

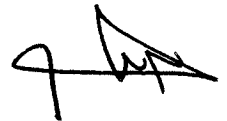
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Name: ID:

Answer all the following Questions on the same sheet. Please answer the questions in ORDER (A total exam mark 60, 6 marks each).

1. Explain the mechanism(s) of sound amplification by the human ear. Mention the parts responsible for this/these mechanism(s).
2. Discuss the role of respiratory surfactant in maintain normal respiratory function. Mention the chemistry, site of synthesis of the surfactant. What is impact of absence of the surfactant on respiratory function?
3. Describe the conductive system of the heart and its function. Mention the pace maker of the heart. Discuss the effect of damaging the pace maker of the heart.
4. List the factors affecting blood pressure.
5. Describe in brief the mechanism of urine formation. Define the glomerular filtration rate.
6. List the types of motility at the stomach, small and large intestine.
7. List functions of the blood.
8. Define the hormone, list the chemistry of the hormones then describe how does the chemistry impact the mechanism of action of the hormones.
9. List the mechanisms of propagation of action potential along the nerves.
10. Define action potential then list its phases.

Best Wishes (:



Helwan Universty
Engineering College
Bio Medical Engineering

Course (Thermodynamics)
Time: 3 hours

year: 2nd Bio. Eng.
Academic year: 15/16
Maximum Credit: 100

General Notes:

Assume any necessary assumptions
Solve each problem with P-V and T-S diagrams as possible
For air take $C_v=0.726 \text{ kJ/kg.K}$ and $C_p=1.013 \text{ kJ/kgK}$
Thermodynamic Tables are allowed
Answer the following questions

Question 1. (20Points)

- State the second law of thermodynamic statements using diagrams and deduce term for the efficiency and COPEquations?
- A farmer runs a heat pump with a 2 kW motor. It should keep a chicken hatchery at 30°C, which loses energy at a rate of 10 kW to the colder ambient Tamb. What is the minimum coefficient of performance that will be acceptable for the heat pump?

Question 2. (20Points)

Consider a rigid tank connected to a paddle wheel which is connected to both the shaft and an electric resistor which is connected to a battery. The rigid tank contains air. The rate of energy added to the air through an electrical heater resistor is 200 Watts. In addition the rate of energy added to the air through the paddle wheel is 50 Watts. The rate of heat transferred to the surroundings is given by the relation $\delta \dot{Q} = 250[1 - \exp(-0.03t)]$ where t is the time in seconds and \dot{Q} is the rate of heat in watts. Estimate (a) an equation for dE/dt and (b) plot the value of [dE/dt] for the first 3 minutes.

Question 3. (20Points)

- An air compressor takes in air at 100 kPa, 17°C and delivers it at 1 MPa, 600 K to a constant-pressure cooler, which it exits at 300 K. Find the specific compressor work and the specific heat transfer in the cooler.
- Prove that the efficiency of Carnot cycle is function only in absolute temperatures .

Question 4. (20Points)

Engine operates on the basis of an ideal Otto cycle has a compression ratio of 7. At the beginning of the compression process, the air is at 101.35kPa and 21°C, and 953.66kJ/kg of heat is transferred to air during the constant-volume heat addition process. Accounting for the variation of specific heats of air with temperature, determine (a) the maximum temperature and pressure which occur during the cycle, (b) the thermal efficiency, (c) the mean effective pressure for the cycle, if the engine uses 1kg/min of air. Also determine the Carnot efficiency

Question 5. (20Points)

A diesel engine has a compression ratio of 20:1 with an inlet of 95 kPa, 290 K, state 1, with volume 0.5 L. The maximum cycle temperature is 1800 K. Find the maximum pressure, the net specific work and the thermal efficiency.

Examining committee:

Name: Dr I G EL GIZAWY

Signature:

1. Write a temperature-conversion program that gives the user the option of converting Fahrenheit to Celsius or Celsius to Fahrenheit. Then carry out the conversion - (the Conversion Formula: $(F-32)*5/9 = C$).
2. Write a program to read a number of days and convert this number in terms of Years, Weeks and Days.
3. Write a C++ program that can be used to simulate the functionality of an ATM machine. Your program should include the following functions: Print_Balance, Add_Balance, and Withdraw_Balance. You may assume an initial user balance of 100 L.E. Your program should prompt the user to select an operation and then prints out the result on the screen. The program should terminate only if you type 'q' or 'Q'.
4. What is the output of the following program? You also need to describe on the functionality of the program.

```
#include <iostream>
int main(){
    int num1 =10, num2=20, temp;
    int *ptr1 = &num1, *ptr2=&num2;
    cout << num1 << num2 << "\n";
    temp = *ptr1;
    *ptr1 = *ptr2;
    *ptr2 = temp;
    cout << num1 << num2;
    return (0); }
```

5. Write a C++ program that can be used to read patients' blood sugar readings stored in an input file called "readings.txt". Your program should be able to:
 - a. Store the input values in an integer array
 - b. Assume that the lowest reading in the file is 100 and the highest reading is 300, draw a histogram with an increment of 50.
 - c. Search for the highest and lowest blood sugar readings
 - d. Sort the patients' blood sugar readings in a descending order
 - e. Store the sorted array values in a file called patients.txt
6. a) What is object-oriented programming (OOP)? What is meant by inheritance? What is a derived class?
 - b) Explain the difference between the access control types (public / protected / private). You need to illustrate your answer by an example.
 - c) Write a C++ program that can be used to implement a student Class. Your Student class should include the following data members: Student ID / Name / Address. The Student class should also include the following class member functions/methods: setData and showData.
 - d) Using inheritance you need to derive a Bio class from the Student Class. You need to add the following data members to the derived Bio class: GPA and Academic_Year. You also need to implement the following class member functions/methods: setInfo and showInfo.

Good Luck

Faculty of Engineering
 Second year
 Code symbol: Gen 4212
 Total Marks: 70 Marks



Department: Biomedical Engineering
 Subject: Mathematics 3
 January exam for 2015/2016
 Exam time: three hours

Solve the following equation

1. Solve the recurrence relation $x_{k+2} + 5x_{k+1} + 6x_k = 1$, where $x_0 = 0$ and $x_1 = 1$ [10 marks]

2. Answer the following question:

a) Determine the value of the root correct to 4 dp by using fixed point iteration for the equation:
 $f(x) = x^2 - 2x - 3 = 0$ Starting with $x_0 = 3$. [5 marks]

b) Rearrange the following equations into a suitable form Solve by using Jacobi iterative method
 $x_1 + 10x_2 - x_3 = 1$, $x_1 + x_2 + 10x_3 = 0$, $10x_1 + 2x_2 + x_3 = 1$. Then solve the resulting system
 using Jacobi-iteration method with $x^0(0 \ 0 \ 0)^T$ [10 marks]

3. Prove that: $(n+1)P_{n+1}(x) - (2n+1)xP_n(x) + nP_{n-1}(x) = 0$. If we have $P_0(x) = 1$, $P_1(x) = x$ find $P_2(x)$ and

$P_3(x)$. Then expand the function $f(x) = \begin{cases} 0 & -1 < x < 0 \\ 1 & 0 < x < 1 \end{cases}$ in a series of the form $\sum_{k=0}^{\infty} A_k P_k(x)$

[10 marks]

4. Evaluate each of the following integral

a. $\int_0^1 \frac{dx}{\sqrt{-\ln x}}$. [5 marks]

b. $\int_0^2 x \sqrt[3]{8-x^3} dx$. [5 marks]

5. Solve the differential equation $y' = 2x + 3y$, $y(0) = 1$, $h = 0.1$ using Euler method at $x = 0.4$. If the solution is $y = \frac{1}{9}(-2 - 6x + 11e^{3x})$ find the percentage error for each step. [10 marks]

6. A firm produces three types of pumps, A, B, C, each of which requires the three processes of turning, assembling, testing.

Pump type	Process time (hours) per pump			Profit per pump \$
	Turning	Assembling	Testing	
A	2	4	1	2
B	5	2	3	6
C	2	3	5	4
Total available time (h/week)	38	57	57	

Determine 1. The weekly output of each type to maximize profit.

2. The maximum weekly profit

[15 marks]

Best wishes

Dr. Ahmed Mahsoub