Name: _____ B: Index No: _____

University of Ruhuna- Faculty of Technology

Bachelor of Engineering Technology Honours
Level 4 (Semester I) Examination, December 2020
Academic year 2019/2020

Course Unit: ENT4152 Biomedical Equipment **Duration: 3 hours**

Name: _____ **B: Index No:** _____

- This question paper carries **five (05)** questions in **nine (09)** pages including the cover page
- Answer **ALL** questions
- You may use calculators if needed.
- Multiple choice questions have **only ONE** correct answer, out of the four options given. Circle in the question paper itself.
- Please put your name and index number of every page of the question paper.
- Please attach **ALL** nine (09) pages of the question paper to your answer script.
- Each question carries 12 marks totaling to 60% of your final grade.

Question	Sub Questions	LO	Total	Received
Q1	10 Sub Questions	LO1	12	
Q2	10 Sub Questions	LO2	12	
Q3	5 Sub Questions	LO2	12	
Q4	4 Sub Questions	LO3	12	
Q5	6 Sub Questions	LO4	12	
			60	

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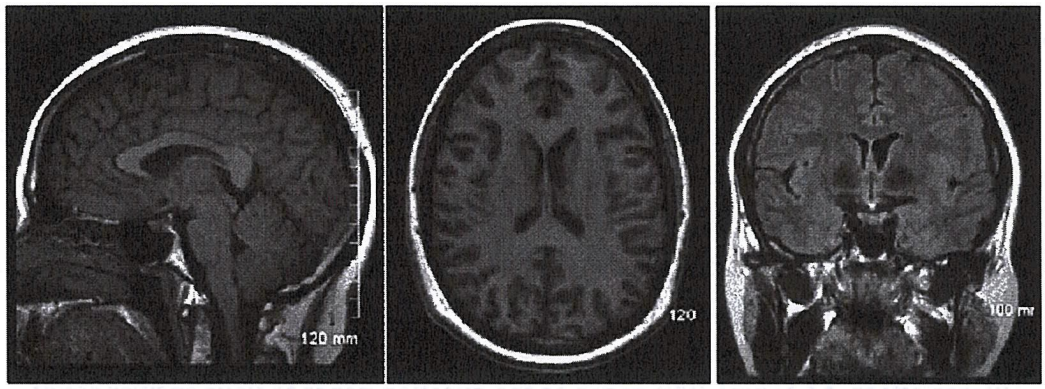
Question 1

Circle one (01) of the provided options from a) to d) that best suits each question from 1 to 4.
(0.5 each × 4 = 02 marks)

1. Which of the following statements is **TRUE**.
   a) Lateral view is well defined while the medial view cannot be defined since it refers to the midline which cannot be determined exactly.
   b) Superior parts of the body refer to the head while inferior are the parts referring to the rest of the body.
   c) The median plane divides the body into left and right halves.
   d) Posterior view is preferred for a mammogram.



(A) (B) (C)

Figure 1: Brain Slices for Question 1 Part 2

2. Referring the Figure 1 on "Brain Slices", which of the following statements is **TRUE** about the different view in the figure?
   a) A is a sagittal plane while C is a coronal plane.
   b) A is a sagittal plane while B is a coronal plane.
   c) A is a coronal plane while C is a transverse plane.
   d) A is a coronal plane while B is a transverse plane.

3. Which of the following statements is **TRUE**.
   a) Dorsal root of the spinal cord carries efferent neurons.
   b) Brain and nerves are part of the central nervous system.
   c) Parasympathetic activity dominates 'fight or flight' response.
   d) Cranial cavity and vertebral cavity comprises the dorsal body cavity.

4. Which of the following statements is **TRUE**.
   a) Schwann cells carry electric information in the neuron.
   b) Schwann cells produce nodes of Ranvier to conduct axon potentials.
   c) Schwann cells play no significant part in the neuron.
   d) Schwann cells produce myelin.

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5. Name the body cavities shown in Figure 2: "Body Cavities"

(0.5 each × 5 = 2.5 marks)

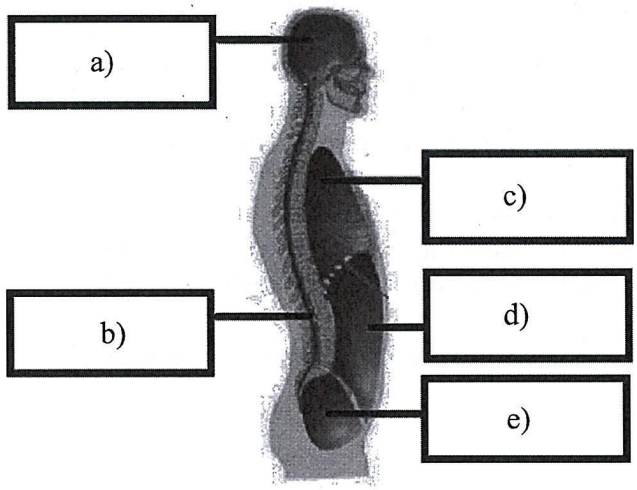

Figure 2: Body Cavities for Question 1 Part 5

6. Explain the positive feedback system, using normal childbirth as an example.

(02 marks)

7. What is the difference between 'anatomy' and 'physiology' ?

(0.5 marks)

8. Answer the following questions regarding transportation of ions.
   a) Explain the mechanism of sodium-potassium pump.

   (02 marks)

   b) How is it different from facilitated diffusion ?

   (0.5 marks)

9. Explain two (02) differences between DNA and RNA

(0.5 each × 2 = 01 mark)

10. Explain the function of each of the following

(0.5 each × 3 = 1.5 marks)

   a) mRNA
   b) rRNA
   c) tRNA.

End of Question 1

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Question 2

Circle one (1) of the options from a) to d) that best suits each question from 1 to 8.
(0.5 each × 8 = 04 marks)

1. Which of the following statements is TRUE.
   a) Underexposed X ray images are dark, while overexposed X ray images look white
   b) Overexposed X ray images are dark, while underexposed X ray images look white
   c) Both underexposed and over exposed X ray images are white
   d) Both underexposed and over exposed X ray images are dark

2. Which of the following statements is TRUE.
   i) Ultrasound is more dangerous than X ray in terms of effective radiation dose.
   ii) Chest X ray has high exposure to radiation but not as high as a body CT or cardiac angiography.
   iii) Dental X ray has a very low effective dose of exposure.

   a) i and ii only
   b) ii and iii only
   c) i and iii only
   d) ALL of the above are true

3. Which of the following statements is TRUE.
   i) Alpha rays have higher ionization than X rays.
   ii) X rays cannot be stopped by thin aluminum but can be stopped by water or concrete.
   iii) Gamma rays and X rays have similar penetration.

   a) i and ii only
   b) ii and iii only
   c) i and iii only
   d) ALL of the above are true

4. Which of the following statements is TRUE.
   a) PET uses a single gamma ray while SPECT uses two gamma rays in opposite directions.
   b) Doppler ultrasound can visualize blood where red is moving away from probe.
   c) Nuclear medicine provides functional and anatomic information.
   d) Radionuclide and radiopharmaceutical are referring to the same thing.

5. Which of the following statements is FALSE.
   a) Collimation is the ability of light to be narrow over a great distance.
   b) Collimation is a characteristic of X rays.
   c) Personal protective equipment is needed for laser treatments.
   d) Lasers can be used in cancer treatment.

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6. Which of the following statements is FALSE.
   a) Ultrasound has the highest image quality in any medical imaging modality.
   b) MRI has a high image quality but low temporal resolution.
   c) PET has a better image quality than SPECT.
   d) MRI and fMRI both have high spatial resolution.

7. Which of the best describes the function of a collimator light in X ray machines
   a) The light helps to focus the collimator blades.
   b) The light focuses the X ray beam to the patient.
   c) The light causes only straight X rays to pass to the patient.
   d) When the light is used, the intensity of the X ray becomes less harmful to the patient.

8. Which of the best describes the difference of absorption in X ray
   a) Bones absorb the most of the X rays and therefore is not recommended for patients with weak bones.
   b) Lungs absorb the most of the X rays and therefore is not recommended for patients with respiratory illnesses.
   c) X rays can give 3D information and therefore used to diagnose fractures in bones.
   d) Most of the X ray radiation is absorbed by the bones.

9. Answer the following with brief descriptions. You may use diagrams to explain your answers if needed.

   a) What is meant by 'ionization radiation' ?

   (01 mark)

   b) What is fMRI and how is it different from MRI?

   (02 marks)

   c) Mention two types of patients who should never get MRI. Briefly explain the reasons for each type.

   (01 each × 2 = 02 marks)

   d) Explain scattering and attenuation in ultrasound imaging

   (01 mark)

10. What is the relative intensity level in decibels when intensity is increased to double of its original value? Show your calculations.

    (02 marks)

End of Question 2

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Question 3

1. Answer the following with brief descriptions, regarding lungs and respiratory systems. You may use diagrams to explain your answers if needed.

(01 each × 4 = 04 marks)

a) What is the difference between residual volume and functional residual capacity?
b) How does obesity affect the residual volume and expiratory reserve volume?
c) What is pneumonia? How does it affect the respiratory system of the human body?
d) Name two (02) syndromes / conditions caused by coronavirus.

2. Answer the following briefly and to the point regarding ventilators. You may use diagrams to explain your answers if needed.

a) Briefly explain the mechanism of the two (02) types of positive pressure ventilators

(01 each × 2 = 02 marks)

b) Briefly describe the function of the four (04) components of a ventilator

(0.5 each × 4 = 02 marks)

3. Discuss reasons for disagreeing with the following statement

"Defibrillators should not be allowed to be used in ambulances as it requires highly trained medical professionals to operate it"

(01 mark)

4. List applications of each of the following.

(0.5 each × 3 = 1.5 marks)

a) Wearable Cardioverter Defibrillator (WCD)
b) Implantable Cardioverter-Defibrillators (ICD)
c) Artificial Cardiac Pacemakers

5. Briefly discuss the differences of each of the following.

(0.5 each × 3 = 1.5 marks)

a) Automated External vs Wearable Cardioverter Defibrillator (AED vs WCD)
b) Wearable vs Implantable Cardioverter-Defibrillators (WCD vs ICD)
c) Implantable Cardioverter-Defibrillators (ICD) vs Artificial Cardiac Pacemakers

End of Question 3

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Question 4

For questions 1 and 2, circle the most appropriate answer out of the given options from a) to d).

(0.5 each × 2 = 01 mark)

1. Another name for a unity gain amplifier is:
   a) Comparator
   b) Differential Amplifier
   c) Instrument Amplifier
   d) Voltage Follower

2. The summing amplifier is an application of:
   a) Inverting op-amp
   b) Noninverting op-amp
   c) Differentiator
   d) Integrator

3. Op Amps and Circuits
   a) Draw an op-amp circuit for a differential amplifier output and derive the equation for the output of the circuit

   (01 mark)

   b) Calculate the gain of the circuit given in Figure 3: "Instrumentation Amplifier" according to the resistor values given. Do NOT assume any formulas other than ohms law and the answer in 3.(a). Give your answer to four (04) decimal places.

   (06 marks)

   - $R_1 = 54\ \Omega$
   - $R_2 = 4.7\ k\Omega$
   - $R_g = 10\ k\Omega$

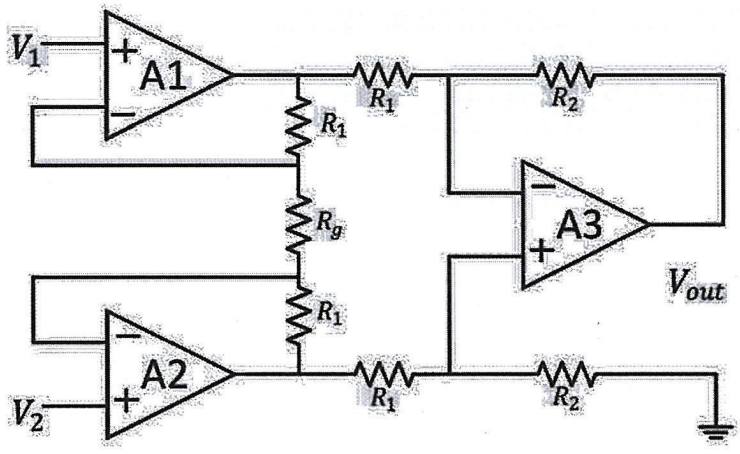

Figure 3: Instrumentation Amplifier for Question 4 part 3.b)

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4. Figure 4: "EEG" shows 4 different artifacts during a recording. Identify the phenomena that relates to each artifact and briefly state one method to eliminate each artifact.
(0.5 each × 8 = 04 marks)

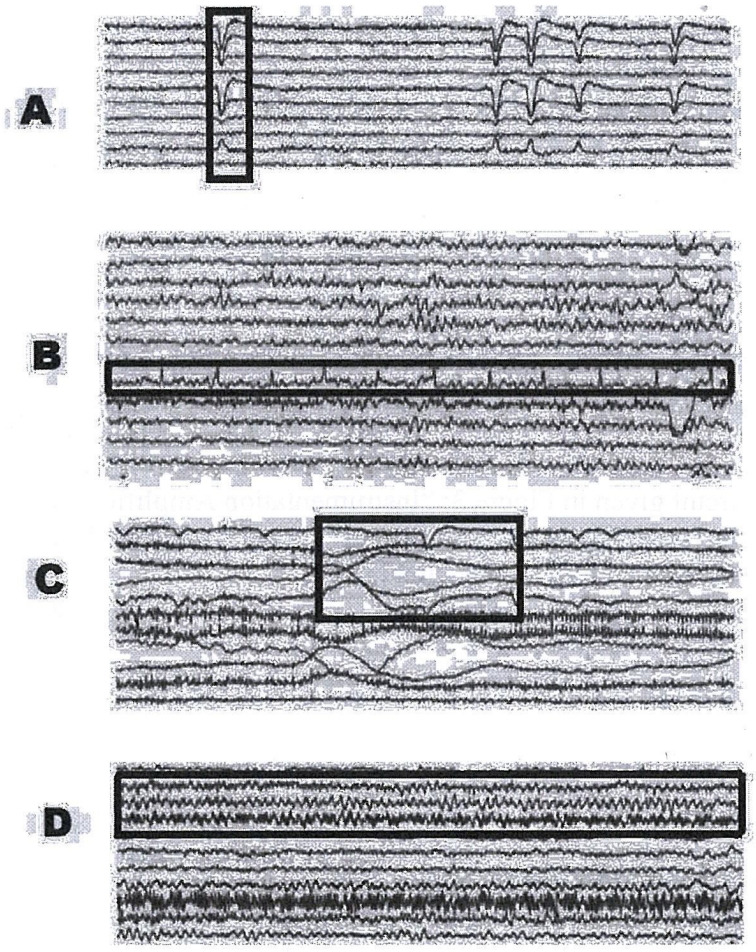

Figure 4: EEG for Question 4 part 4

End of Question 4

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Question 5

For questions 1 and 2, circle the most appropriate answer out of the given options from a) to d).
(0.5 each × 2 = 01 mark)

1. How often should an ECG machine be taken out for maintenance?
   a) Every 6 months because it cannot be done any sooner
   b) When it stops working so that the maximum use can be taken
   c) According to whatever instructions given by manufacturer
   d) Annually during the holiday period

2. Preventive maintenance is used to ensure that breakdowns:
   a) are reduced.
   b) are eliminated.
   c) cannot happen.
   d) are less costly.

3. Answer the following questions in relation to medical ethics.

   a) Briefly describe 'Autonomy' and 'Distributive justice'.
   (0.5 each × 2 = 01 marks)

   b) List an application that 'Autonomy' can be challenged in medical ethics.
   (0.5 marks)

   c) List an application that 'Distributive justice' can be challenged in medical ethics.
   (0.5 marks)

4. The World Health Organization (WHO) lists four (04) underlying principles of good donation practice. Briefly describe them.
   (01 each × 4 = 04 marks)

5. List three (03) international standard codes and names that apply to hospital equipment maintenance.
   (0.5 each × 6 = 03 marks)

6. List three (03) types of predetermined preventative maintenance strategies and 1 type of condition based preventative maintenance strategy.
   (0.5 each × 4 = 02 marks)

End of Question 5

END OF THE QUESTION PAPER.

Please attach **ALL** nine (09) pages of this question paper to your answer script.