# Question of Term Final Examination
# Khulna University

School: Life Science Discipline: Biotechnology and Genetic Engineering Program: Bachelor
Year: 4th Term: I Examination Year: 2026 Session: 2024-25
Course Code: 0512 07 BGE 4101 Course Title: Plant Biotechnology and Genetic Engineering
Total Marks: 60 Time: 3 Hours Credit: 03

- The figures in the margin indicate full marks. The questions are of equal value.
- Use separate script for each section.

**Section-A**

(There are four (04) questions in this section. Answer any three (03) questions.)

| Question no. | | Question Description | Marks | *Level ($L_1$-$L_6$) | CLO No. |
|---|---|---|---|---|---|
| 1. | (a) | What do you understand by the term "Green Revolution"? | 01 | 1 | 1 |
| | (b) | What were the adopted measures during "Green Revolution"? Explain also their impacts. | 03 | 2 | 1 |
| | (c) | "Green Revolution was a blessing as well as a curse"- justify the statement. | 03 | 5 | 1 |
| | (d) | In what situations are somatic hybridization technique used to develop a new variety? Illustrate protoplast fusion technique. | 03 | 2 | 1 |
| 2. | (a) | Define *in vitro* ploidy manipulation and explain the concepts of gene pools, diploid species and polyploidy | 03 | 1,2 | 1 |
| | (b) | Discuss gene transfer involving chromosomes or chromosome segments, future prospects of ploidy manipulation, and its implications in agriculture. | 04 | 1, 3, 4, 5 | 1 |
| | (c) | Explain the role of Biotechnology in the biological control of insects, pathogens, nematodes, and weeds, including biocontrol agents, integrated pest management, new diagnostic techniques, and detection of GM crops. | 03 | 2, 4, 5, 6 | 1 |
| 3. | (a) | Enlist five commercial biopesticides with their target pests. Discuss the prospects of biopesticides in Bangladesh. | 03 | 4,6 | 1 |
| | (b) | Analyze how pesticide overuse simultaneously contributes to residue problems, pest resistance and pest resurgence. | 03 | 4 | 1 |
| | (c) | Explain how fall armyworm population can be effectively managed in corn field using IPM strategies so that the pest remains below the economic threshold level. | 04 | 2 | 1 |
| 4. | (a) | Define biodiversity and explain its concept, components, levels, hierarchical patterns, and scales, including genetic diversity and its implications in agriculture. | 3 | 1, 2 | 1 |
| | (b) | Discuss the causes of erosion of genetic resources, losses of biodiversity, conservation strategies, and the role of biotechnology in utilization of plant genetic resources and biodiversity conservation. | 4 | 1, 3, 4, 5 | 1 |

| | | | | | |
|---|---|---|---|---|---|
| | (c) | Explain the concepts of patents and intellectual property rights (IPR), Plant Variety Protection (PVP), farmers' rights, and the Cartagena Protocol on Biosafety in relation to biotechnology applications in agriculture. | 3 | 2, 4, 5, 6 | 1 |

## Section-B

(There are four (04) questions in this section. Answer any three (03) questions.)

| Question no. | | Question Description | Marks | *Level ($L_1$-$L_6$) | CLO No. |
|---|---|---|---|---|---|
| 5. | (a) | Explain the mechanisms of insect resistance, disease resistance, and abiotic stress resistance in plants, with suitable examples. | 4 | 2, 3 | 1 |
| | (b) | Describe the role and mechanism of restriction enzymes and DNA modification enzymes in gene manipulation techniques. | 3 | 2, 3, 4 | 2 |
| | (c) | Discuss the prerequisites of plant genetic engineering, including essential tools, host system requirements, and vector systems used in transformation. | 3 | 4, 5, 6 | 1, 2 |
| 6. | (a) | Why is it essential to clearly define the intended biological objectives like gene knockout, knock-in, or sequence correction prior to designing a CRISPR-based experiment? | 02 | 2,5 | 2 |
| | (b) | How does sgRNA sequence specificity influence the success and safety of gene editing? | 04 | 2 | 2 |
| | (c) | How would you distinguish between homozygous and heterozygous mutations? | 02 | 4 | 2 |
| | (d) | Interpret why is mosaicism a challenge in embryo editing experiments. | 02 | 2 | 2 |
| 7. | (a) | Describe the stepwise process for development of transgenic plants, including vector preparation and key stages of transformation. | 4 | 1, 2 | 1 |
| | (b) | Explain the mechanism of *Agrobacterium*-mediated gene transfer methods in plants. Compare relative advantages and disadvantages of *Agrobacterium* and biolistic methods of gene transfer. | 3 | 2, 3, 4 | 2 |
| | (c | Discuss CRISPR-Cas9 genome editing technology, including its mechanism, and describe strategies for stable foreign gene expression in plants, highlighting key challenges and solutions. | 3 | 3, 4, 5, 6 | 1, 2 |
| 8. | (a) | Describe the techniques used for plant variety identification and selection of segregating populations, with emphasis on selection of quantitative traits in plant breeding. | 4 | 1, 2 | 1 |
| | (b) | Explain the concepts of QTL mapping and genome-wide association studies (GWAS) and their role in identifying genetic variation for important agronomic traits. | 3 | 2, 3, 4 | 2 |
| | (c | Discuss marker-assisted gene introgression, gene pyramiding, and PCR-based cloning, including their applications in molecular breeding and molecular farming for genetic improvement of crops. | 3 | 3, 4, 5, 6 | 1, 2 |

# Question of Term Final Examination
# Khulna University

School: Life Science Discipline: Biotechnology and Genetic Engineering Program: Bachelor

Year: 4th Term: I Examination Year: 2026 Session: 2024-25

Course Code: 0512 07 BGE 4103 Course Title: Animal Biotechnology and Genetic Engineering

Total Marks: 60 Time: 3 Hours Credit: 03

- The figures in the margin indicate full marks. The questions are of equal value.
- Use separate script for each section.

**Section-A**

(There are four (04) questions in this section. Answer any three (03) questions.)

| Question no. | | Question Description | Marks | *Level ($L_1$-$L_6$) | CLO No. |
|---|---|---|---|---|---|
| 1. | (a) | "Biotechnology has revolutionized animal production"- justify the statement with examples. | 03 | 5 | 1 |
| | (b) | Explain the importance of molecular and reproductive biotechnological approaches in improving livestock productivity. | 04 | 4 | 1 |
| | (c) | Outline the key points in the management of donor and recipient herds in embryo transfer programs. | 03 | 2 | 1 |
| 2. | (a) | Describe the methods of super-ovulatory treatments in cattle. | 04 | 3 | 1 |
| | (b) | Why is accurate oestrus detection essential in embryo transfer programs? Discuss the signs and methods of oestrus detection. | 04 | 5 | 1 |
| | (c) | Why are bovine embryos usually recovered on days 6-8 after oestrus? Explain the significance of this recovery period. | 02 | 4 | 1 |
| 3. | (a) | Illustrate the process of embryo transfer into the ipsilateral horn of the uterus. | 04 | 3 | 1 |
| | (b) | Discuss the criteria used for morphological evaluation of bovine embryos. | 04 | 5 | 1 |
| | (c) | Briefly describe sperm capacitation, the acrosome reaction, and the development of embryos to the transferable stage. | 02 | 4 | 2 |
| 4. | (a) | Define metabolomics and metabonomics. | 02 | 1 | 4 |
| | (b) | Discuss the applications of metabolomics in livestock production systems. | 04 | 1 | 4 |
| | (c) | Explain how dietary components influence gene expression and metabolite production in animals. | 04 | 4 | 4 |

## Section-B

(There are four (04) questions in this section. Answer any three (03) questions.)

| Question no. | | Question Description | Marks | *Level ($L_1$-$L_6$) | CLO No. |
|---|---|---|---|---|---|
| 5. | (a) | Define transgenic animals. Explain the significance of transgenic animals in medical research. | 03 | 2,4 | 4 |
| | (b) | Describe the applications of transgenic livestock in biotechnology. | 03 | 3 | 4 |
| | (c) | Compare between DNA microinjection and stem cell mediated gene transfer. | 04 | 5 | 3 |
| 6. | (a) | What is partial zona dissection (PZD)? | 02 | 1,4 | 3 |
| | (b) | Discuss different micromanipulation-assisted fertilization techniques used in reproductive biotechnology. | 04 | 1 | 3 |
| | (c) | Discuss factors affecting the success of micromanipulation-assisted fertilization. | 04 | 1,4 | 3 |
| 7. | (a) | What is therapeutic cloning? | 02 | 2 | 3 |
| | (b) | Explain the potential applications of cloning in endangered species conservation. | 04 | 2 | 3 |
| | (c) | Define surrogate mother. Explain ethical concerns associated with human cloning. | 04 | 1 | 3 |
| 8. | (a) | What is recombinant vaccine? Explain different categories of recombinant vaccines with suitable examples. | 06 | 3 | 5 |
| | (b) | Describe the recent advances and future prospects of recombinant vaccines in livestock industries. | 04 | 6 | 5 |

# Question of Term Final Examination
# Khulna University

School: Life Science Discipline: Biotechnology and Genetic Engineering Program: Bachelor

Year: 4th Term: I Examination Year: 2026 Session: 2024-25

Course Code: 0512 07 BGE 4105 Course Title: Microbial Biotechnology and Genetic Engineering

Total Marks: 60 Time: 3 Hours Credit: 03

- The figures in the margin indicate full marks. The questions are of equal value.
- Use separate script for each section.

**Section-A**

(There are four (04) questions in this section. Answer any three (03) questions.)

| Question no. | | Question Description | Marks | Level ($L_1$-$L_6$) | CLO No. |
|---|---|---|---|---|---|
| 1. | (a) | Explain microbial biotechnology. | 02 | 2,5 | 1,2 |
| | (b) | Evaluate the application of microorganisms in agriculture to ensure global food security. | 04 | 5,6 | 2,3 |
| | (c) | Explain functional foods prepared through the fermentation process using microorganisms. | 04 | 3,4 | 2,4 |
| 2. | (a) | What is single-cell protein (SCP)? Classify microbes that are being employed as SCP. | 03 | 1 | 2 |
| | (b) | What is gene library? Compare and contrast between cDNA and genomic DNA library. | 04 | 2 | 3 |
| | (c) | Describe a genetic transformation approach for prokaryotes with proper illustration. | 03 | 3 | 2 |
| 3. | (a) | Define restriction endonuclease. Compare and contrast among restriction endonucleases. | 04 | 1,2 | 1,2 |
| | (b) | The table below shows DNA fragment sizes (in kilobase pairs) after single and double restriction digestions of a plasmid of 12.0 kb. Using the data, construct a restriction site map on the plasmid. | 04 | 4,6 | 4 |

| BamH1 | HaeII | BamHI+HaeII |
|---|---|---|
| 12.0 | 6.0 | 6.0 |
| | 4.0 | 4.0 |
| | 2.0 | 1.5 |
| | | 0.5 |

| | | | | | |
|---|---|---|---|---|---|
| | (c) | Illustrate the special features of pBR322 plasmid that warranted its use as a successful cloning vector. | 02 | 4,6 | 4 |

| | | | | | |
|---|---|---|---|---|---|
| 4. | (a) | Define and explain the mechanisms of antibiotic resistance. Why is it a global problem? | 03 | 1,2,4 | 1,2 |
| | (b) | Describe the isolation and improvement scheme of an antibiotic producing bacterium from soil. | 04 | 6 | 3,4 |
| | (c) | Describe the Ames (1973) test to detect carcinogens. | 03 | 2,3 | 2,3 |

**Section-B**

(There are four (04) questions in this section. Answer any three (03) questions.)

| Question no. | | Question Description | Marks | Level ($L_1$-$L_6$) | CLO No. |
|---|---|---|---|---|---|
| 5. | (a) | Describe the steps involved in microbial protoplast fusion. | 04 | 2 | 1 |
| | (b) | How can protoplast fusion be applied in the form of molecular breeding in bacteria? Explain with suitable example. | 04 | 1,2 | 2 |
| | (c) | Compare and contrast between *E. coli* and *Saccharomyces cerevisiae* as host system in heterologous expression. | 02 | 2 | 1 |
| 6. | (a) | What are immobilization and co-immobilization of microorganism? | 02 | 1,2 | 1,2 |
| | (b) | Analyze the advantages of immobilizing whole microbial cells compared to using free cells or isolated enzymes in biotechnological processes. | 04 | 4,5 | 3 |
| | (c) | How can immobilized microorganisms be utilized for developing highly sensitive and stable biosensors? | 04 | 4,5 | 4 |
| 7. | (a) | Classify therapeutic agents that are being produced by rDNA technology. | 02 | 2 | 1 |
| | (b) | Explain how recombinant human insulin is being produced in *E. coli*. | 04 | 5 | 2 |
| | (c | Describe the production of hepatitis B virus surface antigen (hBsAg) in yeast. | 04 | 2 | 2 |
| 8. | (a) | Write short notes on any four (04) of the followings-<br>(a) Enzyme engineering<br>(b) Viral gene delivery system<br>(c) Genome shuffling<br>(d) Fusion protein<br>(e) Vector system | 2.5x4 =10 | 1,2,3 | 1,2, 3 |

# Question of Term Final Examination
# Khulna University

School: Life Science | Discipline: Biotechnology and Genetic Engineering | Program: Bachelor

Year: 4th | Term: I | Examination Year: 2026 | Session: 2024-25

Course Code: 051207 BGE 4107 | Course Title: Downstream Processing

Total Marks: 60 | Time: 3 Hours | Credit: 03

- The figures in the margin indicate full marks. The questions are of equal value.
- Use separate script for each section.

**Section-A**

(There are four (04) questions in this section. Answer any three (03) questions.)

| Question no. | | Question Description | Marks | *Level ($L_1$-$L_6$) | CLO No. |
|---|---|---|---|---|---|
| 1. | (a) | Why is market analysis important in downstream processing? Discuss with respect to possible product development in Bangladesh. | 04 | 1 | 2 |
| | (b) | Discuss the relationship between fermentation yield and cost of bioproducts. | 02 | 1 | 3 |
| | (c) | You are asked to produce acetic acid and antibiotic in two different bioreactors. Design your fermentation and bioseparation processes. | 04 | 1 | 5 |
| 2. | (a) | Define and classify filtration process. Explain the particle movement principles with proper illustrations. | 04 | 2 | 1,2 |
| | (b) | How does compressibility affect filtration process? Explain. | 02 | 2 | 4 |
| | (c) | Graphically calculate the membrane resistance and cake resistance of a test filter from the test data given below- | 04 | 2 | 3 |

| Filtration time (s) | Filtration volume (ml) |
|---|---|
| 5 | 40 |
| 10 | 55 |
| 20 | 80 |
| 30 | 95 |

Given: Filter area= 0.1 $ft^2$; viscosity= 0.011 kg/m.s; pressure drop= 25 in Hg; Feed density= 0.016 kg dry cake/l.

| | | | | | |
|---|---|---|---|---|---|
| 3. | (a) | What is the role of centrifugal force in separation? | 01 | 2 | 1 |
| | (b) | Differentiate between gravity settling and centrifugal settling. | 02 | 2 | 2 |
| | (c) | Derive the equation for terminal settling velocity for a free-falling object under gravity and centrifugal force. | 05 | 2 | 3 |
| | (d) | How does rotor radius affect RCF during centrifugation? | 02 | 2 | 2 |
| 4. | (a) | Classify cell disruption technique. Explain on what factors cell disruption method depends on. | 03 | 3 | 1,4 |
| | (b) | Explain how homogenizer design affects cell disruption. | 03 | 3 | 4 |
| | (c) | Define extraction. Explain the principle of a batch extraction process. | 04 | 3 | 1,4 |

## Section-B

(There are four (04) questions in this section. Answer any three (03) questions.)

| Question no. | | Question Description | Marks | *Level ($L_1$-$L_6$) | CLO No. |
|---|---|---|---|---|---|
| 5. | (a) | Define adsorption and desorption. | 02 | 1 | 2 |
| | (b) | Differentiate between physical and chemical adsorption. | 02 | 2 | 2 |
| | (c) | Write the importance of adsorption isotherm. | 02 | 3 | 2,3 |
| | (d) | Classify chromatography. Briefly describe about the principle and applications of HPLC for biological product purification. | 04 | 1,2 | 2,3 |
| 6. | (a) | What do you understand by $R_f$ value? | 01 | 1 | 2 |
| | (b) | How does temperature affect precipitation? | 02 | 1 | 3 |
| | (c) | Explain the precipitation technique using salt. | 03 | 2 | 2,3 |
| | (d) | Discuss the factors that can affect the performance of ion exchange chromatography. | 04 | 3 | 2,3 |
| 7. | (a) | What is isoelectric precipitation? | 01 | 1 | 2,3 |
| | (b) | Summarize the principles of precipitation. | 02 | 2 | 2,3 |
| | (c) | Discuss about the salting in and salting out effect in case of solubility of protein. | 03 | 2 | 2,3 |
| | (d) | Solubility of bovine serum albumin (BSA) is about 12 and 0.006 g/liter at ammonium sulfate concentrations of 2.5 and 3.5 M respectively. What is it's solubility at 3.0 M $(NH_4)_2SO_4$? | 04 | 4 | 2,3 |
| 8. | (a) | What is crystallization? | 01 | 1 | 2,3 |
| | (b) | Compare and contrast between ultrafiltration (UF) and reverse osmosis (RO). | 02 | 4 | 2,3 |
| | (c) | Write the importance of crystallization in various industries. | 03 | 3 | 2,3 |
| | (d) | Discuss various types of membrane geometries for ultrafiltration. | 04 | 4 | 2,3 |

# Question of Term Final Examination
# Khulna University

School: Life Science | Discipline: Biotechnology and Genetic Engineering | Program: Bachelor
Year: 4th | Term: I | Examination Year: 2026 | Session: 2024-25
Course Code: 0512 07 BGE 4109 | Course Title: Research Methodology
Total Marks: 60 | Time: 3 Hours | Credit: 03

- The figures in the margin indicate full marks. The questions are of equal value.
- Use separate script for each section.

**Section-A**

(There are four (04) questions in this section. Answer any three (03) questions.)

| Question no. | | Question Description | Marks | *Level ($L_1$-$L_6$) | CLO No. |
|---|---|---|---|---|---|
| 1. | (a) | Define research methodology. Why is research methodology considered more than simply using research methods? | 03 | 1,2 | 1 |
| | (b) | Why should a research problem be clearly defined before data collection begins? | 03 | 4 | 1 |
| | (c) | Explain why reproducibility is considered a hallmark of good scientific research. | 04 | 2 | 1,2 |
| 2. | (a) | Define research design. Discuss the importance of research design in scientific investigation. | 03 | 1,2 | 2 |
| | (b) | Differentiate between qualitative, quantitative, and mixed-methods research designs. | 03 | 2 | 2 |
| | (c) | A study aims to assess students' attitudes toward GMOs at a single point in time. Which research design would be most suitable? Justify your answer. | 04 | 5 | 2 |
| 3. | (a) | Discuss the advantages and limitations of secondary data in biotechnology research. | 03 | 1,2 | 3 |
| | (b) | What are FAIR principles? Explain the importance of FAIR principles in biotechnology research. | 03 | 2,3 | 4 |
| | (c) | Analyze why case study research is particularly useful for investigating complex real-world biological problems. | 04 | 3 | 4 |
| 4. | (a) | Why is critical literature review essential before formulating research objectives? | 03 | 4 | 5 |
| | (b) | What is peer review? Discuss the different types of peer review, including their advantages and disadvantages. | 04 | 1,2 | 5 |
| | (c) | Explain why ethical considerations are especially important in biotechnology and medical research. | 03 | 4 | 5 |

## Section-B

(There are four (04) questions in this section. Answer any three (03) questions.)

| Question no. | | Question Description | Marks | *Level ($L_1$-$L_6$) | CLO No. |
|---|---|---|---|---|---|
| 5. | (a) | Write down the basic concept of RRA and RRSA. How does RRSA overcome the limitations of RRA? | 03 | 4 | 1,2,3 |
| | (b) | Explain Solution Matrix Ranking with suitable examples. | 03 | 4 | 1,2 |
| | (c) | How is the Critical Path Method (CPM) applied in an Activity-on-node (AON) diagram for project maintenance? Explain with an example. | 04 | 6 | 1,2,3 ,4 |
| 6. | (a) | Describe the Logical Framework Matrix (LFM) and enumerate its key components, explaining the role of each element in project planning and evaluation. | 04 | 3 | 7 |
| | (b) | Differentiate between Project Performance Indicators and Logical Framework Matrix components in terms of function and purpose. | 03 | 4 | 7 |
| | (c) | What are the methods for evaluating the validity of research data and findings? | 03 | 3 | 7 |
| 7. | (a) | What is a confounding variable, and how does it influence the outcome and validity of a research study? | 03 | 1,4 | 7 |
| | (b) | Outline the process of conducting a literature review. How it can be presented in a structured format? | 04 | 6 | 6 |
| | (c) | Discuss the major ethical concerns in research. Why is ethical clearance necessary before conducting a study? | 03 | 3 | 7 |
| 8. | (a) | What are the guidelines for writing a structured abstract? | 04 | 3 | 6 |
| | (b) | What important aspects should be considered when preparing a research report? | 03 | 5 | 8 |
| | (c | How is research coordination conducted among universities in Bangladesh? State the common challenges dealt with this process. | 03 | 3,5 | 7 |

# Question of Term Final Examination
# Khulna University

School: Life Science | Discipline: Biotechnology and Genetic Engineering | Program: Bachelor

Year: 4th | Term: I | Examination Year: 2026 | Session: 2024-25

Course Code: 0512 07 BGE 4111 | Course Title: Bionanoscience

Total Marks: 60 | Time: 3 Hours | Credit: 02

- The figures in the margin indicate full marks. The questions are of equal value.
- Use separate script for each section.

**Section-A**

(There are four (04) questions in this section. Answer any three (03) questions.)

| Question no. | | Question Description | Marks | *Level ($L_1$-$L_6$) | CLO No. |
|---|---|---|---|---|---|
| 1. | (a) | Define bionanoscience. | 02 | 1,2 | 1 |
| | (b) | Electron and photon plays vital role in nano world-justify. | 04 | 2 | 2 |
| | (c) | Discuss diverse applications of nanomaterials in health and medicine. | 04 | 4 | 2 |
| 2. | (a) | What is bionanoassembly? Why bionanoparticles are superior to synthic nanopartciles? | 03 | 1,2 | 1 |
| | (b) | Compare and contrast the use of liposome and virus like particles as theranostic vehicle. | 03 | 5 | 2 |
| | (c) | How DNA origami was used to make controllable DNA box for drug delivery? | 04 | 4 | 2 |
| 3. | (a) | Identify the two major structural arrangements of carbon atoms found in Carbon Nanotubes (CNTs). | 03 | 4 | 1 |
| | (b) | Outline how structural biomolecules like DNA can be used as templates to assemble non-biological metal nanoparticles (DNA origami). | 04 | 2 | 2 |
| | (c) | State two distinct physical properties of graphene that make it useful for developing biosensors. | 03 | 1 | 1,2 |
| 4. | (a) | Define analyte and biorecognition element with examples. | 02 | 2 | 1 |
| | (b) | To detect whole Hantavirus immunologically targetting viral surface glycoprotein, draw the design diagram of a labelled and a lable free biosensor. | 04 | 5 | 2 |
| | (c) | Discuss the operational principle of amperometric and impedimetric biosensors. | 04 | 4 | 2 |

## Section-B

(There are four (04) questions in this section. Answer any three (03) questions.)

| Question no. | | Question Description | Marks | *Level ($L_1$-$L_6$) | CLO No. |
|---|---|---|---|---|---|
| 5. | (a) | Define top down and bottom up synthesis of nanoparticles. | 02 | 1,2 | 1 |
| | (b) | Describe stepwise processes of mechanical milling. | 03 | 2 | 2 |
| | (c) | What is coaxial electrospinning? | 02 | 3 | 1 |
| | (d) | Sputtering can produce thin film coating-justify. | 03 | 4 | 2 |
| 6. | (a) | What do you understand by solvothermal and hydrothemal method? | 02 | 2 | 1 |
| | (b) | What is atomic force microscopy (AFM)? Describe contact mode and non contact mode AFM. | 04 | 3 | 2 |
| | (c) | Describe the basic operational mechanism of a Transmission Electron Microscope (TEM) used to image nanomaterials. | 04 | 2 | 2 |
| 7. | (a) | Discuss fine detail of the three liposome-doxorubin formulation and characterization in pH sensitive antitumor therapy. | 05 | 2 | 2 |
| | (b) | How mRNA vaccine against Oropouche virus (OROV) was designed to produce VLP with high immunogenicity? Why ELISPOT was used? | 05 | 2,5 | 2 |
| 8. | (a) | Write short notes on any four of the followings- | 4x2.5 =10 | | |
| | | (i) Fullerene | | 4 | 2 |
| | | (ii) Optical biosensor | | 3 | 2 |
| | | (iii) Lithography | | 3 | 2 |
| | | (iv) Self assembled monolayer | | 2 | 2 |
| | | (v) Bionanotoxicology | | 2 | 2 |