

USN

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RV COLLEGE OF ENGINEERINGTM
(An Autonomous Institution Affiliated to VTU)
V Semester B. E. Examinations April/May-2024

Biotechnology

BIOSAFETY STANDARDS AND ETHICS

Time: 03 Hours

Maximum Marks: 100

Instructions to candidates:

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2 is compulsory. Answer any one full question from 3 and 4, 5 and 6, 7 and 8, 9 and 10.

PART-A

M BT CO

1	1.1	List the advantages of preserving of food with examples	02	1	1
	1.2	Mention the dangerous temperature of food preservation	02	1	1
	1.3	Mention the examples of food borne diseases.	02	1	3
	1.4	Give the importance of HEPA filters and examples	02	1	4
	1.5	Write the role of antibiotics in Poultry	02	1	1
	1.6	What is GHP? Explain its importance	02	1	3
	1.7	What is food sterilization? Give examples.	02	1	4
	1.8	What is biosafety committee and its functions?	02	2	1
	1.9	List out the unit operations applicable in food processing with suitable examples.	02	1	1
	1.10	Differentiate between LAF and Biosafety Cabinet	02	2	2

PART-B

2	a	Define biohazard and mention the various biohazards with example.	08	2	1
	b	Explain various biosafety levels using a triangular diagram	08	2	2
3	a	Mention various functions of IBSC with examples	08	3	2
	b	Define GMO. Explain 1 st Generation , 2 nd Generation GM food.	08	2	1
		OR			
4	a	Write short notes on i)RCGM ii)GEAC	08	1	3
	b	Discuss on the salient features of Cartagena Protocol	08	1	2
5	a	List out the important food safety Standards and Regulations	08	2	2
	b	Mention the possible pathogens that can contaminate food and how do you prevent food contamination.	08	1	1
		OR			

6	a	Explain 7 basic principles of Hazard Analysis Critical Control Point (HACCP).	08	1	4
	b	Explain various biochemical analysis of food.	08	2	4
7		Explain chemical and physical method of food processing	16	2	2
		OR			
8	a	Classify food packaging methods and write an explanatory note on the novel food packaging methods.	08	4	4
	b	Write short notes on GMP and GLP	08	1	3
9	a	Discuss in detail about food and Drug administration.	08	5	2
	b	Write explanatory notes on food production and economics. Why is food production important to the economy?	08	2	3
		OR			
10	a	Differentiate between clinical ethics and bioethics.	08	3	3
	b	Discuss the limits of additives to be added to the food as per the standards.	08	4	4

USN | R | V | 2 | 2 | B | T | O | 5 | 6

RV COLLEGE OF ENGINEERING^(Aut)

(An Autonomous Institution Affiliated to VTU)

III Semester B. E. Examinations Apr/May-2024

Biotechnology

CELL AND MOLECULAR BIOLOGY

Time: 03 Hours

Maximum Marks: 100

Instructions to candidates:

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2 is compulsory. Answer any one full question from 3 and 4, 5 and 6, 7 and 8, 9 and 10.

PART-A

M BT CO

1	1.1	Mention the four hall marks of Programmed Cell Death.	02	1	1
	1.2	Name any one primary and one accessory pigments present in chloroplast.	01	1	1
	1.3	Where does Electron transport chain occur in mitochondria?	01	1	1
	1.4	Write any two functions of Proliferating cell nuclear antigen.	02	1	2
	1.5	Difference between Homologous and non-homologous recombination.	02	3	2
	1.6	In a bacterium, what happens when the levels of tryptophan is high?	01	1	2
	1.7	Name two proteins each involved in regulation of gene expression through GA and Auxin.	02	1	2
	1.8	Name the scientists who were awarded the Nobel prize for their discovery on RNA silencing.	01	1	2
	1.9	In LB bacterial medium, what does LB stand for?	01	1	2
	1.10	What is replica plating?	01	1	2
	1.11	Name any two types of sterilization of bacteria media.	02	1	1
	1.12	Differentiate between innate and adaptive immune response (any one each).	02	3	2
	1.13	Write any four diagnostic immunological techniques.	02	1	2

PART-B

<input checked="" type="checkbox"/>	a	Decipher the experiments to prove that DNA is the genetic material.	08	2	1
		Explain the major signaling pathways through which the extracellular messenger molecules elicit intracellular responses.			
3	a	Explain the mode of replication in telomeres.	06	2	1
		Explain the post translational mechanism and add a note on protein sorting pathways in eukaryotes.			
4	a	OR			
		Living organisms are continuously exposed to a myriad of DNA damaging agents that can impact health and modulate disease-states, but nature takes care through repair mechanism, in this context, explain in detail the types of repair mechanisms.	10	2	2
		Differentiate the cut-and-paste mechanism and copy-and-paste fashion of jumping elements into a new genomic location.			

5	a	The entire sustenance of an organism is largely through gene regulation, explain the mechanism emphasizing on the levels of gene regulation in eukaryotes.	08	3	3
	b	Identify and explain the technology that results in a gain of function of a gene or a completely knock out the gene function.	08	3	3
OR					
6	a	Write an explanatory note on Riboswitch.	06	1	2
	b	Steroid hormones are key regulators of a diverse array of physiological processes and its regulation plays a pivot role in development. Explain the mechanism of regulation of the same.	10	2	2
7	a	Illustrate and explain the structures of (3 marks each) i) Corona Virus ii) Spirulina iii) <i>Saccharomyces cerevisiae</i>	09	2	3
	b	Discuss the beneficial microflora and its applications in agriculture and industry.	07	3	3
OR					
8	a	Elaborate on the diseases caused by protozoa, bacteria and viruses.	10	2	3
	b	Demonstrate the horizontal gene transfer in bacteria emphasizing on the process of conjugation.	06	2	3
9	a	A diagnostic center in Bangalore is given 20 blood samples by a ICMR to detect antigen for particular viral disease. Identify and explain the assays the center conducts to detect the viral antigen.	10	4	4
	b	Elucidate the structure of Human immunoglobulin and add a note on its types.	06	2	3
OR					
10	a	The researcher at CCMB, Hyderabad working on cancer types is interested to delineate the mechanism of signaling pathways involved in tumorigenesis. Comment on the flow of study he follows for the same.	08	4	4
	b	Explain the types of vaccines and add a note on Corona vaccines.	08	2	3

USN | I | R | V | 2 | 2 | B | T | 0 | 5 | 6

RV COLLEGE OF ENGINEERING[®]
 (An Autonomous Institution Affiliated to VTU)
 III Semester B. E. Examinations Apr/May-2024

Biotechnology
UNIT OPERATIONS

Time: 03 Hours**Maximum Marks: 100****Instructions to candidates:**

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2 and 11 is compulsory. Answer any one full question from 3 and 4, 5 and 6, 7 and 8, 9 and 10.

PART-A

M BT CO

1	1.1	Mention the Reynolds's number value for laminar flow and turbulent flow.	02	1	1
	1.2	Define <i>NPSH</i> in pumps and write the Bernoulli equation.	02	1	1
	1.3	Mention the three forces used for size reduction.	02	2	3
	1.4	Mention the equation for Fourier's law of heat conduction with all the units of all the parameters.	02	2	2
	1.5	A feed containing 50 <i>mole percent</i> methanol and remaining water at its boiling point is to be separated into an overhead product with 98% methanol and a residue of 5% methanol. Find amount of bottom product (W).	02	3	4
	1.6	A copper block of 10 cm thick, one side of which is maintained at 0°C and the other at 100°C. The thermal conductivity can be assumed constant at 380 w/mK. Calculate steady state heat flux across a copper block.	02	3	2
	1.7	What is relative Volatility? Write its significance.	02	2	4
	1.8	List the different characteristics for selection of solvent for extraction.	02	1	4
	1.9	Define terminal settling velocity and free settling.	02	1	3
	1.10	What is constant pressure filtration?	01	2	3
	1.11	Name the most suitable multiple effect evaporator method of feeding for cold viscous.	01	1	3

PART-B

2	a	Derive an equation to calculate the <u>pressure drop in the simple U-tube manometer</u> .	08	3	1
	b	Explain <u>Newtonian and non-Newtonian liquids</u> with a <u>neat diagram</u> .	08	2	1
3	a	Develop a mathematical equation to determine the heat flow through a multi-layer cylindrical pipe.	09	3	2
	b	Compare the merits and demerits of orifice and venturimeter for the case of fluid flow measurements.	07	2	2
		OR			
4	a	With neat sketch, explain the construction and working principle of a <u>centrifugal pump</u> .	10	2	1
	b	Explain various modes of heat transfer with suitable examples.	06	2	2

5	a	With the help of a neat sketch, explain the working and construction of a <u>shell and tube heat exchanger</u> . Explain with a neat diagram, the <u>three-stage forward feeding multiple effect evaporators</u> .	10 06	2	2 2
		OR			
6	a	Describe capacity and economy of effect evaporator over single effect evaporator.	06	2	2
	b	With the help of a neat sketch, explain the working and construction of a double pipe heat exchanger.	10	2	2
7	a	Discuss the working principle of <u>vacuum leaf filter</u> .	08	2	3
	b	Explain the working mechanism of <u>ball mill</u> with a neat diagram.	08	2	3
		OR			
8	a	Develop an equation for one dimensional motion of particle through a fluid in gravitational field.	10	3	3
	b	Discuss the working principle of rotary drum filter with a neat diagram.	06	2	3
9	a	Discuss the principle of liquid extraction with an example.	07	2	4
	b	A binary mixture of water and toluene containing 40% of toluene is to be distilled at 1atm pressure to recover 98% of the toluene as a distillate, similarly 96% of water from the residue. Calculate D , L and W .	09	3	4
		OR			
10	a	Explain with a diagram, the mechanism of separation of components using a simple distillation.	07	2	4
	b	Derive Rayleigh's equation equation for differential distillation.	09	3	4

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RV COLLEGE OF ENGINEERING[®]

(An Autonomous Institution Affiliated to VTU)

III Semester B. E. Examinations Apr/May-2024

Biotechnology

THERMODYNAMICS AND BIOANALYTICAL TECHNIQUES

Time: 03 Hours

Maximum Marks: 100

Instructions to candidates:

- Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
- Answer FIVE full questions from Part B. In Part B question number 2 and 11 is compulsory. Answer any one full question from 3 and 4, 5 and 6, 7 and 8, 9 and 10.

PART-A

M BT CO

1	1.1	Water flow over a waterfall 100 min height. Take 1 kg of water as the system and assume that it does not exchange energy with its surroundings. What is the potential energy of the water at the top of the falls with respect to the base of the falls?	02	3	2
	1.2	A dead-weight gauge with a 1 cm diameter piston is used to measure pressures very accurately. In a particular instance a mass of 6.14 (including piston and pan) brings it onto balance. If the local acceleration of gravity is 9.82 m/s, what is the gauge pressure being measured. If the barometric pressure is 748 Torr, what is the absolute pressure?	02	3	2
	1.3	Define entropy and state the second law of thermodynamics.	02	2	1
	1.4	Mention any two principles of electrophoresis.	02	2	3
	1.5	Differentiate between Sedimentation and Centrifugation.	02	1	2
	1.6	Provide at least any two application of Raman Spectroscopy.	02	2	3
	1.7	Mention any two principles of mass spectroscopy.	02	2	2
	1.8	Differentiate between enthalpy and heat.	02	1	1
	1.9	Differentiate between Ideal gas and Real gas.	02	2	2
	1.10	Mention the lacuna of 1 st law of thermodynamics.	02	2	2

PART-B

2	a	Derive a mathematical equation for first law of thermodynamics for steady state flow process. Draw a neat diagram.	10	5	2
	b	Prove that $C_p = \left(\frac{\delta H}{\delta T}\right)_P$.	06	4	2
3	a	State Kelvin Planck and Clausius statement of second law of thermodynamics and show that they are equivalent.	08	2	2
	b	Develop an equation for constant volume, constant pressure and constant temperature processes involving ideal gas law.	08	4	2
		OR			
4	a	Develop a mathematical equation to determine the efficient of Carnot heat engine.	08	5	2
	b	Discuss the criteria for phase equilibrium and state.	08	5	2
5	a	Explain how to generate T-x-y diagram for H_2O -Methanol system.	08	4	3
	b	Derive an equation to calculate the fugacity of gases using compressibility factor method.	08	4	3

		OR			
6	a	Develop a relation for the effect of temperature on equilibrium constant.	08	4	2
	b	Explain how to generate a p-x-y diagram for H_2O -Methanol system.	08	5	3
7	a	Explain the principle and applications of agarose gel electrophoresis.	08	3	3
	b	Discuss the different components and its function in the FPLC.	08	3	3
		OR			
8	a	How the gel is produced in SDS-PAGE? Explain.	08	3	3
	b	Briefly explain the mechanism / concept of various types of chromatography and its specific applications.	08	2	4
9	a	Explain the principle operation and application at ultracentrifugation with a neat sketch.	08	3	4
	b	Explain the working principle and important parts of fluorescence microscope.	08	2	4
		OR			
10	a	Differentiate the analytical and preparative ultracentrifugation.	08	3	3
	b	Analyze the applications of turbidometry in pharmaceutical analysis, environmental monitoring and industrial quality control and its advantages.	08	3	4

Program	BIOTECHNOLOGY	
Course Title	Cell and Molecular Biology	
Course Code	BT233AI	

CONTINUOUS INTERNAL EVALUATION - I

Sem	III		January 2024
Max Marks	50	33	Max Duration

Instructions to Candidate: Answer all five full questions

Q.No.	QUESTIONS	Marks	BTL	CO
1.	Illustrate, elucidate and interpret the results of <u>Griffith</u> , and <u>Hershey-Chase</u> experiments on DNA.	10	2	3
2.	“ <u>Cell signaling</u> mechanism refers to the translation of an external signal into cells response” Substantiate with suitable example.	10	5	4
3.	Distinguish between intrinsic and extrinsic pathways of apoptosis.	10	4	2
4.	“ <u>ATP synthesis is coupled to electron transport in ‘Z’ scheme of photosynthesis</u> ” Justify.	10	5	4
5.	Compare and contrast prokaryotic DNA replication and eukaryotic DNA replication mechanisms.	10	4	2

CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
00	20	10	20	0	10	00	20	20	00



R.V. COLLEGE OF ENGINEERING

Autonomous
Institution Affiliated
To Visvesvaraya
Technological
University, Belagavi

Approved by AICTE
New Delhi, Accredited
By NBA, New Delhi

Program	BIOTECHNOLOGY	
Course Title	Cell and Molecular Biology	
Course Code	BT233AI	

CONTINUOUS INTERNAL EVALUATION – II

Sem	III	February 2024	
Max Marks	50	Max Duration	90 Min

Instructions to Candidate: Answer all five full questions

Q.No.	QUESTIONS	Marks	BTL	CO
1.	Compare and contrast rho-dependent and rho-independent prokaryotic transcription termination mechanisms.	10	4	2
2.	"General transcription factors play important role in eukaryotic transcription mechanism" Justify the statement with diagrammatic representation.	10	5	4
3.	Distinguish between nucleotide excision DNA repair system and SoS DNA repair system.	10	4	2
4.	<p><i>E.coli</i> is the best example to explain both positive and negative gene regulation mechanisms in prokaryotes. Induction and repression mechanisms in lac-operon and trp-operon is based on the type of sugar and concentration of tryptophan respectively present in the growth medium. Analyze the events that take place in <i>E.coli</i> in each of the following growth conditions:</p> <ul style="list-style-type: none"> a) Medium supplemented with lactose only b) Medium supplemented with glucose only c) Medium supplemented with both glucose and lactose d) Medium with high tryptophan concentration e) Medium with low tryptophan concentration 	03 01 01 03 02	4	4
5.	Gene expression in plants is regulated at different levels by variety of molecular mechanisms. In this context, illustrate and elucidate Auxin-mediated gene regulation in plants.	10	2	1

CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
10	20	00	20	0	10	00	30	10	00



Program	BIOTECHNOLOGY		
Course Title	Cell and Molecular Biology		
Course Code	BT233A1		
CONTINUOUS INTERNAL EVALUATION - III			
Sem	III		March 2024
Max Marks	50	Max Duration	90 Min

Instructions to Candidate: Answer all five full questions

Q.No.	QUESTIONS	Marks	BTL	CO
1.	Illustrate and elucidate the structure of yeast and Bacteriophage.	10	3	1
2.	Genome editing systems such as ZFNs, TALENs and CRISPR-Cas9 are used to modify the genome of an organism. A) These genome editing systems are very specific, and it performs based on the interaction between the molecules. Justify the statement. B) Compare TALENs with CRISPR-Cas9 genome editing system. C) Why are two domains required in genome editing system?	04 04 02	4	2
3. a. b.	Elucidate the various phases of bacterial growth curve. List any five human bacterial diseases with causative organism.	03 02	2	1
4. a. b.	Illustrate and explain various mechanisms of horizontal gene flow in bacteria. Illustrate and elucidate replica plating technique.	05 05	3	3
5	Suggest, illustrate, and elucidate a strategy for isolation of microorganisms from soil sample.	10	4	4

CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
20	10	10	10	0	10	20	20	00	00

DEPARTMENT OF

BIOTECHNOLOGY

Academic year 2023-2024 (Odd Sem)

Date	January 8, 2024	Maximum Marks	50 (1)
Course Code	BT232AT	Duration	90 min
Sem	III Semester	Closed Book Offline Test-I	

Bio Safety Standards and Ethics (Basket course)

Sl. No	Questions (Test)	M	BT-L	CO
1	Elaborate on various bio hazards from nature	10	2	1
2	List out and discuss biosafety levels with a neat triangular diagram	10	4	1
3	Explain with a help of a neat diagram, biosafety cabinet B2	10	4	1
4	Differentiate the bio safety cabinets I, II and III	10	2	1
5	Give details on GMO and their applications in various fields	10	2	2

BT-L-Blooms Taxonomy, CO-Course Outcomes, M-Marks

Marks Distribution	Particulars		CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
	Test	Max Marks	40	10	---	---	---	---	30	20	---	--



**DEPARTMENT OF
BIOTECHNOLOGY**

Academic year 2023-2024 (Odd Sem)

Date	February 20, 2024	Maximum Marks	50
Course Code	BT232AT	Duration	90 min
Sem	III Semester	Closed Book Offline Test-2	

Bio Safety Standards and Ethics (Basket course)

Sl. No	Questions (Test)	M	BT-L	CO
1.	Explain briefly the importance of The Cartagena Protocol on Biosafety	10	2	3
2	Mention the physical, chemical, and biological hazardous material which contaminate the food.	10	2	3
3	List out various methods to eliminate the chemical, Biological and physical hazardous materials from food.	10	3	3
4	Explain the terms FSSAI & HACCP, Elaborate on the seven principles of HACCP.	10	3	4
5a	Illustrate on various Techniques that take place in a food testing laboratory.	5	4	4
b	Mention and briefly explain the five methods used for food analysis applicable to samples	5	4	4

BT-L-Blooms Taxonomy, CO-Course Outcomes, M-Marks

Marks Distribution	Particulars		CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
	Test	Max Marks	---	--	30	20	---	20	20	10	---	--

DEPARTMENT OF

BIOTECHNOLOGY

Academic year 2023-2024 (Even Sem)

Date	January 2024	Maximum Marks	50
Course Code	BT235A1	Duration	90 min
Sem	III Semester	Closed Book Offline Test-I	
Thermodynamics and Bioanalytical techniques			

Sl. No	Questions (Test)	M	BT-L	CO
1.	Define the following System and surroundings Open, closed, and isolated system State and properties	5	2	1
2	Mention the various units used to measure pressure, temperature, and energy and explain the deficiency of first law of thermodynamics	5	2	1
3a	Develop a mathematical equation to determine enthalpy in a flow process with a neat diagram	10	4	1
3b	A steam entering the turbine at 20 m, 15 m/s at a enthalpy of 2000 J and exit at 35 m, 20 m/s at a enthalpy 2520 J. if the system is adiabatic calculate the work done from the turbine to the surroundings in HP.	8	3	1
4	Show that $C_P - C_V = R$	2	4	2
5	Develop a mathematical equation to determine the efficiency of the Carnot cycle with a neat diagram.	10	5	2
5	Develop a equation for various processes involving ideal gas law (Isobaric, isochoric and adiabatic)	10	4	1

BT-L-Blooms Taxonomy, CO-Course Outcomes, M-Marks

Marks Distribution	Particulars		CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
	Test	Max Marks	38	12	---	---	---	10	08	22	10	--

Academic year 2023-2024 (ODD Sem)

DEPARTMENT OF BIOTECHNOLOGY

Date	Feb 2024	Maximum Marks	60
Course Code	BT235AI	Duration	90 Min
Sem	Semester III	Closed Book offline Test-2	

THERMODYNAMICS AND BIOANALYTICAL TECHNIQUES

Sl. No.	Questions	M	BT	CO																					
1A	Explain the applications of Gel filtration chromatography	10	2	3																					
1B	The relative molecular mass (Mr) of a protein was investigated by exclusion chromatography using a Sephadex G-200 column and using aldolase, catalase, ferritin, thyroglobulin and Blue Dextran as standard. The following elution data were obtained. What is the approximate Mr of the unknown protein? Explain.		&3																						
	<table border="1"> <thead> <tr> <th>Protein</th><th>Mr.wt</th><th>Retention volume</th></tr> </thead> <tbody> <tr> <td>Aldolase</td><td>158000</td><td>22.5</td></tr> <tr> <td>Catalase</td><td>210000</td><td>21.4</td></tr> <tr> <td>Ferritin</td><td>444000</td><td>18.2</td></tr> <tr> <td>Thyroglobulin</td><td>669000</td><td>16.4</td></tr> <tr> <td>Blue dextran</td><td>2000000</td><td>13.6</td></tr> <tr> <td>Unknown</td><td>?</td><td>19.5</td></tr> </tbody> </table>	Protein	Mr.wt	Retention volume	Aldolase	158000	22.5	Catalase	210000	21.4	Ferritin	444000	18.2	Thyroglobulin	669000	16.4	Blue dextran	2000000	13.6	Unknown	?	19.5			
Protein	Mr.wt	Retention volume																							
Aldolase	158000	22.5																							
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Thyroglobulin	669000	16.4																							
Blue dextran	2000000	13.6																							
Unknown	?	19.5																							
2 A	E. coli ribosomes contain three RNA molecules named for their sedimentation behavior: 15S, 25S, and 50S. Draw a diagram showing the approximate positions of the three RNA species following electrophoresis. Explain the reasons for the positions they occupy in the agarose gel.	10	2	3																					
2B			&3																						
	Explain the Principle and Applications of Agarose gel electrophoresis																								
3	Explain the Principle, Protocol and Applications of SDS PAGE	10	2	4																					
4	What is Centrifugation? Explain the different types of centrifuges.	10	2	4																					
5	Explain the principle and applications of Ion exchange Chromatography and Thin Layer chromatography	10	2	1																					

DEPARTMENT OF
BIOTECHNOLOGY
 Academic year 2023-2024 (Odd Sem)

Date	January 2024	Maximum Marks	50
Course Code	18BT43	Duration	90 min
Sem	III Semester	Closed Book Offline Test-III	
THERMODYNAMICS AND BIOANALYTICAL TECHNIQUES			

Sl. No	Questions (Test)	M	BT-L	CO
1.	Develop a equation to calculate the Mole fraction of more volatile component in liquid phase and vapor phase for ideal system	10	4	4
2	Develop a mathematical equation to determine the fugacity of the gaseous compound using compressibility factor	10	4	4
3a	Explore how turbidity measurements are utilized to monitor environmental pollutants and assess the health of aquatic ecosystems.	10	3	3
4 a	Discuss the utility of the Jablonski diagram in understanding photophysical processes such as absorption, fluorescence, and phosphorescence. Explain how the diagram visualizes electronic energy level transitions, vibrational relaxation, and intersystem crossing.	5	4	3
b	Discuss the importance of atomic absorption spectroscopy (AAS) in elemental analysis. Explore its applications in determining trace metal concentrations in environmental samples, food analysis, clinical diagnostics, and materials characterization	5	*	
4 5	Compare and contrast absorption and fluorescence spectrometry in terms of principles, instrumentation, applications, and advantages.	10	5	3
5	Explore how turbidity measurements are utilized to monitor environmental pollutants and assess the health of aquatic ecosystems.	10	4	2

BT-L-Blooms Taxonomy, CO-Course Outcomes, M-Marks

Marks Distribution	Particulars		CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
	Test	Max Marks	----	10	30	20	---	---	10	40	10	--

Academic year 2023-2024 (ODD Sem)

DEPARTMENT OF
BIOTECHNOLOGY

Date	08.01.2024
Course Code	BT234AI
Sem	III Semester

Maximum Marks	50
Duration	1.5 Hour
	CH-1

UNIT OPERATIONS

Instructions to students:

1. Answer any FIVE full questions;
2. All questions carry equal marks;

PART A

Sl. No.	Questions	M	BT	CO
1. a)	Define fluid static? Derive an equation for hydrostatic equilibrium.	08	3	1
b)	Find the pressure intensity at a depth of 20 m below the free surface of water.	02	3	1
2. a)	With the help of shear stress-shear rate diagram, explain the classification of fluids. Discuss their important characteristics	08	2	1
b)	It is impossible to have gauge pressures that are as low as -20 psig (pounds per square inch gauge). Justify this statement.	02	2	1
3.	State and derive the Bernoulli's theorem for steady state flow of an Incompressible fluid? List out all the assumptions	10	3	1
4. a)	What is a manometer? Explain about differential U tube manometer with a neat sketch and write its expression.	05	2	1
b)	Find the kinematic viscosity of an oil having density 981 kg/m^3 . The shear stress at a point in oil is 0.2452 N/m^2 . And velocity gradient at that point is $0.2 / \text{sec}$. $\tau = \mu \frac{du}{dy}$	05	3	2
5.	A simple manometer is used to measure the pressure of oil (sp.gr = 0.8) flowing in a pipe line. Its right limb is open to the atmosphere and left limb is connected to the pipe. The center of the pipe is 9 cm below the level of mercury (sp.gr = 13.6) in the right limb. If the difference of mercury level in the two limbs is 15 cm, estimate pressure of the oil in the pipe.	10	3	2



Department of Biotechnology

Date	FEB 22, 2024	Maximum Marks	50
Course Code	BT234AI	Duration	90 Min
Sem	III Semester	TEST 2	

UNIT OPERATIONS -BT234AI**Instructions to students:**

1. Answer **FIVE** full questions;
2. All questions carry equal marks;

Sl. No.	Questions	M	BT	CO
1	Describe with neat sketches the working of a Reciprocating pump. What are its advantages and demerits?	10	2	2
2	A pitot tube is inserted in a pipe of 30 cm diameter. The static pressure of the tube is 10 cm of mercury vacuum. The stagnation pressure at the center of the pipe recorded by the pitot tube is 1 N/cm^2 . Calculate the rate of flow of water through the pipe, if the mean velocity of flow is 0.85 times the central velocity.	10	3	3
3	A steel pipe ($K = 50 \text{ W/m.K}$) of I.D = 100 mm and O.D = 110 mm is to be covered with two layers of insulation, each having a thickness of 50 mm. Thermal conductivity of the first insulation material is 0.06 W/m.K and that of the second is 0.12 W/m.K . Calculate the loss of heat per meter length of pipe and the interface temperature between the two layers of insulation when the temperature of the inside tube surface is 250°C and that of the outside surface of the insulation is 50°C .	10	3	3
4	With the help of a neat sketch, explain the working and construction of a 2- 4 Shell and Tube exchanger.	10	2	2
5 a)	Compare the merits and demerits of Orifice meter and Venturi meter in the measurement of flow.	06	2	2
b)	Draw a neat sketch of backward feed multiple effect evaporation system and discuss the salient features. When is backward feed operation preferred over forward feed?	04	2	2



Department of Biotechnology

Date	MARCH 20, 2024	Maximum Marks	50
Course Code	BT234AI	Duration	90 Min
Sem	III Semester	TEST 3 (IMPROVEMENT)	

UNIT OPERATIONS -BT234AI

Instructions to students:

1. Answer any **FIVE** full questions.
2. All questions carry equal marks.

Sl. No.	Questions	M	BT	CO
1 a)	Distinguish between constant rate and constant pressure filtration	05	2	3
b)	Find the operating speed of ball mill from the following data. Diameter of the mill is 600mm, diameter of balls is 40mm and operating speed is 48% of critical speed.	05	3	3
2	Explain with neat diagram the working principle of leaf filter	10	2	3
3	3 kg/sec of material is crushed in a Jaw crusher such that the average size of the particle is reduced from 70 mm to 3.8 mm with a consumption of energy at the rate of 0.6 watt. Find the Rittinger's constant, kick's law constant, Bond's law constant.	10	3	3
4	Steel ball having a diameter of $20 \mu\text{m}$ is to be settled in water. The density of the steel ball is 7800 kg/m^3 . Calculate the terminal settling velocity of the steel ball. <u>Justify your answer</u>	10	3	3
5 a)	What is reflux, and the function of reboiler in distillation? how does reflux affect the efficiency of the distillation process?	05	2	4
b)	What is the signification of cake resistance? How is it estimated?	05	2	3

**Course: STATISTICS, LAPLACE
TRANSFORM AND NUMERICAL METHODS**
Course code: MAT231BT

TEST-1

Maximum marks: 50

Third semester 2023-2024
Branch: AS, BT, CH, IM, ME

Time: 10-11.30am
Date: 08/01/2024

Q.No	Answer all questions	M	BT	CO
1(a)	The functional form of a signal in time domain is given by $t e^{-4t} \sin 2t$, find its transform in frequency domain. (LT)	6	2	3
1(b)	Compute the Laplace transform of $f(t) = 5^t + 2\cos 4t \cos 2t$.	4	1	1
2	Find $L\left[\left(2\sqrt{t} - \frac{3}{\sqrt{t}}\right)^3 + \frac{\cos at - \cos bt}{t}\right]$.	10	2	2
3(a)	Express the following in terms of unit step function and hence find the Laplace transform of $f(t) = \begin{cases} \cos t, & 0 < t \leq \pi \\ 1, & \pi < t \leq 2\pi \\ \sin t, & t \geq 2\pi \end{cases}$	6	2	2
3(b)	Given $L\left[2\sqrt{\frac{t}{\pi}}\right] = \frac{1}{s^{3/2}}$ show that $L\left[\frac{1}{\sqrt{\pi t}}\right] = \frac{1}{\sqrt{s}}$.	4	2	3
4	A periodic function $f(t)$ of period $2a$, $a > 0$ is defined by, $f(t) = \begin{cases} E, & 0 \leq t \leq a \\ -E, & a < t \leq 2a \end{cases}$ Show that $L\{f(t)\} = \frac{E}{s} \tanh\left(\frac{as}{2}\right)$.	10	3	4
5(a)	The signal in frequency domain is given by $\frac{4s+5}{(s-1)^2(s+2)}$. Determine the transformation in time domain. (ILT)	6	3	3
5(b)	Find the inverse Laplace transform of $F(s) = \frac{(s+1)^2}{s^4}$	4	2	3

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

Marks Distribution	Particulars		CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
	Test	Max Marks	4	16	20	10	4	30	16	--	-	-

Department of Mathematics

Course: Statistics, Laplace transform and Numerical Methods

Course code: MA231TB

Test II

Maximum marks: 50

Third semester 2023-2024
(AS, BT, CH, IM, ME)

Time: 10 AM to 11:30 AM
Date: 20/02/2024

Instructions to candidates: Answer all questions.

Q.No	Questions	M	BTL	CO																											
1a	By using the convolution theorem evaluate: $L^{-1} \left[\frac{1}{(s+1)s^2} \right]$	5	1	1																											
1b	Solve $x''(t) + 9x(t) = \cos(2t)$, $x(0) = 1$, $x'(0) = \frac{12}{5}$ by method of Laplace transforms.	5	3	2																											
2 a	Evaluate: $L^{-1} \left[\frac{s e^{-\frac{s}{2}} + \pi e^{-s}}{s^2 + \pi^2} \right]$	5	2	1																											
2 b	The equations of regression lines of two variables x and y are $x - y = 0$, $4x - y = 3$ and the standard deviation of x is 1. Obtain the variance of y and the coefficient of correlation between x and y .	5	2	2																											
3	Compute the first four moments about the mean of the frequency distribution given below:	10	2	3																											
	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr> <tr> <td>f</td><td>1</td><td>8</td><td>28</td><td>56</td><td>70</td></tr> </table>	x	0	1	2	3	4	f	1	8	28	56	70																		
x	0	1	2	3	4																										
f	1	8	28	56	70																										
4	The following table gives ranking of 10 students according to their achievements in both the laboratory and lecture portions of an engineering course. Find the coefficient of rank correlation.	4	1	2																											
	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Lab(x)</td><td>8</td><td>3</td><td>9</td><td>2</td><td>7</td><td>10</td><td>4</td><td>6</td><td>1</td><td>5</td></tr> <tr> <td>Lecture(y)</td><td>9</td><td>5</td><td>10</td><td>1</td><td>8</td><td>7</td><td>3</td><td>7</td><td>2</td><td>6</td></tr> </table>	Lab(x)	8	3	9	2	7	10	4	6	1	5	Lecture(y)	9	5	10	1	8	7	3	7	2	6								
Lab(x)	8	3	9	2	7	10	4	6	1	5																					
Lecture(y)	9	5	10	1	8	7	3	7	2	6																					
4b	If the velocity V (km/hr) and the resistance R (kg/tonne) are related by a relation of the form $R = a + bV^2$, find a and b , by the method of least squares, given:	6	3	1																											
	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>V</td><td>10</td><td>20</td><td>30</td><td>40</td><td>50</td></tr> <tr> <td>R</td><td>8</td><td>10</td><td>15</td><td>21</td><td>30</td></tr> </table>	V	10	20	30	40	50	R	8	10	15	21	30																		
V	10	20	30	40	50																										
R	8	10	15	21	30																										
5	The following table shows the weights (z), heights (x) and ages (y) of 8 boys. Find the regression equation of z on x and y , estimate the weight of a boy who is 9 year old and 54 inches tall.	10	3	4																											
	$z_{xy} + z_{yz}$ <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>z (lbs.)</td><td>64</td><td>71</td><td>53</td><td>67</td><td>55</td><td>58</td><td>77</td><td>57</td></tr> <tr> <td>x (in.)</td><td>57</td><td>59</td><td>49</td><td>62</td><td>51</td><td>50</td><td>55</td><td>48</td></tr> <tr> <td>y (yrs.)</td><td>8</td><td>10</td><td>6</td><td>11</td><td>8</td><td>7</td><td>10</td><td>9</td></tr> </table>	z (lbs.)	64	71	53	67	55	58	77	57	x (in.)	57	59	49	62	51	50	55	48	y (yrs.)	8	10	6	11	8	7	10	9			
z (lbs.)	64	71	53	67	55	58	77	57																							
x (in.)	57	59	49	62	51	50	55	48																							
y (yrs.)	8	10	6	11	8	7	10	9																							

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

Particulars	C01	C02	C03	C04	L1	L2	L3	L4	L5	L6
Test	Max Marks	16	14	10	10	9	20	21	--	--

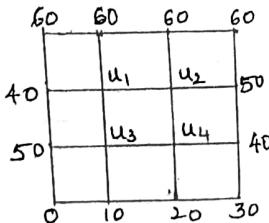


Department of Mathematics

Course: Statistics, Laplace Transforms and Numerical Methods Course code: MA231TB	Improvement Test	Maximum marks: 50
	III Semester (AS, BT, CH, JM, ME)	Time: 10.00AM-11.30AM Date: 19/03/2024

Instructions to candidates: Answer all questions

Q.No	Questions	M	BT	CO
1(a)	Find the Laplace transform of $e^{2t}(3t^5 - \cos 4t)$.	5	1	1
1(b)	Find the Laplace transform of $\frac{e^{at}-\cos bt}{t}$.	5	2	2
2(a)	Express the following function in terms of unit step function and hence find the Laplace transform of $f(t) = \begin{cases} 2t & \text{for } 0 < t < \pi \\ 1 & \text{for } t > \pi \end{cases}$	5	2	2
2(b)	Solve the parabolic equation $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$ with the conditions $u(0, t) = u(1, t) = 0$, $u(x, 0) = x(1 - x)$. Assume $\Delta x = h = 0.2$. Tabulate $u(x, t)$ for 3 levels of time using Bredre Schmidt Method.	5	3	3
3	Find the solution of one-dimensional wave equation $u_{tt} = u_{xx}$ up to $t = 0.5$ with a spacing of $\Delta x = h = 0.1$ and $\Delta t = k = 0.1$ subject to $u(0, t) = 0$, $u(1, t) = 0$, $u_t(x, 0) = 0$ and $u(x, 0) = 10 + x(1 - x)$.	10	3	3
4	The temperature distribution $u(x, t)$ is modelled as one-dimensional heat equation $\frac{1}{4}u_t = u_{xx}$ for $0 \leq x \leq 4$ subject to the boundary conditions $u(0, t) = u(4, t) = 0$ and initial condition $u(x, 0) = \frac{x(4-x)}{2}$. Determine the temperature distribution $u(x, t)$ by taking $\Delta x = h = 1$ and $\Delta t = k = \frac{1}{16}$ using Schmidt relation for 4 levels.	10	3	4
5	Solve the Laplace equation $u_{xx} + u_{yy} = 0$ given the square mesh (Carry out five iterations).	10	3	3



BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

Marks Distribution	Particulars	CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
	Max Marks	5	10	25	10	5	10	35	--	--	--

***** ALL THE BEST *****

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RV COLLEGE OF ENGINEERING®

(An Autonomous Institution Affiliated to VTU)

III Semester B. E. Examinations April-2024

Common to AS, BT, CH, IEM, ME

STATISTICS, LAPLACE TRANSFORM AND NUMERICAL METHODS

Time: 03 Hours

Maximum Marks: 100

Instructions to candidates:

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2 is compulsory. Answer any one full question from 3 and 4, 5 and 6, 7 and 8, 9 and 10.
3. Use of scientific calculator and hand book for mathematics is permitted.

PART-A

M CO BT

1	1.1	If the first four moments of a distribution about the value 25 of the variables are $-3, 11, -29$ and 71, then the second moment about the mean is _____.	02	2	1
	1.2	The equations of regression lines are $y = 0.5x + 1$ and $x = 0.4y + 3$. The correlation coefficient is _____.	02	2	2
	1.3	The real part of the complex function $f(z) = \log_e z$ in cartesian co-ordinate system is _____.	02	1	1
	1.4	Taylor's series expansion of $\cos z$ about the point $z = \frac{\pi}{4}$ is _____.	02	1	2
	1.5	The Laplace transform of the signal $f(t) = t + \cos 2t$ is _____.	02	1	1
	1.6	Region of convergence of $L[a^t]$ to hold good is _____.	02	1	1
	1.7	$L^{-1} \left[\frac{1}{4s-1} \right] =$ _____.	02	2	1
	1.8	If $F(s) = \frac{1}{s^2+4s+4}$, then the inverse Laplace transform of $F(s) =$ _____.	02	1	2
	1.9	The equation $u_{xx} + u_{yy} - 4u_x - 6u_y = 3$ is classified as _____.	02	1	1
	1.10	For the one dimensional wave equation $u_{xx} = u_{tt}$ with the boundary conditions $u(0, t) = 0, u(1, t) = 0, u_t(x, 0) = 0$ and $u(x, 0) = x - x^2$, the value of $u(0.25, 0.25)$ by taking $h = 0.25$ and $k = 0.25$ is _____.	02	2	2

PART-B

- a* From the following frequency distribution, compute first three moments about the mean.

x	1	2	3	4	5	6
f	1	6	13	25	30	22

05 3 2

- b* A simply supported beam carries a concentrated load P at its mid-point. Corresponding to various values of P , the maximum deflection Y is measured and is given in the following table.

P	100	120	140	160	180	200
Y	0.45	0.55	0.60	0.70	0.80	0.85

Fit a law of the form $Y = a + bP$ and hence estimate Y when P is 150.

06 2 3

	Calculate the rank correlation coefficient from the following data:	$\begin{array}{ c c c c c c c c c } \hline x & 81 & 78 & 73 & 73 & 69 & 68 & 62 & 58 \\ \hline y & 10 & 12 & 18 & 18 & 18 & 22 & 20 & 24 \\ \hline \end{array}$	05	3	3
3 a	Determine the analytic function whose real part is $u = e^x(x \cos y - y \sin y)$ by Milne-Thomson method. Also find its harmonic conjugate v .		08	2	2
b	Obtain the Laurent's series expansion for $f(z) = \frac{1}{(z+1)(z+3)}$ in the region		08	2	2
	i) $1 < z < 3$ ii) $ z > 3$ iii) $ z < 1$				
	OR				
4 a	Find the analytic function $f(z) = u + iv$ where $u - v = 2xy + x^2 - y^2 + x - y$.		08	2	2
b	Evaluate the integral $\int_C \frac{e^{2z}}{(z+1)(z-2)^2}$ where C is the circle $ z = 3$ using Cauchy's residue theorem.		08	2	2
5 a	A periodic function $f(t)$ of period $2a, a > 0$ is defined by $f(t) = \begin{cases} K & 0 \leq t \leq a \\ -K, & a < t \leq 2a \end{cases}$				
b	Show that $L\{f(t)\} = \frac{K}{s} \tanh\left(\frac{as}{2}\right)$ Obtain the Laplace transform of $\frac{e^{-t}-e^{7t}}{t} + \left(2\sqrt{t} - \frac{3}{\sqrt{t}}\right)^3$		08	2	2
	OR		08	3	3
6 a	Express the following in terms of unit step function and hence find the Laplace transform of				
b	$f(t) = \begin{cases} 3t^2 & 0 < t < 3 \\ 5t & t > 3 \end{cases}$ Find $L\left\{e^{-t} \left(\int_0^t t \sin 4t dt\right) + \cos 2t \sin 5t\right\}$		08	2	2
			08	3	3
7 a	The signal in frequency domain is given by $\frac{s}{(s-3)(s^2+4)}$. Determine the transformation in time domain.		08	3	2
b	Employing convolution theorem, find inverse Laplace transform of $\frac{1}{(s^2+a^2)^2}$		08	4	3
	OR				
8 a	Evaluate $L^{-1}\left[\frac{s+1}{s^2-s+1}\right]$		08	3	2
b	Solve the differential equation using Laplace transform given $\frac{d^2y}{dt^2} - 3 \frac{dy}{dt} + 2y = 12e^{-t}$ when $y(0) = 2$ and $y'(0) = 6$.		08	4	3
✓ a	Determine the value of $u(x,y)$ satisfying the Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ at the pivotal points of a square region with boundary values as shown in Fig 9a.				
	 Fig 9a				
	Carry out 3 iterations.		08	4	2

	b	<p>Employ Bendre-Schmidt method with $h = 1$ to find the values of $u(x, t)$ upto $t = 1$ for the equation $2 \frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$, $0 < x < 4, t > 0$ under the conditions</p> $u(x, 0) = x(4 - x), \quad 0 < x < 4$ $u(0, t) = u(4, t) = 0, \quad t \geq 0$	08	3	3
10	a	<p>The temperature distribution $u(x, t)$ is modeled as the one-dimensional heat equation $\frac{\partial u}{\partial t} = \frac{4}{5} \frac{\partial^2 u}{\partial x^2}$, $0 < x < 100, t > 0$ subject to the boundary conditions $u(0, t) = 0 = u(100, t)$, $t \geq 0$ and the initial condition $u(x, 0) = \begin{cases} x, & 0 \leq x \leq 50 \\ 100 - x, & 50 \leq x \leq 100 \end{cases}$</p> <p>Determine the temperature distribution $u(x, t)$ by taking $h = 20$ and $k = 10$ using Schmidt relation for 5 levels.</p>	08	3	2
	b	<p>Solve $\frac{\partial^2 u}{\partial t^2} = 16 \frac{\partial^2 u}{\partial x^2}$ taking $h = 1$ in five steps given that</p> $u(x, 0) = x^2(5 - x), \quad u_t(x, 0) = 0, \quad u(0, t) = u(5, t) = 0$	08	4	3