Khulna University of Engineering & Technology
B. Sc. Engineering 4th Year 2nd Term Regular Examination, 2021
Department of Biomedical Engineering

BME 4251
Biomedical Ethics and Safety

Time: 3 Hours **Full Marks: 210**

N.B. i) Answer **any THREE** questions from each section in separate scripts
ii) Figures in the right margin indicate full marks.

Section A

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

1. a) What is research and what is a human subject in research? Discuss about the key principles for the ethical development of research. (12)

b) Discuss about the potential risks for human subjects involved in research? (12)

c) Discuss about the differences between the research ethics and clinical ethics. (11)

2. a) Define bioethics. Discuss the principle of bioethics. Discuss the top bioethical issues in biomedical advances. Give five examples of bioethics. (20)

b) What are the differences between ethics and morality? Explain with examples. (08)

c) Compare and construct between ethics and law with examples. (07)

3. a) Define institutional review board (IRB). What value does IRB add to the research process and how does an IRB work? (15)

b) Discuss the details about the IRB submission and IRB administrator task (pre-review). (15)

c) Write a short note on 'Identifiable information'. (05)

4. a) Define and classify informed consent. Write down the challenges that may arise during taking the informed consent. How it can be solved? (15)

b) Define toxicology. What are the specific benefits of using animals in toxicology research? (10)

c) Discuss about the duties and responsibilities of Society of Toxicology regarding the use of animals in Toxicology. (10)

Section B

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

5. a) Define health. Discuss briefly primary types of health. (08)

b) Give five examples of each type of hazards. (10)

c) Classify medical waste with proper examples. (06)

d) Discuss briefly the consequence of hazards. (04)

e) State with examples –"16-elements MSDS data sheet". (07)

6. a) Explain the following terms with examples: Risk, Threat, Safety, IU health, accident, and incident. (12)

b) Describe different biosafety levels on the following points. (i) Lab type, (ii) Laboratory practices, (iii) Safety equipment, and (iv) Facility construction. (14)

c) What is the risk assessment? Describe five steps of risk assessment. Mention the key points to consider assessing infection risk. (09)

7. a) What is the innovation matrix? Show the innovation matrix based on (i) problem-domain defined and (ii) competence-dedication innovation. (15)

b) What is technology transfer? What are the main parts of technology transfer? Why is it necessary to collaborate between universities and industry? (12)

c) Why is laboratory safety important? Mention the lab safety rules. (08)

8. a) Why is respiratory protection necessary? When are respirators needed? Discuss different types of respirator devices with their use and adjustment, maintenance, and storage. (13)

b) Discuss different types of fire with example. Also describe different types of fire extinguishing agents. (09)

c) What is bloodborne pathogen? Give examples. Describe engineering controls of bloodborne pathogens. (08)

d) What are different PPE used for different types of protection? (05)

Khulna University of Engineering & Technology
B. Sc. Engineering 4th Year 2nd Term Regular Examination, 2021
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BME 4215
Bio-Nanotechnology

Time: 3 Hours **Full Marks: 210**

N.B. i) Answer **any THREE** questions from each section in separate scripts
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Section A

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

1.	a)	What is meant by nanoscience and nanotechnology? Give five examples of nanoscale.	(08)
	b)	What are the factors to understand nanoscale –related properties? Explain them with suitable diagram.	(15)
	c)	"Melting temperature of nanoparticles is higher than its bulk material"-Justify your answer with proper reasons.	(07)
	d)	How does a nanosized material act as a better catalyst than macrosized material?	(05)
2.	a)	Define quantum confinement. How does the band-gap energy increases in semiconductor due to quantum confinement? Explain with suitable diagram.	(10)
	b)	What is meant by quantum tunnelling? Define low dimensional systems. Classify and briefly explain low dimensional systems.	(09)
	c)	Classify engineered nanomaterials. And describe them briefly.	(10)
	d)	Briefly explain 'Bottom-up' approach of nanomaterial synthesis with suitable figure.	(06)
3.	a)	Define bionanotechnology. Discuss about the major fields in bionanotechnology.	(12)
	b)	What are the differences between traditional drug delivery and targeted drug delivery?	(08)
	c)	What is CNT? How can you use CNTs for drug delivery and cancer therapy? Explain with necessary diagram.	(15)
4.	a)	What is hazard in nanomaterials? Briefly explain the hierarchy of hazard control with suitable diagram.	(15)
	b)	How does nanotechnology impact our daily lives? Explain.	(10)
	c)	What are the impacts of nanotechnology on industry? Explain briefly.	(10)

Section B

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

5.	a)	What are the types of QDs? Describe the size dependent properties of QDs.	(15)
	b)	Explain the principle of Gram Staining. Why is bacteria chose in nanoparticle synthesis?	(10)
	c)	Explain the applications of virus-based nanoparticles in therapeutic intervention and immunotherapy.	(10)
6.	a)	Briefly describe the design process of DNA origami.	(15)
	b)	Why are lipid-based carrier systems so promising for targeted drug delivery? Explain the importance of niosome as nanoparticle.	(10)
	c)	What is self-assembly? Write down the types, features, and driving forces of self-assembly.	(10)
7.	a)	What is nanoemulsion? How can we produce nanoemulsion using high energy emulsification and low energy emulsification methods?	(12)
	b)	Which one is more advantageous for targeted drug delivery among SLN, NLC, and Liposome and why? Mention some applications of SLN in medical area.	(08)
	c)	What is DNA nanotechnology? How are DNA nanostructures built? Explain briefly using necessary diagrams.	(15)
8.	a)	Design a building array and nanotube or sheet using protein self-assembly approach.	(10)
	b)	Give a succinct description of how viruses are classified structurally. Why have we not been able to develop a vaccine for HIV?	(13)
	c)	What is Liposome? Why do you choose Liposome in drug delivery? What are the applications of Liposome?	(12)

Khulna University of Engineering & Technology
B. Sc. Engineering 4th Year 2nd Term Regular Examination, 2021
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BME 4217
Rehabilitation Engineering

Time: 3 Hours **Full Marks: 210**

N.B. i) Answer **any THREE** questions from each section in separate scripts
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Section A

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

1. a) Write down the process of Rehabilitation. Mention the major activities in Rehabilitation Engineering. (10)

b) What is Physiological sensor? Draw and design a Biotextile-based T-shirt for a handicap child with short description. (15)

c) Classify handicap according to WHO. Show the relationship between impairment, disability, and handicap both from scientific aspect and medical perspective. (10)

2. a) What is Epidemiological Triad? Explain the COVID-19 diseases by this epidemiological trial. (10)

b) Illustrate the interaction between a physiatrist and other core members of the rehabilitation team. (12)

c) Define Prevention. What are the different level of prevention? Explain with short description. (13)

3. a) What is decondition? Write down the cycle of deconditioning. (07)

b) What is Argus II? What factors should you take into account when selecting writing aids? (08)

c) "A 89 years old man suffering from stroke and paralyzed for 1 year"- Suggest and design a bed for the patient. (15)

d) Write a short note on 'Visual communication'. (05)

4. a) Write down the parts of inner ear. Draw the auditory pathway. (08)

b) What are the types of deafness? Explain the sensori-neural types of deafness. (12)
A 6 months child has hearing loss then what are the process of hearing test for this child.

c) Draw the typical block diagram of a Cochlear Implant. (05)

d) What are the types of prosthesis? Briefly explain the Q angle, Tibiofemoral angle, mechanical axis, and anatomical axis. (10)

Section B

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

5. a) What is assistive technology? Describe the participatory action design model for developing assistive devices. (15)

b) What is telerehabilitation? How does the concept of person and society aid in the acceptance of assistive technology? (10)

c) Design a prosthetic Elbow. Write down the material you want to use in your proposed prosthetics and why? (10)

6. a) Define orthotics. List the types of orthotic device with example. (10)

b) Discuss the biomechanical principles for designing orthotics device. Also compare the properties of orthotic materials with natural muscle. (13)

c) Explain the process of assessing abnormal gait in patients with cerebral palsy. (12)

7. a) What is calipers? Classify calipers. List the advantages and disadvantages of HKAFO. (12)

b) What is myoelectric prosthesis? Show the degrees of freedom in the hand for a myoelectric prosthesis. (10)

c) Write down an essay on the popular research projects for the development of prosthetic hands. (13)

8. a) What is mobility aid? Discuss some common mobility aids for the rehabilitation of impaired people. (15)

b) Analyze the clinical applications of soft-tissue prosthetics. (08)

c) Define craniofacial prosthesis. Illustrate a map showing both the traditional and advanced manufacturing approaches for soft tissue prosthetic. (12)

Khulna University of Engineering & Technology
B. Sc. Engineering 4th Year 2nd Term Regular Examination, 2021
Department of Biomedical Engineering

BME 4231
Telemedicine and Healthcare

Time: 3 Hours **Full Marks: 210**

N.B. i) Answer **any THREE** questions from each section in separate scripts
ii) Figures in the right margin indicate full marks.

Section A

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

1. a) What do you mean by telemedicine and teleconsultation? Briefly explain the technical factors need to be ensured for the quality of teleconsultation. (11)

b) Define telehealth. Discuss the safety and security issues in establishing a good telemedicine program. (12)

c) Describe the business plan required for launching a telehealth program. (12)

2. a) What are the possible ethical and legal challenges of telemedicine program? How would you encounter such conflicts? (20)

b) Draw the circuit diagram of a condenser microphone. Briefly discuss the T-carrier system used in digital transmission. (15)

3. a) Suppose, an overweight person has been advised to perform physical workout in order to improve his cardiovascular health. Now, design a telemedicine service to help him achieve a good health. (15)

b) Define HIS. Write down the relationship between PACS and HIS/RIS. (12)

c) Write short notes on (i) PAL vs NTSC, and (ii) eHealth. (08)

4. a) Write down an algorithm to encrypt a digital medical image using DNA cryptography. (15)

b) Perform compression of the following data using Lempel Ziv method. Then, decode the compressed data using the same method. (14)
Data: BAA BABBBAA BBBBAA

c) Draw the block diagram of JPEG compression process. (06)

Section B

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

5. Briefly explain (i) Bluetooth, (ii) OCC, (iii) RFID, (iv) WiFi, and (v) mobile communication technologies used in telemedicine and also mention their roles in telemedicine. Mention the prospects and limitations of each of the technologies in the deployment of telemedicine. (35)

6. a) A patient is admitted at Khulna medical college hospital. A doctor from USA is monitoring the patient. Draw the communication link between the patient and the doctor. Multiple options should be provided if possible in any part of the link. (10)

b) List the basic components of a communication system. Draw the block diagram of a communication system and explain each of the blocks. (10)

c) What are the specifications of 6G communication? How 6G can add new dimension of telemedicine? Briefly explain different multiple access techniques those can be used in telemedicine. (10)

d) What do you mean by OWC? Why OWC is a promising solution in telemedicine? (05)

7. a) Briefly explain the terms multicast, bus topology, full-duplex, LAN, and PAN. (10)

b) How optical fiber communication can play a significant role in telemedicine? Explain it. (08)

c) How GPS is needed in telemedicine? Explain the working principle of a GPS system. (08)

d) What are the advantages and limitations of satellite communication in telemedicine? Draw a scenario to provide the telemedicine service using satellite communication. (09)

8. a) Define BAN. Mention some key advantages and limitations of using BAN in different aspects. (10)

b) What do you mean by interference? What are the sources of interferences? What are the effect of interference in telemedicine? (05)

c) What do you mean by mHealth? Briefly explain the key success factors for mHealth. (10)

d) Explain the telemedicine framework for monitoring vital parameters in patients with respiratory diseases. (10)

Khulna University of Engineering & Technology
B. Sc. Engineering 4th Year 2nd Term Regular Examination, 2021
Department of Biomedical Engineering

BME 4221
Bioinformatics

Time: 3 Hours **Full Marks: 210**

N.B. i) Answer **any THREE** questions from each section in separate scripts
ii) Figures in the right margin indicate full marks.

Section A

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

1. a) Define Bioinformatics. Briefly discuss the key contributions of bioinformaticians in the current biological research. (10)

b) Find the global sequence alignment between the two sequences 'GTAACCTC' and 'GCAACTC' using dynamic programming. (Gap = -4, Mismatch = -3, and Match =1) (17)

c) What is Gumble extreme value distribution? Compare between PAM and BLOSUM matrices. (08)

2. a) Explain the process of FASTA for database similarity searching. (15)

b) What are some unique requirements for database searching? How can you avoid high similarity scores in the low complexity regions? (12)

c) What is dot plot method? Mention some advantages and disadvantages of this method. (08)

3. a) What does the propensity value mean? What are the steps involved in the Chou Fasman method to predict the secondary structure of protein? (12)

b) Illustrate the protein-protein interactions. Describe the significance of different types of protein-protein interactions. (10)

c) Discuss multiple sequence alignment and phylogenetic tree. Formulate a relationship among them. (08)

d) Write down a comparison between ortholog and paralog. (05)

4. a) Define functional genomics. Describe the DNA microarray-based global gene expression profiling method. (15)

b) Name a sequence-based approach for transcriptome analysis. Discuss the statistical matrices used in BLAST. (12)

c) What is dihedral angle? Illustrate the Ramachandran plot for secondary structure of protein. (08)

Section B

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

5. a) What is computational biology? Give an overview of various subfields of bioinformatics. (11)

b) Briefly discuss the structure and sequence format of GenBank. (12)

c) What is database? The following flat file contains records of five students from four different regions, each taking a different course. (12)

Name, Region, Course Number, Course Title| S. Saha, Noakhali, BME 3213, Biomechanics| I. Khan, Pabna, BME 4231, Telemedicine| S. Ahmed, Rangpur, Math 2115, Differential Equations| A. Naim, Khulna, CSE 1215, Computer Programming| M. Hasan, Noakhali, ME 1115, Engineering Drawing.

Construct a relational database.

6. a) Discuss the key features of the database retrieval system: Entrez. (12)

b) How could you accomplish a complex query in a database? (08)

c) Briefly discuss the modification process of a nascent eukaryotic transcript into a mature mRNA for protein translation. (15)

7. a) What is gene prediction? Describe the process of gene prediction in eukaryotes. (12)

b) What are the parameters used for evaluating the performance of gene prediction programs? Discuss them mentioning their limitations and remedies for limitations. (10)

c) What is natural selection in evolution? Why is it difficult to find a true phylogenetic tree? Give rationale discussion for both rooted and unrooted trees. (13)

8. a) When is the DNA based phylogeny preferable to protein based phylogeny? Give detailed insights into it by discussing the synonymous and nonsynonymous substitutions. (10)

b) Suppose, an alignment of sequences A and B is twenty nucleotides long and six pairs are different. Given, four and two pairs of the total differences are result of transitions and transversions, respectively. Find the true evolution distances between these sequences using Jukes-Cantor model and Kimura model. (11)

c) What is bootstrapping? Briefly discuss the classification of bootstrapping. (07)

d) Give a brief comparison among SAGE and DNA microarrays. (07)