Khulna University of Engineering & Technology
B. Sc. Engineering 4th Year 2nd Term Examination, 2020
Department of Biomedical Engineering

BME 4215
Bio-nanotechnology

Time:1 Hour 30 Minutes   **Full Marks: 120**

N.B.   i) Answer **ANY TWO** questions from each section in separate script.

ii) Figures in the right margin indicate full marks.

Section A

(Answer **ANY TWO** questions from this section in Script A)

1. a) What is bionanomaterial? Briefly describe the classification of low-dimensional (08) system.

   b) Explain several size-dependent properties of nanomaterials. (15)

   c) Why does nanomaterial act a better catalyst than bulk material? (07)

2. a) How does bionanotechnology become advantageous in the analysis of (10) pathophysical changes and anatomical changes?

   b) Briefly explain the significance of bionanotechnology in disease diagnosis and (12) targeted drug delivery with proper examples.

   c) Explain the principle of quantum tunneling phenomenon. (08)

3. a) Discuss about the potential hazards of nanomaterials in human body. (12)

   b) Briefly discuss about the ethical concerns that must be conserved in the application (12) of bionanotechnology.

   c) Write down the applications of nanotechnology in healthcare. (06)

(Answer **ANY TWO** questions from this section in Script B)

4. a) Why virus is used as nano carrier? Enumerate the methods of developing (12)
        functionalized virus based nanoparticles. Explain each of the methods with suitable
        example.

    b) Explain the role of virus based nanoparticles in different imaging modalities. (10)

    c) What is the basic difference between the gram-positive and gram-negative (08)
        bacteria? How would you determine the loading capacity of bacteria based
        nanoparticles?

5. a) Why lipid-based carrier systems are very promising now a days? What are the (12)
        basic steps of noisome production? Explain the drug entrapment process in
        liposome.

    b) Which one is more advantageous for targeted drug delivery among SLN, NLC, (10)
        liposome and why? Write down the applications of SLN and NLC in the medical
        sector.

    c) What are the types of core-shell QDs? Write down the differences among each (08)
        type.

6. a) What is self assembly? What are driving forces of self assembly? (06)

    b) What is peptide Lego? How do the self-assembling peptides change their (14)
        appearance in different physiological and salt solutions? Briefly explain the
        fabrication of peptide nanotube and its application in biosensor development.

    c) What is DNA nanotechnology? Why is DNA nanotechnology used as (10)
        nanotechnological tools?

Khulna University of Engineering & Technology
B. Sc. Engineering 4th Year 2nd Term Examination, 2020
Department of Biomedical Engineering
BME 4217
Rehabilitation Engineering

Time:1 Hour 30 Minutes   **Full Marks: 120**

N.B.   i) Answer **ANY TWO** questions from each section in separate script.

ii) Figures in the right margin indicate full marks.

Section A

(Answer **ANY TWO** questions from this section in Script A)

1. a) Define health. Draw the Meikirch Model of health with short description.   (07)

b) What is SARS, MARS and SARS-2? What type of diseases these are? Mention the   (08)
relationship among impairment, disability and handicap.

c) Write down the formula of life. Describe the tertiary prevention of Heart diseases.   (08)

d) What is pressure sores? What are the function of pressure mattress to prevent   (07)
pressure sore?

2. a) What is conduction Aphasia? Propose a semi-automated aphasia diagnosis system   (10)
by using machine learning.

b) What is Ear drum? Draw (with label) the human ear drum and normal ABR graph.   (06)

c) Define language and cognitive disorders. Draw and label the classical   (10)
Wernicke- Geschwind model of language.

d) Write a short note on Q Angle in human femur bone.   (04)

3. a) Write down the different level of lower limb amputation. Draw and label the original   (10)
design of the Canadian type hip-disarticulation Prosthesis.

b) "Vision communication is important skill to hear" – justify the statement.   (06)

c) Define Isolation, Quarantine and Hard immunity.   (06)

d) Write short notes on: (08)
    i)   Health promotion
    ii)   Disease Iceberg

(Answer **ANY TWO** questions from this section in Script B)

4. a) What is meant by assistive technology? Discuss on the benefits and challenges of (10)
        assistive technologies for rehabilitation support.

    b) What materials are used to make prosthetic devices? Write down some advantages (08)
        and disadvantages of aluminum and titanium as a prosthetic material.

    c) Define orthotics. Briefly explain the biomechanical principle that are needed to (12)
        consider in orthotics design.

5. a) Distinguish between orthotics and prosthetics. List different orthoses considering (07)
        their functions.

    b) Explain the working principle of Ionic Polymer Metal composite artificial muscle (09)
        using suitable diagram.

    c) Design a myoelectric hand prosthesis to write English alphabets related to $+90°$, $0°$ (14)
        and $-90°$ rotations. Explain your design strategy using suitable block diagrams.
        Detail circuit diagram are not necessary.

6. a) What is Knee unit? Explain the friction mechanism of knee unit. (08)

    b) Briefly describe the 3D bio-printing process for prosthetics. (10)

    c) What is meant by bionic eye? Explain the working principle of bionic eye using (12)
        suitable diagram.

Khulna University of Engineering & Technology
B. Sc. Engineering 4th Year 2nd Term Examination, 2020
Department of Biomedical Engineering

BME 4221
Bioinformatics

Time:1 Hour 30 Minutes   **Full Marks: 120**

N.B.   i) Answer **ANY TWO** questions from each section in separate script.

ii) Figures in the right margin indicate full marks.

Section A

(Answer **ANY TWO** questions from this section in Script A)

1. a) What is the main role of a bioinformatician in present biological research and   (06)
development area?

b) Consider the following two sequences: (14)

C-C-A-T G G C C A T C G
C G G C T A C G

Apply FASTA to compute the alignments.

c) What is protein? Write down the important functions of protein.   (10)

2. a) How many pair wise alignments would be performed to get a multiple sequence   (07)
alignments of 5 sequences? Justify your answer with examples.

b) Consider the following two sequences   (13)

A T C G A
T C G A
(i)   Compute the scoring matrix.
(ii)   Align the two sequences using global sequence alignment techniques.

c) What is sequence Motif and PROSITE? Write down the steps to find the Motif on   (10)
PROSITE.

3. a) Define the term propensity value. What steps does Chou Fasman method perform   (12)
to predict the secondary structure of protein?

b) What is a dot plot and why is it useful for? Which types of databases are used in   (10)
bioinformatics?

c) Define homolog. What are the differences between an ortholog and paralog?   (08)

(Answer **ANY TWO** questions from this section in Script B)

4. a) What is bioinformatics? Briefly discuss about the subfields of bioinformatics. (10)

b) Given flat file contains records of five students from different states, each taking a different course. (12)

Flat file

> Name, States, Course number, Course name | John Smith, Texas, Biol 689, Bioinformatics | Jane Doe, Kansas, Bich 441, Biochemistry | William Brown, Illinois, Chem 289, Organic Chemistry | Jennifer Taylor, New York, Hort 201, Horticulture | Howard Douglas, Texas, Math 172, Calculus

Construct an object-oriented database to store the same information.

c) What is gene prediction? What is the ultimate goal of gene prediction? (08)

5. a) Explain data retrieval system: Entrez for biological databases. (12)

b) Illustrate the structure of atypical eukaryotic genome. (10)

c) Write short note on consensus-based program for gene prediction. (08)

6. a) What is meant by functional genomics? Write down the advantages of transcriptome analysis. (08)

b) What is homoplasy? Briefly explain any one substitution model for correcting homoplasy. (12)

c) Write short notes on: (10)
   (i)   Bootstrapping
   (ii) Jackknifing.

Khulna University of Engineering & Technology
B. Sc. Engineering 4th Year 2nd Term Examination, 2020
Department of Biomedical Engineering
BME 4231
Telemedicine and Health Care

Time:1 Hour 30 Minutes   Full Marks: 120

N.B.   i) Answer ANY TWO questions from each section in separate script.

ii) Figures in the right margin indicate full marks.

Section A

(Answer ANY TWO questions from this section in Script A)

1. a) What is meant by teleconsultation? Briefly explain the technical factors needed to ensure the quality of teleconsultation.   (10)

   b) What are the drivers of telemedicine and healthcare?   (08)

   c) Evaluate the readiness of Home Telehealth in terms of health agency and patients.   (12)

2. a) State Nyquist theorem. Briefly describe the working principle of a supercardiod microphone.   (08)

   b) How can swimmers be benefitted by telemedicine and healthcare technologies?   (12)

   c) Write down the differences between SD and HD video.   (10)

3. a) Describe the significance of confidentiality and law for a telemedicine program from the perspective of ethics.   (12)

   b) Illustrate a telemedicine framework for supporting maternal and newborn health in developing countries.   (13)

   c) What are the differences between PAL and NTSC?   (05)

Section B

(Answer **ANY TWO** questions from this section in Script B)

4. a) What is meant by communication system? List the commonly used wireless   (10)
        networks in telemedicine including their operating frequency, data rate and
        coverage.

    b) Define body area network. Briefly describe the challenges centered around the   (10)
        implementation of BAN hardware.

    c) Sketch a telemedicine framework for monitoring vital parameters in patients with   (10)
        respiratory insufficiency.

5. a) Illustrate an emergency rescue system with telemedicine support. How can you take   (10)
        advantages of tracking technology in telemedicine?

    b) What are the limitations of a traditional k-type or Hg-thermometer for temperature   (12)
        monitoring in telemedicine applications? What could be a possible solution? Explain
        with suitable example.

    c) What are the reasons for the emergence of smartphone based telemedicine device?   (08)
        List some smartphone based scientific devices for telemedicine.

6. a) Briefly explain the leading approaches for incorporating information security in a   (12)
        hospital with telemedicine backbone.

    b) What are the steps of converting a DICOM image file to JPEG? Illustrate with a   (12)
        block diagram.

    c) Write a short note on EHR.   (06)

Khulna University of Engineering & Technology
B. Sc. Engineering 4th Year 2nd Term Examination, 2020
Department of Biomedical Engineering

BME 4251
Biomedical Ethics and Safety

Time:1 Hour 30 Minutes   **Full Marks: 120**

N.B.   i) Answer **ANY TWO** questions from each section in separate script.

ii) Figures in the right margin indicate full marks.

Section A

(Answer **ANY TWO** questions from this section in Script A)

1. a) Define principle. Mention the name of basic principle of the biomedical ethics.   (06)

    b) Define ethics and moral agent. Mention the specific rules that are supported by   (14)
        nonmaleficence and beneficence.

    c) What is normative ethics? Discuss about consequentialism.   (10)

2. a) Mention the purposes of human subject research.   (08)

    b) Discuss about the criteria for the approval of Institutional Review Board (IRB) in: (16)
        (i) Human subject research
        (ii) Animal research.

    c) Describe the responsibilities of a researcher in human subject research.   (06)

3. a) Define informed consent. What information should be included in informed   (10)
        consent form?

    b) Discuss the process of taking informed consent from: (12)
        (i)   Children
        (ii)   Pregnant Women
        (iii)   Prisoners.

    c) Define privacy and confidentiality. Discuss about the basic elements of Nuremburg   (08)
        code.

Section B

(Answer **ANY TWO** questions from this section in Script B)

4. a) Describe different biosafety levels with examples. Describe laboratory practices, safety equipment and facility construction of different safety levels.   (20)

    b) Mention the relation between risk and hazard. Give some examples of threat.   (10)

5. a) Why it is important to understand the different states of atmospheric hazards?   (05)

    b) Describe the guidelines for clinical, scientific, technical and medical laboratory staff working in a laboratory. Also mention the guidelines for the visitors to laboratories.   (15)

    c) What are the instruments for monitoring hazards? What are the safety precautions of using them?   (10)

6. a) Give some examples of common work place hazards.   (15)

    b) What is meant by lab safety symbols? Mention the criteria of a good laboratory practice.   (10)

    c) Mention different types of PPE.   (05)