{x} + 5}{x} \quad \text{IF}\, (x+5) > 10, x > 0 \]
\[ Y = x^2 + 3x + 10 \quad \text{IF}\, x < 5 \]
\[ Y = x^2 - 5x \quad \text{other wise} \]

Using the text box to enter the value of \(x\), and display the result \(Y\) on the form.

(B) Define the meaning of:
   - Label Box, Data Tool, Image Box, Text Box, Command Button.

Q3: (A) Write a program to enter the elements values of the one dimensional array \(A(6)\) by using the InputBox, then display array \(B(6)\) which is the inverse of \(A(6)\).

(B) Define the meaning of:
Q4: (A) For the project Form shown below, Write code to insert the two numbers in two text boxes, then choose the option of operation and click on Find command button to display the result on Total text box.

(B) What is the output of the following program?

```vba
Private Sub Form_Click()
    Dim A, B, C, D
    Dim V1, V2, V3, V4, V5
    A = 20: B = 10: C = 30: D = 40
    V1 = ((A^2 / 4) > B^3) And (C * 10 < D)
    V2 = (D / A < 0.5) Xor (D <> B)
    V3 = V1 Or ((C - D) ^ 2 = (A / 2) ^ 2) And V2
    V4 = Not (C ^ 2 / 90 = C Or V3)
    V5 = V1 And V2 Or V3 Xor V4
    Print V1, V2, V3, V4, V5
End Sub
```

Q5: (A): Draw a flow chart to calculate the sum of degrees for (80) students, where each student have (? degrees

(B) Design a Form with List Box, Text Box and three command buttons, write code for the following events:

1- Hello_command event to add Hello to List Box.
2- Welcome_command event to write Welcome in the Text Box.
3- Clear_command event to delete the statements from the List Box and Text Box.
4- Form_click event to terminate the program.

GOOD LUCK