

TYBSC/2024-25

Exam. Seat No.

Total No. of Pages: 2

Total No. of Questions: 5

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)

Affiliated to Savitribai Phule Pune University, Pune
T.Y. B.Sc.

ELECTRONICS

Semester: VI

USEL361: Advanced Communication Techniques
(2022 Pattern)

(No. of credits -03)

Max. Marks: 60

Time: 2.00 Hours

Instructions to the candidates:

1. All questions are compulsory and carry equal marks.
2. Figures to the right indicate full marks.
3. Use of calculator is allowed.
4. Draw the neat diagram wherever necessary.

(1 Mark each)

Q.1 A) Attempt each of the following.

- i) Define modulation.
- ii) What is resonant antenna?
- iii) Which frequency range is used for mobile communication?
- iv) List active components used in balanced modulator.

(2 Mark each)

B) Attempt each of the following.

- i) Compare analog modulation and Digital modulation.
- ii) State application of space wave propagation.
- iii) Define virtual height and skip distance of sky wave propagation.
- iv) If the operating frequency of antenna is 1MHz then what is its mechanical length?

(4 Mark each)

Q.2 Attempt any three of the following.

- i) Compare TDM with FDM.
- ii) Write a note on Doppler Radar.
- iii) Write advantage and disadvantage of synchronous detector.
- iv) Define the following antenna parameters

- i) Band width
- ii) Radiation Resistance
- iii) Beam Width
- iv) Directive Gain

(6 Mark each)

Q.3 Attempt any two of the following.

- i) What is the principle used for balanced modulator? Explain the working of balanced modulator using FETs with neat diagram.
- ii) Explain construction of rhombic antenna. Draw its radiation pattern.
- iii) Draw the block diagram of delta modulation and explain its operation.

P.T.O.

Q.4 Attempt any two of the following.

- i) With the help of block diagram explain mobile receiver.
- ii) What is an ionosphere? Using neat diagram explain how the different layers of an ionosphere used for wave propagation.
- iii) What is PCM? State the advantages and disadvantages of PCM.

(6 Mark each)

Q.5 Attempt any one of the following questions.

- i) Draw the block diagram of phase shift method of SSB generation and explain its working. Derive expression for its output. Write its advantages and disadvantages.
- ii) a) Explain effect of ground on antennas.
b) Explain digital communication system suitable block diagram.

(12 Mark each)

Total No. of Questions: 5

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Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce,
Baramati.

(Autonomous)

Affiliated to Savitribai Phule Pune University, Pune.

T. Y. B. Sc.

ELECTRONICS

USEL362: Embedded System Design

(2022 Pattern)

Time: Two Hours

(No. of Credits 03)

Max Marks: 60

Instructions to Candidates:

1. All Questions are compulsory.
2. Neat Labeled Diagrams must be drawn whenever necessary
3. Use of calculator is allowed
4. Figures to the right indicate full marks

Q1. (A) Attempt each of the following.

(1 Mark each)

- (i) What is SBC?
- (ii) Write the data type for any single bit of port1.
- (iii) What is the function of Router in network access devices of SBCs.
- (iv) List any two features of Python.

(B) Attempt each of the following.

(2 Marks each)

- (i) Differentiate between C and Embedded C.
- (ii) Write any four features of Arduino microcontroller.
- (iii) Draw the TMOD register in 8051 microcontroller.
- (iv) What is the use of functions in programming?

P. T. O.

Q2. Answer any three of the following.

(4 marks each)

- (i) Write an 8051 C program to toggle only bit P1.5 continuously every 50 ms. Use timer 0, mode 1 (16 bit) to create the delay.
- (ii) What is Python? List any four features of Python.
- (iii) Explain LED blinking in Arduino with suitable code.
- (iv) Write an 8051 C program to generate a square wave and a triangular wave.

Q3. Answer any two of the following

(6 marks each)

- (i) Explain 8051C data types and their functions
- (ii) Write a note on Arduino UNO microcontroller board.
- (iii) Write a python program for addition and subtraction of two numbers.

Q4. Answer any two of the following

(6 marks each)

- (i) Write a note on various operators in Arduino.
- (ii) Write an 8051 C program to toggle the bits of P1 ports continuously with a 250 ms delay.
- (iii) Write a note on python variables and various data types used in Python.

Q5. Answer any one of the following

(12 marks each)

- (i) Write an 8051 C program to display "TYBSc" on LCD with the necessary interfacing diagram.
- (ii) Draw the diagram for LM35 interfacing with 8051 microcontroller and write down the program for displaying temperature. Also write down the features of LM35 sensor.

Exam Seat No.

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T. Y. B. Sc.

ELECTRONICS

Semester VI

USEL363: Power Electronics

(2022 Pattern)

Time: 2 Hours

(No. of Credits 03)

Max marks: 60

Instructions to the candidates:

- I. All questions are compulsory.
- II. Neat labeled diagrams must be drawn wherever necessary.
- III. Use of calculator and log table is allowed.
- IV. Figures to the right indicate full marks.

Q.1 (A) Attempt **each** of the following.

(1 Mark each)

- (i) Define power electronics.
- (ii) Draw symbol of Enhancement MOSFET.
- (iii) Write the principle of on-off control of AC voltage controller.
- (iv) List the types of microelectronic relays.

(B) Attempt **each** of the following.

(2 Marks each)

- (i) What is inverter? Give its types.
- (ii) Draw transient model of power BJT.
- (iii) Write down the general classification of DC power supply.
- (iv) Draw practical characteristics of switch.

Q.2 Attempt any **THREE** of the following.

(4 Marks each)

- (i) With the help of circuit diagram and output waveforms explain the working of phase angle control with resistive load.
- (ii) Write a note on IGBT.
- (iii) Differentiate single phase and three phase supply.
- (iv) What is SMPS? State the advantages of it.

P.T.O

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Seat No.

[Total No. of pages: 02

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
Empowered Autonomous
Department of Statistics
T.Y.B.Sc (Sem- VI)
USES364: Environmental Statistics
(2022 Pattern)

Time Allowed: 2.00 Hrs.

Max Marks: 60

Instructions:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Use of scientific calculator is allowed.
- 4) Symbols and abbreviation have their usual meaning.

Q.1) Attempt each of the following :

[1 each]

A) In each of the following cases, choose the correct alternative:

- i) The mid value of the class 120-130 is
a) 135 b) 125 c) 120 d) 110
- ii) For testing human blood group, which method of sampling is used?
a) SRSWOR b) SRSWR c) Stratified sampling d) Systematic sampling.
- iii) Probability is always lies between
a) -1 to 1 b) $-\infty$ to ∞ c) 0 to ∞ d) 0 to 1
- iv) Range of correlation coefficient is
a) -1 to 1 b) $-\infty$ to ∞ c) 0 to ∞ d) 0 to 1

B) Define the following:

[2 each]

- i) Impossible event
- ii) Sample space
- iii) Class width
- iv) Range

Q.2) Attempt any three of the following

[4 each]

- i) Draw histogram and frequency polygon for the following frequency distribution:

Class	0-5	5-10	10-15	15-20	20-25
Frequency	5	20	15	36	8

- ii) Explain simple random sampling with and without replacement.
- iii) Describe the relation between raw and central moments.
- iv) Let us consider the heights of 40 students selected at random from among those studying in a certain college.
144,120,132,130,163,140,135,160,155,175,132,150,162,142,151,138,
162,145,128,155,146,145,125,140,144,147,136,143,148,165,156,
155,158,156,155,151,163,153,157, 136.

Prepare a continuous frequency distribution of above data

[P.T.O]

Q.3 Attempt any **TWO** of the following.

(6 Marks each)

- (i) Explain the working of single phase transformer connection changers with the help of circuit diagram and output voltage waveforms for different control ranges.
- (ii) Derive an expression for anode current using two transistor model of thyristor.
- (iii) What is UPS? Explain the working of online UPS with the help of block diagram. State its advantages and disadvantages.

Q.4 Attempt any **TWO** of the following.

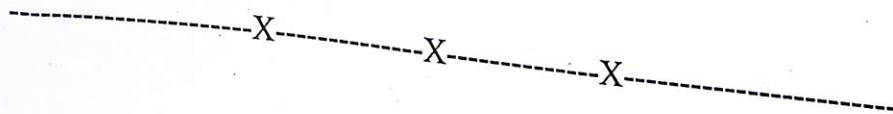
(6 Marks each)

- (i) Explain the working of single phase dual converter. Draw the waveforms across the load resistance for 30° firing angle of SCR.
- (ii) Describe switching characteristics of MOSFET. Compare BJT and MOSFET.
- (iii) Enlist the types of AC drives. Explain induction motor drives. Write the advantages of AC motor.

Q.5 Attempt any **ONE** of the following.

(12 Marks each)

- (i) a) State the various types of thyristors. Discuss the classification of power electronics circuits.
b) What is reverse recovery time? The reverse recovery time of a diode is $t_{rr} = 3 \mu s$ and the rate of fall of the diode current is $di/dt = 30 A / \mu s$. Calculate i) Q_{RR} ii) I_{RR}
- (ii) How diode rectifiers are differ than controlled rectifiers? With input output waveforms explain full wave rectifier with purely resistive load. Obtain an expression for average output voltage of it. Determine the efficiency and the form factor for FW rectifier circuit.



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Seat No.

[Total No. of pages: 02

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
Empowered Autonomous
Department of Statistics
T.Y.B.Sc (Sem- VI)
USES364: Environmental Statistics
(2022 Pattern)

Time Allowed: 2.00 Hrs.

Max Marks: 60

Instructions:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Use of scientific calculator is allowed.
- 4) Symbols and abbreviation have their usual meaning.

Q.1) Attempt each of the following :

[1 each]

A) In each of the following cases, choose the correct alternative:

- i) The mid value of the class 120-130 is
a) 135 b) 125 c) 120 d) 110
- ii) For testing human blood group, which method of sampling is used?
a) SRSWOR b) SRSWR c) Stratified sampling d) Systematic sampling.
- iii) Probability is always lies between
a) -1 to 1 b) $-\infty$ to ∞ c) 0 to ∞ d) 0 to 1
- iv) Range of correlation coefficient is
a) -1 to 1 b) $-\infty$ to ∞ c) 0 to ∞ d) 0 to 1

B) Define the following:

[2 each]

- i) Impossible event
- ii) Sample space
- iii) Class width
- iv) Range

Q.2) Attempt any three of the following

[4 each]

- i) Draw histogram and frequency polygon for the following frequency distribution:

Class	0-5	5-10	10-15	15-20	20-25
Frequency	5	20	15	36	8

- ii) Explain simple random sampling with and without replacement.
- iii) Describe the relation between raw and central moments.
- iv) Let us consider the heights of 40 students selected at random from among those studying in a certain college.

144,120,132,130,163,140,135,160,155,175,132,150,162,142,151,138,
162,145,128,155,146,145,125,140,144,147,136,143,148,165,156,
155,158,156,155,151,163,153,157, 136.

Prepare a continuous frequency distribution of above data

[P.T.O]

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Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)
Affiliated to Savitribai Phule Pune University, Pune

Class : T.Y.B.Sc
Subject-Electronics
Semester:-VI
Course Code:-USEL-364

Course Title:- NanoElectronics
(2022 Pattern)
(No. of Credit 03)

Time: 2.00 hours]

[Max marks: 60

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Neat labelled diagrams must be drawn wherever necessary.
- 3) Use of calculator and log table is allowed.
- 4) Figures to the right indicate full marks.

Q 1. (A) Attempt each of the following

(1 Marks each)

- i) Define time scale.
- ii) Write importance of nano electronics.
- iii) Define mobility.
- iv) State paulis exclusion principle.

(B) Attempt each of the following

(2 Marks each)

- i) What is hall effect.
- ii) State uncertainty principle.
- iii) What is the role of nanotechnology in electronics?
- iv) Give expression cyclotron frequency.

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Total No. of Pages: 2

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
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Affiliated to Savitribai Phule Pune University, Pune

Class : T.Y.B.Sc
Subject-Electronics
Semester:-VI
Course Code:-USEL-364
Course Title:- NanoElectronics
(2022 Pattern)
(No. of Credit 03)

Time: 2.00 hours]

[Max marks: 60

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Neat labelled diagrams must be drawn wherever necessary.*
- 3) *Use of calculator and log table is allowed.*
- 4) *Figures to the right indicate full marks.*

Q 1. (A) Attempt each of the following

(1 Marks each)

- i) Define time scale.
- ii) Write importance of nano electronics.
- iii) Define mobility.
- iv) State paulis exclusion principle.

(B) Attempt each of the following

(2 Marks each)

- i) What is hall effect.
- ii) State uncertainty principle.
- iii) What is the role of nanotechnology in electronics?
- iv) Give expression cyclotron frequency.

Q2. Attempt any three of the following.

(4 Marks each)

- i) State de-broglie assumption.
- ii) Discuss the electron transport in nanostructure.
- iii) Write Maxwell equation in differential form.
- iv) Explain wave particle duality of light.

Q3. Attempt any two of the following.

(6 Marks each)

- i) Derive an expression for wave equation of H.
- ii) Discuss in detail fermi dirac statistics.
- iii) Explain concept of quantum well.

Q4. Attempt any two of the following.

(6 Marks each)

- i) Write short note on density of state.
- ii) Describe the construction of resonant tunneling diode with proper diagram.
- iii) State and prove poynting theorem.

Q5. Attempt any one of the following.

(12 Marks each)

- i) Determine skin depth of copper at 60Hz, 1MHz and 30GHz.
- ii) Derive equation for Schrodinger time independent.

-----**BEST OF LUCK**-----

Total No. of Questions: 5

Exam. Seat No.

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Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)

Affiliated to Sayitribai Phule Pune University, Pune

T.Y. B.Sc.

ELECTRONICS

Semester VI

USEL 365: Mathematical Methods and Circuit Analysis using MATLAB
(2022 Pattern)

Time: 2.00 Hours]

[Max marks: 60

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Neat labelled diagrams must be drawn wherever necessary.
- 3) Use of calculator and log table is allowed.
- 4) Figures to the right indicate full marks.

Q. 1 All questions are compulsory.

1. What is the function of Transpose operator? [1]
2. Define modeling. [1]
3. What is 'clc' command in MATLAB? [1]
4. Write the function of % symbol used in MATLAB? [1]
5. Write MATLAB commands to label X & Y axis in graph. [2]
6. Define Laplace transform. Write expression for laplace transform. [2]
7. Compute output of following MATLAB program: [2]

```
>> a=7;  
>> E=3;  
>> d=[1, a+E, 4, E^2]
```
8. Write the main difference between the command 'who' & 'whos' [2]

Q. 2 Answer any three questions.

1. Explain 'While-end' loop used in MATLAB with suitable example. [4]
2. Find Laplace transform of $\cos \omega t$ and $\sin \omega t$. [4]
3. Write a note on script file. [4]
4. Expand the function as partial function. [4]

$$F(S) = \frac{2s+5}{s^2+5s+6}$$

Q. 3 Answer any two questions.

1. Find inverse Laplace transform of $F(s) = \frac{(S+3)}{(S+1)^2}$. Write MATLAB command to evaluate it. [6]
2. Explain plot command in MATLAB with color and type of marker options. [6]
3. Explain the following MATLAB commands/ functions. [6]
 - a) diag b) Meshgrid c) Title
 - d) colormap e) grid f) linspace

Q. 4 Answer any two questions.

1. What is the function of 'eye', 'zeros' & 'ones' command? Using these commands create 4 x 5 matrix in which the first two rows are 0's & next two rows are 1's. [6]
2. Write the MATLAB program that will find the following expression. [6]

$$S = \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \dots + \frac{1}{n!}$$

3. Find the laplace transform of series RL circuit. [6]

Q. 5 Answer any one questions.

1. What is MATLAB? Describe all MATLAB windows in detail. [12]
2. Draw I-V characteristics of semiconductor junction diode. Write current equation for it. Explain how polyfit function can be used to compute the best fit of set of data for plot of I-V characteristics. [12]

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Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)

T.Y. B.Sc. (Electronic Science)

USEL366: Industrial Automation Systems

(2022 Pattern) Paper-VI

Time: 2 Hrs]

[Max marks: 60

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Neat labelled diagrams must be drawn wherever necessary.
- 3) Use of calculator and log table is allowed.
- 4) Figures to the right indicate full marks.

Q. 1) All questions are compulsory.

- a) What is Seebeck effect? (01)
- b) What is Dead time element? (01)
- c) Define discrete state of the process. (01)
- d) Draw symbol of solenoid in ladder. (01)
- e) Write two parameters of thermistor. (02)
- f) What is active transducer? Give one example. (02)
- g) What is continuous control mode? (02)
- h) State in brief about Tran conductance amplifier. (02)

Q. 2) Attempt any THREE.

- a) Draw and explain LVDT.
- b) Draw instrumentation amplifier with three op amp circuit and explain it.
- c) Write note on "Hall Effect".
- d) Explain two position mode in detail.

Q. 3) Attempt any TWO.

- a) Write note on "Shielding and grounding".
- b) Which are the functional elements of instrument. Explain them in brief.
- c) Explain process lag and self regulation.

Q. 4) Attempt any TWO.

- a) Draw and explain "Optical encoder and Thermocouple" in brief.
- b) State and explain control system parameters.
- c) Write in detail about proportional derivative control mode.

Q. 5) Attempt any ONE.

- A. i) Explain error and control parameter range.
ii) Explain single channel data acquisition system.
- B. i) State and explain proportional integral control mode and its applications.
ii) State and explain proportional control mode with direct and reverse action.

Exam. Seat No.

Total No. of Questions: 05

Total No. of Pages: 01

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)
Affiliated to Savitribai Phule Pune University, Pune
T.Y. B. Sc
Zoology
Semester-V
USZL 351: Animal Systematics and Diversity-V
(2022 Pattern)

Time: Two Hours

No. of Credits:03

Max. Marks: 60

Instructions to the candidates:

- i. All questions are compulsory
- ii. Draw neat labelled diagram wherever necessary
- iii. All questions carry equal marks.

Q.1 (A) Attempt each of the following.

(1 Mark each)

- i) What is the spongocoel in sponges?
- ii) What is the function of the osphradium in *Pila*?
- iii) What is the function of Jacobson's organ in *Calotes*?
- iv) What is function of tentacle in *Pila*?

(B) Attempt each of the following.

(2 Marks each)

- i) What is a medusa in coelenterates?
- ii) What is pseudo-metamerism in Annelida?
- iii) What is the ctenidium in *Pila*?
- iv) Enlist importance of coral reefs.

Q.2 Attempt any three of the following.

(4 Marks each)

- i) Female reproductive system of *Calotes*.
- ii) Heart of *Scoliodon*.
- iii) Aquatic respiration in *Pila*.
- iv) Lateral line system in fishes.

Q.3 Attempt any two of the following.

(6 Marks each)

- i) What is a canal system? Explain the different types of canal systems in sponges.
- ii) Describe in female reproductive system of *Pila*.
- iii) Explain the different sense organs of *Calotes*.

Q.4 Attempt any two of the following.

(6 Marks each)

- i) Explain the systematic position and external characters of *Calotes*.
- ii) What is a dental formula? Explain dentition in mammals based on attachment of tooth.
- iii) Explain the evolution of kidney.

Q.5 Attempt any one of the following.

(12 Marks each)

- i) Describe the digestive system and associated glands of garden lizard.
- ii) Explain the systematic position, habit, habitat and external characters of the apple snail.

Exam Seat No.

Total No. of Questions: 05

Total No. of Pages: 1

Anekant Education Society's
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(Autonomous)

Affiliated to Savitribai Phule Pune University, Pune

T. Y. B. Sc.

ZOOLOGY

Semester-V

USZL-352: Mammalian Histology

(2022 Pattern)

Time: Two Hours

(No. of Credits 03)

Max. Marks: 60

Instructions to the candidates:

- i. All questions are compulsory.
- ii. Neat labelled diagrams must be drawn wherever necessary.
- iii. Figures to the right indicate full marks.

Q.1. (A) Attempt each of the following:

[1 mark each]

- i. Define histology.
- ii. Give any two applications of histology.
- iii. Define tissue.
- iv. Give the types of WBCs.

(B) Attempt each of the following:

[2 marks each]

- i. Enlist any four functions of epithelial tissue.
- ii. Give the function of ligament.
- iii. Give the function of muscle tissue.
- iv. Enlists the types of mucosa papillae.

Q.2. Attempt any three of the following:

[4 marks each]

- i. Describe simple cuboidal epithelial tissue in brief.
- ii. Write short note on scope of histology.
- iii. Sketch and label V.S. of skin.
- iv. Describe T. S. of vein.

Q.3. Attempt any two of the following:

[6 marks each]

- i. Describe compound epithelial tissue in detail.
- ii. Describe L.S. of kidney.
- iii. Describe histological structure of adrenal gland.

Q.4. Attempt any two of the following:

[6 marks each]

- i. Describe connective tissue in detail.
- ii. Describe T.S. of oesophagus.
- iii. Describe histological structure of ovary.

Q.5. Attempt any one of the following:

[12 marks each]

- i. Discuss on histology of adenohypophysis.
- ii. Discuss on fluid connective tissue.

Exam Seat No.

Total No. of Questions: 05

Total No. of Pages: 01

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)

Affiliated to Savitribai Phule Pune University, Pune

Class: T. Y. B.Sc.

Subject: Zoology

Semester V

USZL 354: Environmental Biology and Toxicology

2022 Pattern

Time: Two Hours

(Credits 03)

Max. Marks: 60

Instructions to the candidates:

i) All questions are compulsory.

ii) Neat labelled diagrams must be drawn wherever necessary.

iii) Figures to the right side indicate full marks.

Q1. (A) Attempt each of the following

(1 Mark each)

- i) Define environmental biology.
- ii) Give scope of environmental biology.
- iii) Define pollution.
- iv) Define population size.

(B) Attempt each of the following

(2 Marks each)

- i) What are toxicants? Enlist its types.
- ii) Define LD₅₀ and LC₅₀.
- iii) Give scope and branches of toxicology.
- iv) Define ecosystem and enlist its biotic and abiotic components.

Q2. Attempt any three of the following

(4 Marks each)

- i) Write a short note on effects of pesticides on public health.
- ii) Write a short note on acid rain.
- iii) Write a short note on carbon emission market.
- iv) What is population explosion? Comment on its causes and effects.

Q3. Attempts any two of the following

(6 Marks each)

- i) What is ecological pyramid? Explain its types.
- ii) Explain energy flow in ecosystem.
- iii) Write a note on forest conservation.

Q4. Attempts any two of the following

(6 Marks each)

- i) Explain population growth models.
- ii) Explain the various factors affecting the toxicity.
- iii) What is ecosystem? Explain its types with examples.

Q5. Attempts any one of the following

(12 Marks each)

- i) Explain causes of water pollution and its remedies.
- ii) What is wildlife conservation? Describe in detail various wildlife conservation measures.

XOX

Exam. Seat No.

Total No. of Questions: 05

Total No. of Pages: 01

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)
Affiliated to Savitribai Phule Pune University, Pune
T.Y. B. Sc
Zoology
Semester-V
USZL 355: Parasitology
(2022 Pattern)

Time: Two Hours

No. of Credits:03

Max. Marks: 60

Instructions to the candidates:

- i. *All questions are compulsory*
- ii. *Draw neat labelled diagram wherever necessary*
- iii. *All questions carry equal marks.*

Q.1 (A) Attempt each of the following.

(1 Mark each)

- i) Define Parasitology
- ii) Define Reservoir host
- iii) Write any two effects of parasites on host
- iv) Enlist any two vaccines used against Corona (COVID-19)

(B) Attempt each of the following.

(2 Marks each)

- i) Write any two branches of Parasitology
- ii) Write any two advantages of Parasitism
- iii) Define Host specificity & enlist its types
- iv) Write any two symptoms of Dengue

Q.2 Attempt any three of the following.

(4 Marks each)

- i) Write a short note on Definitive host
- ii) Control measures of *Plasmodium vivax*
- iii) Pathogenicity of *Taenia solium*
- iv) Control measures of Ticks

Q.3 Attempt any two of the following.

(6 Marks each)

- i) Explain types of Parasites
- ii) Describe the life cycle of *Ascaris lumbricoides*
- iii) Write symptoms & prophylaxis of Typhoid

Q.4 Attempt any two of the following.

(6 Marks each)

- i) Define symbiosis & write short note on parasitism
- ii) Explain morphological adaptations of parasite
- iii) Write habit, habitat & control measures of *Taenia solium*

Q.5 Attempt any one of the following.

(12 Marks each)

- i) Write habit, habitat, life cycle and control measures of *Entamoeba histolytica*
- ii) Write morphology, pathogenicity and control measures of Head louse

Total No. of Questions: 05

Exam Seat No.
Total No. of Pages: 01

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science & Commerce, Baramati.
(Autonomous)

Affiliated to Savitribai Phule Pune University, Pune.

T. Y. B.Sc. ZOOLOGY Semester-V

USZL 356 Cell Biology

2022 Pattern

Time: Two hours

(No. of Credits: 03)

Max. Marks: 60

Instructions:

- 1** All questions are compulsory.
- 2** Draw neat labelled diagram wherever necessary.
- 3** Start a new question on new page of answer sheet.
- 4** Figures to the right side indicate full marks to the corresponding question.

Ques. 1. (A). Attempt each of the following.

[01 Mark each]

- i. Define: cytokinesis
- ii. What is multipotency?
- iii. What is necrosis?
- iv. What is pinocytosis?
- v. What is acquired immunity?

(B) Attempt each of the following.

[02 Marks each]

- i. What is phagocytosis?
- ii. What is antibody?
- iii. Explain in brief cell aging.

Ques. 2. Attempt any three of the following.

[04 Marks each]

- i. Write a note on microfilaments.
- ii. Sketch & label nuclear pore complex.
- iii. Describe nuclear membrane?
- iv. Write a note on first line of defence.
- v. Describe in brief suicidal bags of cell.

Ques. 3. Attempt any two of the following.

[06 Marks each]

- i. Sketch & label ultrastructure of nucleus & NPC.
- ii. Describe in brief mitosis.
- iii. Explain properties of stem cell.

Ques. 4. Attempt any two of the following.

[06 Marks each]

- i. Explain the membrane transport mechanisms in brief.
- ii. Describe in brief structure of mitochondria.
- iii. Explain structural details of Golgi complex with the help of suitable diagram.

Ques. 5. Attempt any one of the following.

[12 Marks each]

- i. Explain Fluid Mosaic model with suitable diagram.
- ii. Explain meiosis with the help of neat, labelled diagrams.

*****YOY*****

Exam Seat No.

Total No. of Questions: 05

Total No. of Pages: 1

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science & Commerce, Baramati
(Autonomous)

Affiliated to Savitribai Phule Pune University, Pune

T. Y. B. Sc.

ZOOLOGY

Semester-VI

USZL-361 BIOLOGICAL TECHNIQUES

(2022 Pattern)

Time: 2.00 Hours

(No. of Credits 03)

Max. Marks: 60

Instructions to the candidates:

- i. All questions are compulsory.*
- ii. Neat labelled diagrams must be drawn wherever necessary.*
- iii. Figures to the right indicate full marks.*

Q.1. (A) Attempt each of the following. (1 Mark each)

- (i) Define molarity.
- (ii) Define clearing.
- (iii) Define honing.
- (iv) What is stain?

(B) Attempt each of the following. (2 Marks each)

- (i) State Beer's law.
- (ii) Give any four examples of mounting media.
- (iii) Give any four applications of computer in biology.
- (iv) Enlist the types of microtomes.

Q.2. Attempt any three of the following. (4 Marks each)

- (i) Give the principle of polyacrylamide gel electrophoresis.
- (ii) Give the significance of total count of WBCs.
- (iii) Write short note on tissue procurement.
- (iv) Write short note on polymerase chain reaction.

Q.3. Attempt any two of the following. (6 Marks each)

- (i) What is colorimeter? Give principle and applications of it.
- (ii) Describe various types of microtome knives.
- (iii) Explain the technique of total count of RBCs and give its significance.

Q.4. Attempt any two of the following. (6 Marks each)

- (i) What is fixation? Describe the methods of fixation.
- (ii) Describe Western blotting technique.
- (iii) Explain the principle and working of scanning electron microscope.

Q.5. Attempt any one of the following. (12 Marks each)

- (i) Discuss on Gram Staining
- (ii) Discuss on PAS technique

EXAM. SEAT No.

Total No. of Questions. 05.

Total No. of pages: 01

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science & Commerce, Baramati.
(Autonomous)
Affiliated to Savitribai Phule Pune University, Pune
T. Y. B. Sc.
ZOOLOGY
Semester VI

USZL 362: Mammalian Physiology & Endocrinology
(Regular- 2022 Pattern)

[Time: 2.00 Hours]

(No. of Credits: 03)

[Max. Marks: 60]

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Neat labelled diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.

Q.1. (A) Attempt each of the following:

[01 Mark each]

- i. Define Basal Metabolic Rate.
- ii. Define menarche.
- iii. What is hormone?
- iv. What is malnutrition?

B. Attempt each of the following:

[02 Marks each]

- i. Calculate R.Q. for proteins.
- ii. Write any two symptoms of Grave's disease.
- iii. Give the name & the reaction of enzyme that starts the digestion of starch.
- iv. Write reaction for O₂ transport via hemoglobin.

Q.2. Attempt any three of the following:

[04 Marks each]

- i. Describe transport of carbon dioxide. Add a note on buffering effect.
- ii. Describe the mechanism of prevention of autodigestion of stomach.
- iii. Give the functions of gonadotropins.
- iv. Sketch & label ultrastructure of a nephron.

Q.3. Attempt any two of the following:

[06 Marks each]

- i. Describe the complete digestion of carbohydrates & lipids with suitable reactions.
- ii. Describe the mechanism of action of water-soluble hormone with a suitable diagram.
- iii. Why does myelinated nerve conduct impulses faster than non-myelinated? Explain in detail.

Q.4. Write a note on any two of the following:

[06 Marks each]

- i. Describe mechanism of muscle contraction.
- ii. Define the terms: impulse, stimulation, conduction, response, EEG & epilepsy.
- iii. Describe the counter-current multiplier mechanism for osmoregulation.

Q.5. Answer any one of the following:

[12 Marks each]

- i. Describe hormonal control of pregnancy, parturition & lactation.
- ii. What is cardiac cycle? Describe its chemical & nervous regulation.

Exam. Seat No.

Total No. of Questions: 5

Total No. of Pages: 1

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)
Affiliated to Savitribai Phule Pune University, Pune
T.Y.B.Sc.
Subject: ZOOLOGY
SEM-VI
USZL 363 Genetics and Molecular Biology
(2022 Pattern)
(No. of Credits 03)

Time: Two Hours

Max. Marks: 60

Instructions to the Candidates:

- i. All questions are compulsory.
 - ii. Sketch neat, labelled biological diagram wherever necessary.
 - iii. Figures to the right side indicate full marks
-

Q. 1(A) Attempt each of the following:

(1 Marks each)

- i) Define: Cistron
- ii) Define: Splicing
- iii) Define: Immigration
- iv) Define: Cloning Vector

(B) Attempt each of the following:

(2 Marks each)

- i) Write the role of any two DNA polymerases.
- ii) What are histones? Give the function of histones.
- iii) What is electroporation?
- iv) What are linked and unlinked genes?

Q.2. Attempt any three of the following:

(4 Marks each)

- i) Differentiate between Heterochromatin and Euchromatin.
- ii) Explain the Griffith's experiment with the principle of transformation.
- iii) What are restriction enzymes? Explain the types of restriction enzymes.
- iv) What are genetic codes? Give the characteristics of genetic code.

Q. 3. Attempt any two of the following:

(6 Marks each)

- i) What is translation? Discuss the prokaryotic translation.
- ii) Explain the evolutionary forces that change allele frequency in a population.
- iii) Define crossing over and explain the Holiday model of recombination.

Q. 4. Attempt any two of the following:

(6 Marks each)

- i) Explain the process of polyadenylation with a diagram.
- ii) Explain the Lac operon in prokaryotes as a gene regulation mechanism.
- iii) Explain the Meselson and Stahl experiment of semiconservative replication.

Q.5. Attempt any one of the following:

(12 marks each)

- i) Explain in detail initiation, elongation, and termination of prokaryotic DNA replication.
- ii) Define: Mutation and explain the types of mutation in detail.

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Exam. Seat No.

Total No. of Questions: 05

Total No. of Pages: 01

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)
Affiliated to Savitribai Phule Pune University, Pune
T.Y. B. Sc.
Zoology
Semester-VI
USZL 364: Organic Evolution
(Regular) (2022 Pattern)

Time: Two Hours

No. of Credits 03

Max. Marks: 60

Instructions to the candidates:

- i. All questions are compulsory
- ii. Draw neat labelled diagram wherever necessary
- iii. Figures to the right indicate full marks.

Q.1 (A) Attempt each the following.

(1 Mark each)

- i) Enlist various patterns animal distribution.
- ii) Name any two animals found in the Australian realm
- iii) What is an era in geological time scale?
- iv) What is sympatric speciation?

(B) Attempt each the following.

(2 Marks each)

- i) What are fossils?
- ii) What is co-adaptation?
- iii) Explain Host-pathogen interaction?
- iv) What is geographical isolation?

Q.2 Attempt any three of the following.

(4 Marks each)

- i) Explain various factors influencing animal distribution.
- ii) Explain various factors influencing speciation.
- iii) Explain the post-zygotic isolating mechanism.
- iv) Explain the concept of coevolution with suitable examples.

Q.3 Attempt any two of the following.

(6 Marks each)

- i) Explain Darwin's theory of evolution.
- ii) Describe notable changes during Cenozoic era.
- iii) Explain multi-stressor environment as inducer of evolution.

Q.4 Attempt any two of the following.

(6 Marks each)

- i) Explain theory of inheritance of acquired characters.
- ii) Explain the mechanism of speciation.
- iii) Explain various Zoo-geographical realms.

Q.5 Attempt any one of the following.

(12 Marks each)

- i) Discuss the evolution of man.
- ii) Explain various evidences in favor of organic evolution.

****XOX****

SEAT No.

Total No. of Questions: 05

Total No. of Pages: 01

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)

Affiliated to Savitribai Phule Pune University, Pune

Class: T.Y.B.Sc.

Subject: Zoology

Semester VI

USZL 365: General Embryology

2022 Pattern

Credit 03

Time: 2.00 Hours

Max. Marks: 60

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Neat labelled diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.

Q1. (A) Attempt each of the following (1 Marks each)

- i) Define Embryology
- ii) Define Regeneration
- iii) Define Teratogenesis
- iv) Define Amphimixis

(B) Attempt each of the following (2 Marks each)

- i) What is spermiogenesis?
- ii) Give significance of cleavage.
- iii) What is fertilization? Give its types.
- iv) Define Blastula and enlists its types.

Q2. Attempts any three of the following (4 Marks each)

- i) Explain Axial Gradient Theory.
- ii) Describe different types of eggs.
- iii) Explain fertilization and cleavage in chick embryo.
- iv) Describe ultrastructure of typical sperm.

Q3. Attempts any two of the following (6 Marks each)

- i) Describe the process of capacitation.
- ii) Explain process of primitive streak development.
- iii) Describe secondary and tertiary organizer.

Q4. Attempts any two of the following (6 Marks each)

- i) Write a short note on fast block to polyspermy.
- ii) Explain basic cell movements in gastrulation.
- iii) Write a short note on extra embryonic membranes.

Q5. Attempts any one of the following (12 Marks each)

- i) Describe in details process of oogenesis and comment on general structure of ovum.
- ii) Describe 24 hours development of chick embryo.

YOY

Exam. Seat No.

Total No. of Questions: 05

Total No. of Pages: 01

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)
Affiliated to Savitribai Phule Pune University, Pune
T.Y. B. Sc
Zoology
Semester-VI
USZL 366 (A): Medical Entomology
(2022 Pattern)

Time: Two Hours

No. of Credits: 03

Max. Marks: 60

Instructions to the candidates:

- i. *All questions are compulsory*
- ii. *Draw neat labelled diagram wherever necessary*
- iii. *All questions carry equal marks.*

Q.1 (A) Attempt each of the following.

(1 Mark each)

- i) Define Forensic Entomology
- ii) Define Pest
- iii) Define Myiasis
- iv) Enlist the names of haemocytes in insects.

(B) Attempt each of the following.

(2 Marks each)

- i) Define Medical Entomology
- ii) Enlist the names of any two structural pests.
- iii) Write any two control measures of house fly.
- iv) Enlist any four leg modifications in insects.

Q.2 Attempt any three of the following.

(4 Marks each)

- i) Define Veterinary Entomology & write its applications.
- ii) Describe typical structure of antenna in insects.
- iii) Write a short note on pathogenicity of *Calliphora* spp. (Blow fly/ Bottle fly).
- iv) Write a short note on storage grain pests.

Q.3 Attempt any two of the following.

(6 Marks each)

- i) Describe piercing and sucking type of mouth parts in insects.
- ii) Write a short note on Integrated Pest Management (IPM).
- iii) Explain collection and preservation of entomological evidence during legal investigation in detail.

Q.4 Attempt any two of the following.

(6 Marks each)

- i) Describe female reproductive system in insects.
- ii) Explain life cycle of *Oestrus ovis* (Nasal grub fly)
- iii) Explain role of Blow flies in legal investigation.

Q.5 Attempt any one of the following.

(12 Marks each)

- i) Describe the central nervous system of insect in detail.
- ii) Explain life cycle, nature of damage & control measures of the cockroach.

SEAT No.

Total No. of Questions: 05

Total No. of Pages: 01

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
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Affiliated to Savitribai Phule Pune University, Pune

Class: T.Y.B.Sc.

Subject: Zoology

Semester V

ZOO: 3506 Cell Biology

2019 Pattern

Credit 03

Time: 2.00 Hours

Max. Marks: 60

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Neat labelled diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.

Q1. (A) Attempt each of the following (1 Marks each)

- i) Define cell
- ii) What is exocytosis?
- iii) Define stem cell
- iv) What is necrosis?

(B) Attempt each of the following (2 Marks each)

- i) Give scopes of Cell Biology
- ii) What is antibody?
- iii) Give any two features of Eukaryotic cell
- iv) What is acquired immunity?

Q2. Attempts any three of the following (4 Marks each)

- i) Write a note on smooth endoplasmic reticulum.
- ii) Sketch & label nuclear pore complex.
- iii) Describe structure and function of microtubules
- iv) Write a note on first line of defence.

Q3. Attempts any two of the following (6 Marks each)

- i) Intracellular and extracellular changes during cellular aging.
- ii) Describe in brief meiosis.
- iii) Explain properties of stem cell.

Q4. Attempts any two of the following (6 Marks each)

- i) Explain Lipid membrane concept.
- ii) Describe in brief structure of lysosome
- iii) Cell cycle and its various phases.

Q5. Attempts any one of the following (12 Marks each)

- i) Explain the active & passive membrane transport mechanisms in detail.
- ii) Explain structural details of Golgi complex with the help of suitable diagram. Comment on its functions.

YOY

Exam. Seat No.

Total No. of Questions: 5

Total No. of Pages: 1

Anekant Education Society's
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Affiliated to Savitribai Phule Pune University, Pune

T.Y.B.Sc

Zoology

Sem-IV

ZOO 3603: Genetics and Molecular Biology

(2019 Pattern)

(No. of credits 03)

Time : 02.00 Hours

Max. Marks: 60

Instructions to the Candidates:

1. All questions are compulsory.
2. Neat labeled diagrams must be drawn wherever necessary.
3. Figures to the right side indicate full marks

Q. 1(A) Attempt each of the following:

(1 Marks each)

- i) Define: Phenotype
- ii) Define: Genetics
- iii) Define: Back cross
- iv) Define: Migration

(B) Attempt each of the following:

(2 marks each)

- i) Give the role of DNA polymerase III
- ii) What is a frameshift mutation?
- iii) Give any two methods of gene transfer
- iv) What is microinjection?

Q.2. Attempt any three of the following:

(4 Marks each)

- i) Differentiate between Classical and modern genetics
- ii) State the Hardy-Weinberg law equilibrium and give its significance
- iii) What is Chromatin? Give the type of chromatin
- iv) Explain in brief the bacteriophage as a cloning vector

Q. 3. Attempt any two of the following:

(6 Marks each)

- i) Elaborate on the Meselson and Stahl experiment and its interpretation.
- ii) Explain the process of 5' capping
- iii) Describe the process of elongation in prokaryotic replication

Q. 4. Attempt any two of the following:

(6 Marks each)

- i) Explain Griffith's experiment.
- ii) Define linkage? Explain the types of linkage.
- iii) Discuss the salient features of the genetic code

Q. 5. Answer any one of the following

(12 marks each)

- i) Explain in detail the initiation, elongation, and termination of eukaryotic translation
- ii) What are mutagenic agents? Explain the role of various mutagenic agents in mutation.

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SEAT No.

Total No. of Questions: 05

Total No. of Pages: 01

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)

Affiliated to Savitribai Phule Pune University, Pune

Class: T.Y.B.Sc.

Subject: Zoology

Semester VI

ZOO: 3605 General Embryology

2019 Pattern

Credit 03

Time: 2.00 Hours

Max. Marks: 60

Instructions to the candidates:

1) All questions are compulsory.

2) Neat labelled diagrams must be drawn wherever necessary.

3) Figures to the right indicate full marks.

Q1. (A) Attempt each of the following

(1 Marks each)

- i) Define Embryology
- ii) Define Gametogenesis
- iii) Define Morphogenesis
- iv) Define Alecithal egg

(B) Attempt each of the following

(2 Marks each)

- i) What is Teratogenesis? Give its examples.
- ii) What is Amphimixis?
- iii) Give significance of fertilization.
- iv) What is Chemotaxis?

Q2. Attempts any three of the following

(4 Marks each)

- i) Explain types of cleavage.
- ii) Describe structure of Hen's egg.
- iii) Explain Theory of Epigenesis.
- iv) Explain basic cell movements in gastrulation.

Q3. Attempts any two of the following

(6 Marks each)

- i) Describe the general structure of sperm.
- ii) Describe extra embryonic membranes.
- iii) Explain 24 hours development of chick embryo.

Q4. Attempts any two of the following

(6 Marks each)

- i) Write a short note on slow block to polyspermy.
- ii) What is organizer? Explain its types.
- iii) Explain types of blastula.

Q5. Attempts any one of the following

(12 Marks each)

- i) Describe in detail the process of sperm penetration.
- ii) Describe in details process of oogenesis and comment on general structure of ovum.

XOX

Total No. of Question: 5

Exam Seat No. :

Total No of Pages: 1

Anekant Education Society's
Tuljaram Chaturchand College of Arts Science and Commerce, Baramati
(Autonomous)

(Affiliated to Savitribai Phule Pune University, Pune)

Class T.Y B.Sc.

Subject: Physics

Semester – V

Course Code: USPH-351

Course Title: Mathematical Method of Physics -II
(2022 Pattern)

Time: Two Hours

(No. of Credits: 03)

Max. Marks : 60

Instructions to the candidates:

- i. All questions are compulsory.
- ii. Figures to the right indicates full marks.
- iii. Draw neat diagrams wherever necessary.
- iv. Use of calculator / logarithmic table is allowed.

Q.1. Attempt the following. (i to iv carry 1 mark and v to viii carry 2 marks) 12)

- i) Explain term Scale factor coefficient.
- ii) Write transformation equation between Cartesian and cylindrical coordinates.
- iii) What is line element in curvilinear coordinates?
- iv) Write two partial differential equation used in Physics?
- v) Explain degree and order of differential equation.
- vi) What do you mean by special functions?
- vii) What is singularity?
- Viii) Show that $P_n(-1) = (-1)^n$.

Q.2. Attempt any three of the following. 12)

- i) Derive an expression for line element in Spherical polar coordinate system.
- ii) Use separation of variable in Helmholtz equation in spherical polar coordinates.
- iii) Discuss singularity at $x = \infty$.
- iv) Use separation of variable in heat flow equation.

Q.3. Attempt any two of the following. 12)

- i) Use separation variable for Laplace's equation in Cartesian coordinate.
- ii) Derive expression for Laplacian operator in cylindrical coordinates.
- iii) Express unit vectors r, θ, ϕ in terms of i, j, k .

Q.4. Write a note on any two of the following. (12)

- i) What is generating function? Derive expressions for Hermite polynomials.
- ii) Derive expression for divergence of a vector function in curvilinear coordinates.
- iii) Determine metric coefficients and scale factors in spherical polar coordinate system.

Q.5. Write an essay on any one of the following. (12)

- i) Obtain Forbenius series solution of Hermite differential equation.
- ii) Explain Michelson- Morley experiment with its result.

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Class T.Y B.Sc.

Subject :Physics

Semester – V

Course Code : PHY 3501

Course Title : Mathematical Method of Physics -II
(2019 Pattern)

Time: Two Hours

(No. of Credits: 03)

Max. Marks : 60

Q.1. Attempt the following. (i to iv carry 1 mark and v to viii carry 2 marks) (12)

- i. Draw line and surfaces in Cartesian coordinate.
- ii. Give any two ordinary differential equations used in Physics.
- iii. Write transformation equation between Cartesian and Spherical coordinates.
- iv. Explain role partial differential equation used in Physics.
- v. What is coordinate system?
- vi. What is Partial differential equation?
- vii. What is time dilation?
- viii. What is degree and order of differential equation?

Q.2. Attempt any three of the following. (12)

- i) Discuss singularity at $x = \infty$.
- ii) Derive an expression for volume element in Spherical polar coordinate system.
- iii) Use separation of variable in Helmholtz equation in spherical polar coordinates.
- iv) If F is a continuities vector point function, derive expression for Curl in curvilinear coordinate system.
- v) Use separation of variable in 2 D Laplace's equation in cartesian coordinates. Hence obtain its solution.

Q.3. Attempt any two of the following. (12)

- i) Derive expressions for Legendre polynomials.
- ii) Derive expression for Laplacian operator in Spherical polar coordinates.
- iii) Determine metric coefficients and scale factors in cylindrical coordinate system.
- iv) Discuss singularity at $x = 0$.

Q.4. Attempt any two of the following. (12)

- i) Use separation variable for Heat flow equation in Cartesian coordinate.
- ii) Derive expression for divergence of a vector function in curvilinear coordinates.
- iii) Express unit vectors i, j, k in terms of r, θ, ϕ .
- iv) Derive expression for Bessel's first kind equation

Q.5. Attempt any one of the following. (12)

- i) Obtain Forbenius series solution of Legendre differential equation.
- ii) Obtain Forbenius series solution of Hermite differential equation.

Seat No. :

[Total No. of Questions: 05]

Total No. of Pages: 2

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Empowered Autonomous Status)
Affiliated to Savitribai Phule Pune University, Pune
T.Y.B.Sc. Physics
Semester-V

USPH-353 Classical Mechanics
(2022 PATTERN)

Time: 2.00 hours

No. of Credits-03

Max. Marks: 60

Instructions to Candidates:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Neat diagrams must be drawn wherever necessary.
4. Use of calculator is allowed.

Q 1: (A) Attempt each of the following.

(1 Mark each)

- | | |
|--|-----|
| a) Define degrees of freedom. | [1] |
| b) What do you mean by the time of flight? | [1] |
| c) Define constraints. | [1] |
| d) State Newton's second law of motion. | [1] |

Q 1: (B) Attempt each of the following.

(2 Mark each)

- | | |
|---|-----|
| a) What are the limitations of Newton's laws of motion? | [2] |
| b) Discuss the concept of generalized coordinates with illustrations. | [2] |
| c) State D'Alembert's principle. | [2] |
| d) Define Range of Projectile. | [2] |

Q 2: Attempt any THREE of the following.

- | | |
|--|-----|
| a) Two heavy particles of weight W_1 and W_2 are connected by a light inextensible string and hang over a fixed smooth circular cylinder of radius R , the axis of which is horizontal. Find the condition of equilibrium of the system by applying principle of virtual work. | [4] |
| b) Derive Lagrangian and equation of motion of LC circuit. | [4] |
| c) Explain the motion of a charged particle in a constant electric field. | [4] |
| d) What are the fundamental forces of nature? | [4] |

P.T.O.

Q 3: Attempt any TWO of the following.

- a) Deduce Newton's equation of motion from Lagrangian equation of motion. [6]
- b) Derive the equation of orbit for a particle moving under a central force. [6]
- c) Find Lagrangian and equation of motion of simple harmonic motion [6]

Q 4: Attempt any TWO of the following.

- a) Derive the relation between scattering angles in the Lab system and the CM system. [6]
- b) Obtain the equation of path of projectile in a resistive medium. [6]
- c) Derive Lagrangian and equation of motion of projectile near the surface of the earth. [6]

Q 5: Attempt any ONE of the following.

- a) What are constraints? Explain types of constraints in detail. Write any two examples of each constraint. [12]
- b) Compare Newtonian, Lagrangian and Hamiltonian formulation and discuss the advantages and disadvantages of each. [12]

Total No. of Questions: 5

Exam Seat No

ANEKANT EDUCATION SOCIETY'S
TULJARAM CHATURCHAND COLLEGE, BARAMATI
(Autonomous Status)
Class: T. Y. B.Sc.
Subject: (PHYSICS)
Semester-V
USPH356(A): RENEWABLE ENERGY SOURCES
(2022 Pattern)
(No. Of Credit 3)

Marks: 60

Time: 2.00 hours

Q.1. Attempt the following.

(12)

- (i) What are fossil fuels? (1)
- (ii) Advantages of solar power. (1)
- (iii) What is biomass? (1)
- (iv) What is Geothermal power. (1)
- (v) What are three important facts about wind energy? (2)
- (vi) Give limitations of hydroelectricity generation plant. (2)
- (vii) What causes wind? (2)
- (viii) List the name of renewable energy sources? (2)

Q.2. Attempt any **three** of the following.

(12)

- (i) What is nuclear power? How does nuclear power work? State its advantages and disadvantages.
- (ii) What is hydroelectricity? State advantages and disadvantages.
- (iii) Draw the schematic of components of wind turbine. Describe each component of wind turbine.
- (iv) Explain construction and working of solar cooker

Q.3. Attempt any **two** of the following.

(12)

- (i) What is biomass? Give advantages and disadvantages.
- (ii) What is geothermal energy? Give its advantages and disadvantages.
- (iii) Explain vertical axis wind turbine (VAWT) with diagram. Also write its advantages and disadvantages.

Q.4. Write note on any **two** of the following.

(12)

- (i) Li-ion battery with its applications.
- (ii) Domestic solar hot water system.
- (iii) Solar pond.

Q.5. Write any **ONE** of the following.

(12)

- (i) Write a detailed note on Ni-cadmium battery and Lead-acid battery with applications
- (ii) Explain a) tidal power in brief b) biofuel in brief.

Seat No.
Total No. of Pages: 02
Total No. of Questions: 05

Anekant Education Society's
TULJARAM CHATURCHAND COLLEGE OF ARTS, SCIENCE AND COMMERCE, BARAMATI
(Autonomous Status)
(Affiliated to Savitribai Phule Pune University, Pune)

T.Y.B.Sc. PHYSICS
Semester-VI
USPH 361: Classical Electrodynamics
(2022 Pattern)

[Max. Marks: 60]

Time: Two Hours]

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Instructions to the candidates:

- i) All questions are compulsory
 - ii) Draw neat labelled diagrams wherever necessary
 - iii) Figures to the right indicate full marks
 - iv) Use of calculator is allowed
-

Q.1. Attempt the following (Short answer questions).

(12)

A) Select correct alternative and rewrite the sentence. (4x1)

i) The relation between Electric susceptibility and dielectric constant is given by _____
a) $E_0 = k.E$ b) $k = 1 + \chi_e$ c) $k = 1 - \chi_e$ d) $\epsilon = k. \epsilon_0$

ii) Laplace's equation is given by _____

a) $\nabla^2 \phi = -\frac{\rho}{\epsilon_0}$ b) $\nabla^2 \phi = 0$ c) $\nabla \phi = 0$ d) $\nabla \phi = -\frac{\rho}{\epsilon_0}$

iii) The electrostatic potential is given by $\phi_E =$ _____

a) $\frac{F}{q_0}$ b) $\frac{W}{q_0}$ c) $\frac{E}{q_0}$ d) $\frac{q}{\epsilon_0}$

iv) S.I. Unit of magnetic dipole $\vec{m} = I. \vec{A}$ is _____

a) Ampere.(meter) b) Ampere.(meter)² c) Ampere / (meter)² d) Newton / (meter)²

B) Answer the following questions (4x2)

i) State Ampere's circuital law.

ii) Calculate electric susceptibility if dielectric constant of material $k=5$.

iii) What is relation between three magnetic vectors \vec{B} , \vec{H} & \vec{M} .

iv) Define magnetic susceptibility (χ_m). Give its S.I. unit.

Q.2. Answer any three questions (3x4)

(12)

- i) State and explain Coulomb's law in electrostatics.
- ii) State and explain Biot-Savart's law in magnetostatics.
- iii) Two charges of +20 C & +80 C are separated by distance of 18 cm. Find the position of the point between them where intensity is zero.
- iv) Find potential at centre of square of side 1 m and having charges q , $2q$, $-3q$, $4q$ at its corner.
($q = 1.0 \times 10^{-9}$ coulomb)

Q.3. Attempt any two questions (2x6)

(12)

- i) Explain method of image charges for a point charge near grounded conducting infinite plane with diagram.
- ii) A dielectric slab of thickness 0.6cm and dielectric constant $k=5$ is placed between the parallel plates of plate area 0.01m^2 and separation 0.015 m. A potential difference of 150V is applied with no dielectric is present. If the battery is connected and dielectric is inserted, find three vectors E , D and P .
- iii) Write note on a) Diamagnetism, b) Paramagnetism. c) Ferromagnetism.

Q.4. Attempt any two questions (2x6)

(12)

- i) Explain polarization effect in polar and Non-polar dielectric materials with diagram.
- ii) Write down difference between magnetization (M) and polarization (P).
- iii) Derive an expression for relation between three electric vectors as $D = \epsilon_0 E + P$

Q.5. Attempt any one question (1x12)

(12)

- i) Define Volume (ρ), surface (σ) and line (λ) charge densities with diagram and S.I. unit in electrostatics. Also explain in brief about surface polarisation (σ') and volume polarisation (ρ') charge densities.
- ii) Explain Hysteresis curve for ferromagnetic materials in details. Draw Hysteresis curves to distinguish soft and hard magnets.

OR

- ii) Explain Hysteresis curve for ferromagnetic materials in details. Draw Hysteresis curves to distinguish soft and hard magnets.

Exam Seat No.

Total No. of Pages: 2

Total No. of Questions: 5

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Empowered Autonomous)

Affiliated to Savitribai Phule Pune University, Pune

Class: T.Y.B. Sc

Subject: Physics (Semester VI)

USPH363: Thermodynamics and Statistical Physics
(2022 Pattern)

(No. of Credits 04)

Max. Marks: 60

Time Two Hours

Instructions to the candidates:

- i) All questions are compulsory.
- ii) Figures to the right indicate full marks.
- v) Draw neat labeled diagram wherever necessary.
- vi) Use of calculator is allowed.

Q1. (A) Attempt EACH of the following. (1 Marks each)

04

- i) Define State and equilibrium.
- ii) Write any two law of thermodynamics.
- iii) Define Paramagnetism.
- iv) Calculate the change in entropy when 10grams of ice at 0°C is converted into water at the same temperature, (Given: Latent heat of ice = 80cal/gram)

(B) Attempt EACH of the following. (2 Marks each)

08

- i) Define phase space and gamma space.
- ii) What is meant by constraint on the system. Define accessible and inaccessible state.
- iii) If $p = q = \frac{1}{2}$ and total no of possibilities are $N = 200$, find mean value of n_1 i.e $\langle n_1 \rangle$ and root mean square deviation.
- iv) Define statistical ensemble.

Q2) Attempt any THREE of the following. (4 Marks each)

12

- i) Obtain mean energy and mean square energy in terms of partition function.
- ii) The energy state of a particle moving in a rigid cubical box is specified by the equation;

$$n_x^2 + n_y^2 + n_z^2 = \frac{2mE}{\pi^2 \hbar^2} = 14$$

Determine the number of microstates accessible to the particle

- iii) In a system in thermal equilibrium at temperature T , two states with energy difference 5.52×10^{-14} erg occur with relative probability e^2 erg/deg. Calculate the temperature. Given $k = 1.38 \times 10^{-16}$ erg/deg.
- iv) Write a note on accessible and inaccessible states.

Q3) Attempt any TWO of the following. (6 Marks each)

12

- i) Three particles are to be distributed in four energy levels a, b, c and d. Calculate all possible ways of this distribution when particles are i) Fermions ii) Bosons iii) Classical particles.
- ii) Obtain the relation between entropy and probability in terms of partition function.
- iii) A small system has two states of energy $E_1 = 0$ and $E_2 = 10^{-22}$ J. Find the probabilities p_1 and p_2 for the system to be in states of 1 and 2 respectively, when the mean energy $\langle E \rangle$ of the system is i) $0.2E_2$ ii) $0.5E_2$. Assuming Boltzmann distribution calculate the temperature in the two cases.

Q.4) Attempt any TWO of the following. (6 Marks each)

12

- i) Define the Gibbs potential function and show that for simultaneous isochoric and isothermal process, Gibbs free energy remains constant.
- ii) Find the height at which the atmospheric pressure is $1/100^{\text{th}}$ of sea level. Assume that the atmosphere is at a constant temperature 300K.
- iii) Discuss microcanonical and Canonical ensembles. Give comparison between these ensembles.

Q.5) Attempt any ONE of the following.

12

- A) i) Obtain Maxwell's four thermodynamical relations and hence find first TdS and Second TdS equations. 08
- ii) What is the probability of drawing three kings in succession from a pack of 52 cards? 04

- B) i) Explain in brief Maxwell-Boltzmann (MB) Statistics, Fermi-Dirac(FD) Statistics and Boltzmann-Einstein (BE) Statistics 08.
- ii) Eight distinguishable particles are distributed among three compartments of equal size. Find the probability of the macrostates a) (4,3,1) and b) (3,3,2). 04

Seat No. :

Total No. of Pages: 2

[Total No. of Questions: 05]

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Empowered Autonomous)

Affiliated to Savitribai Phule Pune University, Pune

T.Y.B.Sc. Physics

Semester-VI

USPH-365 (A) Electronics-II

(2022 PATTERN)

No. of Credits-03

Max. Marks: 60

Time: 2.00 hours

Instructions to Candidates:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Neat diagrams must be drawn wherever necessary.
4. Use of calculator is allowed.

Q 1: (A) Attempt each of the following.

(1 Mark each)

- a) Draw symbol of P-channel JFET. [1]
- b) What is meant by Flip-flop? [1]
- c) Draw symbol of N-channel UJT. [1]
- d) What is JFET? [1]

Q 1: (B) Attempt each of the following.

(2 Mark each)

- a) State the important applications of a JFET. [2]
- b) When V_{GS} of JFET changes from 2.2 V to 2.1 V, the drain current raises from 1.1 mA to 1.4 mA. Find the value of transconductance. [2]
- c) Find the value of resistor R_A of monostable multivibrator if pulse width is 2.2 ms and capacitor is $1\mu F$. [2]
- d) A 5-bit asynchronous counter begins with 00000 state. What will be the state of a counter after 80 input pulses. [2]

Q 2: Attempt any THREE of the following.

(4 Mark each)

- a) Explain the concept of Schmitt trigger. [4]
- b) Compare the performance of N-channel and P-channel JFET. [4]
- c) Find the duty cycle of astable multivibrator using IC 555 when $R_A=R_B=R$. [4]
- d) Explain J-K flip flop with logic diagram and truth table. [4]

P.T.O.

Q 3: Attempt any TWO of the following.

(6 Mark each)

- a) What is a counter? Draw neat diagram of 4-bit synchronous counter and explain its working. [6]
- b) Explain D flip-flop using logic diagram and truth table. [6]
- c) Draw a block diagram of IC 555 and explain it in detail. [6]

Q 4: Attempt any TWO of the following.

(6 Mark each)

- a) Discuss the construction and working of UJT as a relaxation oscillator. [6]
- b) Using logic diagram and truth table explain, R-S flip flop using NAND gates. [6]
- c) For a JFET when V_{DS} changes from 7 V to 14 V, the drain current I_D changes from 10 mA to 10.20 mA when $V_{GS}=0$ V. When gate voltage changes from 0 V to 0.3 V, the drain current changes from 10.20 mA to 9.60 mA when $V_{DS}=14$ V. Find the a.c. drain resistance, transconductance and amplification factor. [6]

Q 5: Attempt any ONE of the following.

(12 Mark each)

- a) Discuss the construction and working of N-channel JFET. Draw its characteristics curves. [12]
- b) Discuss the construction and working of N-channel UJT. Draw its characteristics curves. [12]

Seat No. :

Total No. of Pages: 2

[Total No. of Questions: 05]

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Empowered Autonomous Status)
Affiliated to Savitribai Phule Pune University, Pune

T.Y.B.Sc. Physics

Semester-VI

USPH-365 (B) Advanced Electronics
(2022 PATTERN)

No. of Credits-03

Max. Marks: 60

Time: 2.00 hours

Instructions to Candidates:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Neat diagrams must be drawn wherever necessary.
4. Use of calculator is allowed.

Q 1: (A) Attempt each of the following.

(1 Mark each)

- a) Define Signal conditioning. [1]
- b) What do you mean by control system? [1]
- c) Define CMRR. [1]
- d) What do you mean by Reference Value/Set point? [1]

Q 1: (B) Attempt each of the following.

(2 Mark each)

- a) What do you mean by pyrometry? [2]
- b) Calculate the gain of inverting amplifier when input resistance at inverting input terminal is $20\text{ k}\Omega$ and feedback resistance is $200\text{ k}\Omega$. [2]
- c) Convert 100°C into Fahrenheit. [2]
- d) What is the difference between NTC and PTC type thermistors? [2]

Q 2: Attempt any THREE of the following.

(4 Mark each)

- a) Calculate the gain of non-inverting amplifier when input resistance at inverting input terminal is $10\text{ k}\Omega$ and feedback resistance is $100\text{ k}\Omega$. If the feedback resistance is doubled, what is the change in the voltage gain? [4]
- b) What do you mean by thermistor? Explain its working in detail [4]
- c) The amount of radiant energy received by the detector of pyrometer per unit time is 20 J from a hot body. If emissivity is 5.6×10^{-3} , then find the temperature of hot body. [4]
- d) The resistance of platinum wire is 6 ohms at 0°C and 7.2 ohms at 100°C . [4]
Calculate the temperature coefficient of resistance α .

P.T.O.

Q 3: Attempt any TWO of the following.

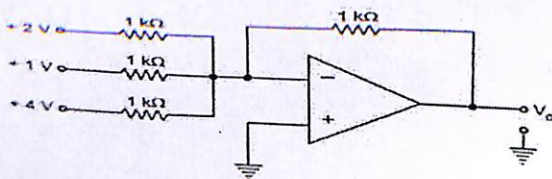
(6 Mark each)

- Based on process objectives and process hardware explain Process specifications. [6]
- Explain principle and working of liquid filled thermometer. State their applications. [6]
- Draw neat diagram of fundamental logic gates. Also draw the truth table of each logic gate. [6]

Q 4: Attempt any TWO of the following.

(6 Mark each)

- Explain logic diagram, truth table and working of RS- flipflop using NAND gate. [6]
- Find the output voltage of the following circuit. [6]

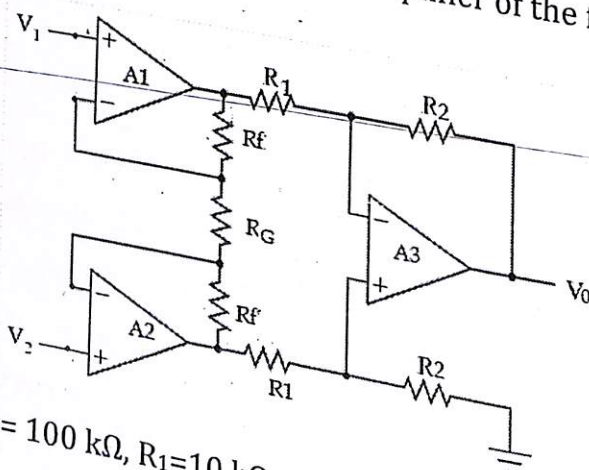


- Describe the discrete -state process control system with examples. [6]

Q 5: Attempt any ONE of the following.

(12 Mark each)

- Draw a block diagram of a simple process control loop and explain each element in brief. [12]
- With the help of a neat diagram, explain the Instrumentation amplifier using three op-amps. In the instrumentation amplifier of the figure below [12]



If $R_G = 1 \text{ k}\Omega$, $R_F = 100 \text{ k}\Omega$, $R_1 = 10 \text{ k}\Omega$, $R_2 = 20 \text{ k}\Omega$. What is the output voltage if $V_{in} = V_2 - V_1 = 2 \text{ mV}$?

Total No. of Questions: 05

Seat No.
Total No. of Pages: 02

Anekant Education Society's
TULJARAM CHATURCHAND COLLEGE OF ARTS, SCIENCE AND COMMERCE,
BARAMATI
(Autonomous Status)
Affiliated to Savitribai Phule Pune University, Pune
Class: T.Y. B.Sc.
Physics
Semester-VI
USPH 366 (C) : Physics of Nanomaterials
(2022 Pattern)

Time: 2.00 Hours]

[Max. Marks: 60]

Instructions to the candidates:

- i) All questions are compulsory
- ii) Neat labeled diagrams must be drawn wherever necessary
- iii) Figures to the right indicate full marks
- iv) Use of scientific calculator is allowed

Q.1. All questions are compulsory

(A) Rewrite the sentence using correct choice from given choices. (4)

1. What is the important reason that nanomaterials have different properties from bulk materials?
a) Larger surface area b) Heavier mass c) Color change d) Chemical bonding
2. What is the most commonly used nanomaterial in sunscreen products?
a) Titanium dioxide b) Silver nanoparticles c) Iron oxide d) Copper oxide
3. Which of the following is NOT a carbon-based nanomaterial?
a) Graphene b) Carbon nanotube c) Quantum dots d) Fullerene
4. What is the typical dimension range for nanomaterials?
a) 1-10 mm b) 1-100 nm c) 100-1000 nm d) 1-10 μm

B) Answer the following questions.

(8)

1. How are the nanomaterials classified based on their dimensions?
2. How does the nanoscale affect the properties of materials compared to bulk materials?
3. List the common methods for synthesizing nanomaterials?
4. What are nanomaterials, and how are they defined by size?

Q.2. Answer any three questions

(12)

1. What role do quantum effects play in the behavior of nanomaterials?
2. Draw the schematic diagram of Scanning Electron Microscope (SEM)?
3. How are nanomaterials used in electronic and semiconductor industries?
4. How do top-down and bottom-up approaches differ in nanomaterial synthesis?

Anekant Education Society's
Tuljaram Chaturchand College of Arts Science and Commerce, Baramati
(Autonomous)

(Affiliated to Savitribai Phule Pune University, Pune)

Class T.Y B.Sc.

Subject :Physics

Semester – V

Course Code : PHY 3501

Course Title : Mathematical Method of Physics -II
(2019 Pattern)

(No. of Credits: 03)

Max. Marks : 60

Time: Two Hours

Q.1. Attempt the following. (i to iv carry 1 mark and v to viii carry 2 marks) (12)

- i. Draw line and surfaces in Cartesian coordinate.
- ii. Give any two ordinary differential equations used in Physics.
- iii. Write transformation equation between Cartesian and Spherical coordinates.
- iv. Explain role partial differential equation used in Physics.
- v. What is coordinate system?
- vi. What is Partial differential equation?
- vii. What is time dilation?
- viii. What is degree and order of differential equation?

Q.2. Attempt any three of the following. (12)

- i) Discuss singularity at $x = \infty$.
- ii) Derive an expression for volume element in Spherical polar coordinate system.
- iii) Use separation of variable in Helmholtz equation in spherical polar coordinates.
- iv) If F is a continuities vector point function, derive expression for Curl in curvilinear coordinate system.
- v) Use separation of variable in 2 D Laplace's equation in cartesian coordinates. Hence obtain its solution.

Q.3. Attempt any two of the following. (12)

- i) Derive expressions for Legendre polynomials.
- ii) Derive expression for Laplacian operator in Spherical polar coordinates.
- iii) Determine metric coefficients and scale factors in cylindrical coordinate system.
- iv) Discuss singularity at $x = 0$.

Q.4. Attempt any two of the following. (12)

- i) Use separation variable for Heat flow equation in Cartesian coordinate.
- ii) Derive expression for divergence of a vector function in curvilinear coordinates.
- iii) Express unit vectors i, j, k in terms of r, θ, ϕ .
- iv) Derive expression for Bessel's first kind equation

Q.5. Attempt any one of the following. (12)

- i) Obtain Forbenius series solution of Legendre differential equation.
- ii) Obtain Forbenius series solution of Hermite differential equation.

Seat No. :

Total No. of Pages: 2

[Total No. of Questions: 05]

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Empowered Autonomous Status)
Affiliated to Savitribai Phule Pune University, Pune
T.Y.B.Sc. Physics
Semester-V
PHY-3502 Classical Mechanics
(2019 PATTERN)

No. of Credits-03

Max. Marks: 60

Time: 2.00 hours

Instructions to Candidates:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Neat diagrams must be drawn wherever necessary.
4. Use of calculator is allowed.

Q 1: (A) Attempt each of the following.

(1 Mark each)

- a) What do you mean by projectile? [1]
- b) State Newton's second law of motion. [1]
- c) Define inertia. [1]
- d) What is the principle of virtual work? [1]

Q 1: (B) Attempt each of the following.

(2 Mark each)

- a) Differentiate between elastic and inelastic scattering. [2]
- b) State and explain Newton's first law of motion with examples. [2]
- c) What is a central force? Give an example. [2]
- d) Define the time of the flight of Projectile. [2]

Q 2: Attempt any THREE of the following.

- a) What are the fundamental forces of nature? [4]
- b) Derive an expression for the total cross-section in scattering theory. [4]
- c) Find the Lagrangian and equation of motion of simple pendulum. [4]
- d) Two heavy particles of weight W_1 and W_2 are connected by a light inextensible string and hang over a fixed smooth circular cylinder of radius R , the axis of which is horizontal. Find the condition of equilibrium of the system by applying principle of virtual work. [4]

P.T.O.

Q 3: Attempt any TWO of the following.

- a) Derive an expression for projectile motion in a medium with resistance. [6]
- b) Find Lagrangian and equation of motion of spring mass arrangement. [6]
- c) Deduce Newton's equation of motion from Lagrangian equation of motion. [6]

Q 4: Attempt any TWO of the following.

- a) What do you mean by the time of the flight? Derive equation for time of flight and show that projectile reaches a maximum height along vertical direction if $\theta=90^\circ$. [6]
- b) Derive Lagrangian and equation of motion of projectile near the surface of the earth. [6]
- c) Explain the concept of the equivalent one-body problem in central force motion. [6]

Q 5: Attempt any ONE of the following.

- a) What are constraints? Explain types of constraints in detail. Write any two examples of each constraint. [12]
- b) Deduce Kepler's laws of planetary motion using Newton's law of gravitation. [12]

Exam Seat No.

Total No. of pages: 2

Total No. of Questions: 5

Anekant Education Society's
Tuljaram Chaturchand College of Art's, Science and Commerce, Baramati
(Empowered Autonomous)
Affiliated to Savitribai Phule Pune University, Pune
Subject: Physics
PHY 3604: Nuclear Physics
No. of Credits (03) (2019 Pattern)

Class: T.Y.B.Sc

Max. Marks: 60

Sem-VI

Time: 02:00 Hours

Instructions to the candidates.

- 1) All questions are compulsory
- 2) Figures to the right indicate full marks.
- 3) Draw neat labelled diagrams wherever necessary

(12)

Q.1) Attempt the following

(1)

- i) Define packing fraction. (1)
- ii) Define isotone of nucleus. (1)
- iii) Define half life of a radioactive decay. (1)
- iv) What is nuclear fusion? (1)
- v) What do you mean by electric quadrupole moment of nucleus (2)
- vi) What are Leptons? (2)
- vii) Define activity of radioactive nuclei. (2)
- viii) State the conservation laws in nuclear reaction. (2)

Q.2) Attempt any three of the following

(12)

- i) What is nuclear reaction? Give two examples of nuclear reaction.
- ii) State the law of radioactive disintegration and obtain an expression for it.
- iii) Calculate the binding energy per nucleon in ${}_{26}\text{Fe}^{56}$, whose mass 55.975 a.m.u.
(Given: mass of proton m_p : 1.007825 a.m.u, mass of neutron m_n : 1.008665 a.m.u)
- iv) Describe the principle and working of a linear accelerator.

Q.3) Attempt any two of the following

(12)

- i) Explain the nuclear magnetic moment and density of nucleus.
- ii) State the difference between nuclear fusion and nuclear fission.

Exam Seat No.

Total No. of Pages: 2

Total No. of Questions: 5

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)

Affiliated to Savitribai Phule Pune University, Pune
Environmental Science

Class: T. Y. B. Sc.

Semester: VI

USES-361: Climate Change

(2022 Pattern)

(No. of Credits 03)

Max. Marks: 60

Time: Two Hours

Instructions to the Candidates:

- I. All questions are compulsory.
- II. Figures to the right indicate full marks.
- III. Draw neat diagrams wherever necessary.

Q1. (A) Attempt each of the following

(1 Marks each)

- i) Define climate change.
- ii) What are greenhouse gases?
- iii) What is mean by UNFCCC?
- iv) Mention any two consequences of global warming.

(B) Attempt each of the following

(2 Marks each)

- i) Explain the impact of climate change on glaciers and ice sheets.
- ii) What is the Kyoto Protocol? Mention its significance.
- iii) Enlist warm and cool ocean currents.
- iv) What are the components of Internal Variability?

Q2. Attempt any three of the following

(4 Marks each)

- i) Describe the role of ocean currents in climate variability.
- ii) Explain the impact of climate change on agriculture and human health.
- iii) Discuss the National Action Plan on Climate Change (NAPCC).
- iv) Write a short note on carbon sequestration.

Q3. Attempt any two of the following

(6 Marks each)

- i) Explain the internal variability factors affecting climate change.
- ii) Describe the economic impacts of climate change.
- iii) Discuss the role of international organizations in combating climate change.

Exam Seat No.

Total No. of Pages: 2

Total No. of Questions: 5

**Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)**

Affiliated to Savitribai Phule Pune University, Pune

Class: T. Y. B. Sc.

Environmental Science

Semester: VI

**USES 362: Analytical Methods
(2022 Pattern)**

(No. of Credits 03)

Max. Marks: 60

Time: Two Hours

Instructions to the Candidates:

- I. All questions are compulsory.
- II. Figures to the right indicate full marks
- III. Draw neat diagrams wherever necessary.

Q1. (A) Attempt each of the following

(1 Mark each)

- i) Define spectrophotometry.
- ii) What is chromatography?
- iii) What is meant by residual effect in hazardous substances?
- iv) Give an example of a carcinogenic compound.

(B) Attempt each of the following

(2 Marks each)

- i) Differentiate between XRD and XRF.
- ii) Explain the role of hydrogen bonding in biological systems.
- iii) What are the factors affecting soil composition?
- iv) Write a short note on gas chromatography.

Q2. Attempt any three of the following

(4 Marks each)

- i) Explain the working principle of atomic absorption spectroscopy.
- ii) Discuss the effect of hydrocarbons on the environment.
- iii) Explain the process of soil formation.
- iv) Write a short note on biosynthesis of DNA.

Q3. Attempt any two of the following

(6 Marks each)

- i) Discuss the principle and applications of neutron activation analysis.
- ii) Explain the chemistry of lead and its environmental effects.
- iii) Describe the classification and properties of hazardous substances.

Q4. Attempt any two of the following (6 Marks each)

- i) Explain the concept of ion exchange chromatography.
- ii) Discuss the role of surfactants in biological systems.
- iii) Describe the chemistry of various organic and inorganic toxic compounds.

Q5. Attempt any one of the following (12 Marks each)

- i) Explain in detail the various analytical techniques used in geochemistry.
- ii) Discuss the different types of spectroscopic methods and their applications.

Exam Seat No.

Total No. of Pages: 1

Total No. of Questions: 5

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science & Commerce, Baramati.
(Autonomous)

Affiliated to Savitribai Phule Pune University, Pune
ENVIRONMENTAL SCIENCE

T.Y.B.Sc.

USES 363: Sustainable Development
(2022 Pattern) (Semester-VI) (Paper-III)

(Time: 2.00 Hours)

(No. of Credits 04)

(Total Marks: 60)

Instructions to the candidates:

- i. All questions are compulsory.
- ii. Figures to right indicate full marks.
- iii. Neat labelled diagrams must be drawn wherever necessary.

-
- Q. 1. (A) Attempt **each** of the following (1 Mark each)
- i. What are 2 strategies of sustainable development?
 - ii. When was the term 'Sustainable Development' come into existence?
 - iii. What are the strengths and weaknesses of the sustainable development goals?
 - iv. What is the role of biodiversity in sustainable development?
- (B) Attempt **each** of the following (2 Mark each)
- i. Define economic sustainability.
 - ii. What are the pillars of human development?
 - iii. Write two importance's of sustainable development goals.
 - iv. Define green building.
- Q. 2. Attempt any **three** of the following (4 Mark each)
- i. Write a difference between ecological and carbon footprint for sustainability.
 - ii. What is the role of culture and design in sustainable development?
 - iii. Write a note on 'Human Development Index'.
 - iv. Explain roll of green building in environmental protection.
- Q. 3. Attempt any **two** of the following (6 Mark each)
- i. What is the 2030 sustainable agenda?
 - ii. What are challenges for energy, food and agriculture in changing India?
 - iii. Write a note on 'The Indian Green Building Council' (IGBC).
- Q. 4. Attempt any **two** of the following (6 Mark each)
- i. Explain merits and demerits of green building.
 - ii. Explain tools for sustainable development.
 - iii. What are the 5 basic principles of green building design?
- Q. 5. Attempt any **one** of the following (12 Mark each)
- i. Explain women and gender equality and write its importance.
 - ii. What is sustainable development? Explain the sustainable development goals.

Exam Seat No.

Total No. of Questions: 5

Total No. of Pages: 2

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)

Affiliated to Savitribai Phule Pune University, Pune

Class: T. Y. B. Sc.

Environmental Science

Semester: VI

USES 365: Environmental Safety and Risk Management
(2022 Pattern)

(No. of Credits 03)

Max. Marks: 60

Time: Two Hours

Instructions to the Candidates:

- I. All questions are compulsory.
- II. Figures to the right indicate full marks.
- III. Draw neat diagrams wherever necessary.

Q1. (A) Attempt each of the following

1 Mark each)

- i) Define environmental risk.
- ii) What is a risk assessment?
- iii) List any two major environmental laws in India.
- iv) Mention two types of personal protective equipment (PPE).

(B) Attempt each of the following

(2 Marks each)

- i) Explain the risk mitigation strategies.
- ii) explain steps in risk allocation..
- iii) What are the key components of disaster management?
- iv) Explain the role of the Central Pollution Control Board (CPCB).

Q2. Attempt any three of the following

(4 Marks each)

- i) Explain the classification of hazardous materials.
- ii) Describe the process of risk communication.
- iii) Discuss various safety measures for handling toxic chemicals.
- iv) Write a short note on environmental sustainability in industries.

Q3. Attempt any two of the following

(6 Marks each)

- i) Discuss the significance of fire and explosion risk assessments.
- ii) Explain the major environmental challenges due to industrialization.
- iii) Describe various techniques for hazard identification.

Exam Seat No.:

Total No. of pages: 02

Total No. of Questions: 5

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Empowered Autonomous)
Affiliated to Savitribai Phule Pune University, Pune

Class: T.Y.B.Sc

Subject: Chemistry

Semester: V

Course Code: USCH351 Course Title: Physical Chemistry I
(2022 Pattern)

(No. of Credits 03)

Max. Marks: 60

Time: Two Hours

Instructions to the candidates:

- a. All questions are compulsory.
- b. Figures to the right indicate full marks.
- c. Neat diagrams must be drawn wherever necessary.
- d. Use of log table and scientific calculator is allowed.
- e. Actual calculations must be shown while solving problems.

Q1. A) Attempt ALL of the following. (1 mark each)

[04]

- i. What is zero point energy?
- ii. Define – strong electrolyte.
- iii. What is Photochemistry?
- iv. Dispersed phase + dispersion medium = ?

B) Attempt ALL of the following. (2 marks each)

[08]

- i. Molar refractions for $\text{CH}_3\text{CH}_2\text{OH}$ and CH_3OH are 12.9 and 8.3 mL mol^{-1} respectively. Calculate the molar refraction for $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$.
- ii. What is effect of concentration on equivalent conductance of weak electrolyte?
- iii. Explain Brownian motion.
- iv. Calculate the energy in Einstein associated with the radiation of wavelength 400 nm.

Q2. Attempt ANY THREE of the following.

[12]

- i. Explain the quantum theory of Raman effect.
- ii. What do you mean by equivalent conductance at infinite dilution (λ_{∞})? How will you determine the value of λ_{∞} for strong electrolyte?
- iii. State and explain laws of photochemistry.
- iv. Distinguish between lyophilic sols and lyophobic sols.

Q3. Attempt ANY TWO of the following.

[12]

- i. Derive an expression for energy of transition from $J \rightarrow J + 1$ level in rotational spectrum of simple diatomic molecule.
- ii. What do you mean by degree of dissociation of weak electrolyte? Explain the effect of dilution on degree of dissociation of acetic acid.
- iii. What are gels? How are they classified? Distinguish between emulsion and gel.

Q4. Attempt ANY TWO of the following.

[12]

- i. The molecules of $^1\text{H}^{35}\text{Cl}$ show a strong absorption line at wavelength $3.465 \times 10^{-4} \text{ cm}$. Assuming origin of line due to vibration, calculate reduced mass and force constant for HCl bond.
- ii. The resistance of N/50 solution of KCl is 400 ohms. If the specific conductance of the same solution at 25°C is $2.76 \times 10^{-3} \text{ ohm}^{-1} \text{ cm}^{-1}$ and resistance of 0.01 N solution of acetic acid at same temperature is 416 ohms, Calculate equivalent conductance of acetic acid.
- iii. A system absorbs 2.5×10^{16} quanta of radiation per second. When it is irradiated for 15 minutes it is found that 3.2×10^{-4} mole of reactant has reacted. Determine the quantum yield of the reaction.

Q5. Attempt ANY ONE of the following.

[12]

- i. What is dipole moment? Describe any one method for its determination. Calculate the dipole moments of ortho-, meta- and para- chlorotoluene. [Given: dipole moment of toluene = 0.37 D and dipole moment of chlorobenzene = 1.58 D]
- ii. Explain in detail, the various applications of conductance measurements. Calculate the dissociation constant of 0.1 N acetic acid at 25°C , if the degree of dissociation of 0.1 N acetic acid is 1.33×10^{-2} .

Total no. of questions:05

Seat no.
Total no. of pages:02

Anekant Education Society's
Tuljaram Chaturchand College Arts, Science and Commerce, Baramati
(Empowered Autonomous)
Affiliated to Savitribai Phule Pune University Pune

TYBSc Chemistry (Semester-V)
USCH352: Subject: Inorganic Chemistry I
(2022 Pattern)
(No. of Credits 03)

Max marks: 60

Time: Two Hours

Instructions to the Candidates

- I) All questions are compulsory
- II) Figures at right indicates full marks

04

Q.1 A) Attempt the following

1) How many types of ligands?

2) Define Metal Chelate

3) How many Valencies are in Werners complexes?

4) Give the oxidation state number of Mn in $\text{Na}[\text{Mn}(\text{CO})_5]$

08

B) Attempt the following

1) Define Polydentate ligand with suitable example

2) Give possible isomers number in Square planar complex of $[\text{M}(\text{abcd})]$

3) Give Coordination number in $[\text{Mn}(\text{en})_3]\text{Cl}_3$

4) Calculate CFSE for $[\text{Mn}(\text{NH}_3)_6]\text{Cl}_2$

Q.2 Attempt any three of the following

12

1) Explain the Werners theory for Coordination compound.

2) What is Isomerism Give in detail Ionization isomerism and Ligand isomerism

3) What is Spectrochemical series? Give in detail the Spectrochemical series

4) What type of Hybridization is shown by the complex $[\text{Zn}(\text{NH}_3)_6]^{3+}$ and calculate magnetic moment by VBT

Q.3 Attempt any two of the following

12

1) Draw and explain the MO energy diagram for $[\text{Co}(\text{CN})_6]^{3-}$ ion calculate Magnetic moment.

[Total No. of Questions: 3]

Seat No-

[Total No. of pages: 2]

Anekant Education Society's
Tuljaram Chaturchand Arts, Science and Commerce College, Baramati,
(Autonomous)

Affiliated to Savitribai Phule Pune University, Pune

T.Y.B.Sc
SEMESTER-V
CHEMISTRY

USCH 353 Organic Chemistry-I
(2022 Pattern)

Time: 2.00 hr.)

(No. of credits=03)

(Max. Marks: 60)

Instructions to candidates:

- IV. All questions are compulsory.
- V. Figures on the right indicate full marks.
- VI. Neat diagrams must be drawn wherever necessary.

Q.1) A) Attempt **each** of the following

[4]

- i) What is carbanion?
- ii) What is σ -complex?
- iii) What is S_N1 reaction?
- iv) State the rule of Saytzeff's elimination.

B) Attempt **each** of the following

[8]

- i) List any four deactivating group for aromatic ring.
- ii) Why is cis 1,4-dimethyl cyclohexane is optically inactive?
- iii) Mono chloro acetic acid is more acidic than acetic acid, why?
- iv) 1-iodo propane undergoes $E2$ elimination faster than 1-chloro propane, why?

Q 2) Attempt any **Three** of the following

[12]

- i) Define Lewis base. aniline is less basic than cyclohexyl amine, explain.
- ii) Benzyl chloride undergoes S_N1 mechanism, explain.
- iii) Explain Dickmann cyclization reaction with mechanism.
- iv) What is benzyne? Explain benzyne mechanism with suitable example.

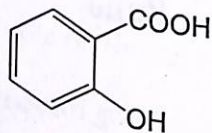
Q 3) Attempt any **Two** of the following

[12]

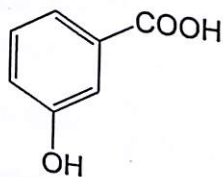
- i) Write a note on Wittig reaction with suitable example.
- ii) Draw all possible chair conformations of trans 1,4-dimethyl cyclohexane and comment on their stability and optical activity.
- iii) Explain the factors affecting the strength of base.

PTO

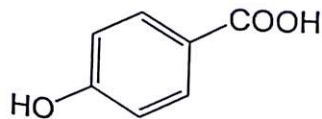
- Q 4) Attempt any **Two** of the following
- Explain the mechanism of ' S_N2 ' reaction with energy profile diagram.
 - Discuss the mechanism of Perkins reaction.
 - Explain the pK_a values of the following compounds-



$pK_a = 2.98$



$pK_a = 4.08$



$pK_a = 4.58$

- Q.5) Attempt any **One** of the following

- What is aromatic electrophilic substitution reaction? Discuss the mechanism of Friedel-Craft alkylation reaction with suitable example.
- What is elimination reaction? Discuss $E1$ elimination reaction with mechanism. Discuss kinetic isotopic effect in $E1$ mechanism. Differentiate $E1$ and $E2$ elimination reaction.

Exam. Seat No.

[Total No. of Pages: 2

Total No. of Question: 3]

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science & commerce Baramati
(Empowered Autonomous)
Affiliated to Savitribai Phule Pune University, Pune

T.Y.B.Sc. Chemistry (Sem.V) Examination October - 2024

Course Code: USCH 356(D)

Course Title: Environmental and Green Chemistry –I
(2022 Pattern)

Time: 02 Hours]

[No. of Credits: 03]

[Max.Marks: 60

Instruction to students:

- All questions are compulsory and carry equal marks.
- Figures to the right indicate full marks.
- Neat and labeled diagram must draw wherever necessary.

Q.1. A) Attempt each of the following

(4 Marks)

- Define residence time.
- Name any two minor components of atmosphere.
- What is the formula of % atom economy?
- Name any two renewable energy sources.

B) Answer the following

(8 Marks)

- Explain the term 'pathway of pollutant' with suitable example.
- What is nitrogen fixation?
- What are the 4 R's on which waste management based?
- Define i) Biosphere ii) Green energy

Q.2 Attempt any three of the following

(12 Marks)

- Explain the chlorine chemistry in atmosphere.
- What are the major classes of pesticides? Give at least one example of each class.
- Write a note on conventional method for synthesis of catechol.
- What is meant by risk? How can it be reduced?

Q.3 Answer any two of the following

(12 Marks)

- Explain the acid rain with its effects.
- Write a note on Eutrophication.
- Give an account of primary pollutant as sulphur oxide (SO_x) with respect to sources and chemical processes involved in it.

Q.4 Attempt any two of the following

(12 Marks)

- a) Write a note on: i) supercritical liquid ii) Green catalysts
- b) Explain in brief the main purpose of green chemistry.
- c) Write a note on photo catalysis.

Q.5 Attempt any one of the following

(12 Marks)

- a) Write a note on:-
 - i. Nitrogen transformation by bacteria.
 - ii. Chlorofluorocarbons.
- b) Explain in brief the new methodologies for sustainable development.

Exam Seat No.:

Total No. of pages: 02

Total No. of Questions: 5

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Empowered Autonomous)
Affiliated to Savitribai Phule Pune University, Pune

Class: T.Y.B.Sc

Subject: Chemistry

Semester: VI

Course Code: USCH361

Course Title: Physical Chemistry II

(2022 Pattern)

(No. of Credits 03)

Max. Marks: 60

Time: Two Hours

Instructions to the candidates:

- a. All questions are compulsory.
- b. Figures to the right indicate full marks.
- c. Neat diagrams must be drawn wherever necessary.
- d. Use of log table and scientific calculator is allowed.
- e. Actual calculations must be shown while solving problems.

Q1. A) Attempt ALL of the following. (1 mark each)

[04]

- i. What is electrochemical cell?
- ii. What do you mean by adsorbent?
- iii. Define the term 'Isotope'. Give one example.
- iv. Define the term 'Degenracy'.

B) Attempt ALL of the following. (2 marks each)

[08]

- i. Write any two advantages of potentiometric titration.
- ii. Write BET adsorption isotherm and explain each term in it.
- iii. Explain with example positive catalysis.
- iv. Define the term Half Life of Radioactive element. Calculate decay constant, if a radioactive element has a half life of 140 days.

P.T.O.

Q2. Attempt **ANY THREE** of the following.

[12]

- i. Formulate the cell if cell reaction is
 - a. $2\text{Ag} + 2\text{Cl}^-_{(\text{aq})} + \text{Cu}^{2+}_{(\text{aq})} \rightleftharpoons 2\text{AgCl}_{(\text{s})} + \text{Cu}_{(\text{s})}$
 - b. $\text{Zn}_{(\text{s})} + \text{Cu}^{2+}_{(\text{aq})} \rightleftharpoons \text{Zn}^{2+}_{(\text{aq})} + \text{Cu}_{(\text{s})}$
- ii. Distinguish between physical and chemical adsorption.
- iii. For the electrochemical cell,
 $\text{Zn} | \text{ZnSO}_4 (\text{solution}) | \text{Hg}_2\text{SO}_4 (\text{s}) | \text{Hg}$ the emf and temperature coefficient are 1.420 V and -0.0013 V K^{-1} at 298 K respectively. Calculate ΔG , ΔH and ΔS of the cell.
 [Given: $F = 96500 \text{ Coulombs}$]
- iv. Calculate the mass defect & per nucleon binding energy for $^{31}_{15}\text{P}$ having atomic mass 30.9840 amu & mass of proton is 1.0080 amu.

Q3. Attempt **ANY TWO** of the following.

[12]

- i. Give the assumptions of Langmuir adsorption isotherm. Write the Langmuir adsorption isotherm.
- ii. Give the classification of electrodes. Explain one of the electrodes with respect to formation, electrode reaction and expression for electrode potential.
- iii. Write a brief note on
 - a) Wave particle duality
 - b) Heisenberg uncertainty principle

Q4. Attempt **ANY TWO** of the following.

[12]

- i. What is chemical cell? Explain in details chemical cell without transference.
- ii. Write short note on heterogeneous catalysis.
- iii. What is radioactivity? Explain its types with examples.

Q5. Attempt **ANY ONE** of the following.

[12]

- i. What do you mean by reference electrode? Explain standard hydrogen electrode in details. Give drawbacks of standard hydrogen electrode.
 Write the cell reaction and calculate the emf of the following cell at 25°C .
 $\text{Zn} | \text{Zn}^{2+} (a=0.1) | | \text{Ag}^+ (a=0.1) | \text{Ag}$
 Given: $E^0_{\text{Ag}(\text{ox})} = -0.799 \text{ V}$ and $E^0_{\text{Zn}(\text{ox})} = 0.76 \text{ V}$
- ii.
 - a) Explain in detail the construction and working of G.M. Counter.
 - b) The half life period of radioactive sodium is 14.80 hours. How much will it take for the radioactivity to fall to one tenth of the original value?

BARAMATI
(Empowered Autonomous)
Affiliated to Savitribai Phule Pune University, Pune

TYBSc Chemistry (Semester-VI)
USCH262: Subject: Inorganic Chemistry
(2022 Pattern)

(No. of Credits 03)

Time: 2:00 hrs

Max marks: 60

Indications to the candidates:

1. All questions are compulsory and carry equal marks.
2. Figures to the right indicates full marks
3. Neat diagram must be drawn wherever necessary.

Q.1a) Attempt the following

04

- 1) Define Actinides.
- 2) How many oxidation state of Iron in Haemoglobin?
- 3) What is Homogenous Catalysis?
- 4) What is the long form of ZSM-5?

b) Attempt the following

08

- 1) Give the IUPAC Nomenclature for Atomic number 119 and 207.
- 2) Give the name and formula of lanthanides ore?
- 3) Arrange the metals increasing order with good conductors Al, Mg and Na
- 4) Draw the structure for 4Fe-4S protein.

Q.2 Attempt any three of the following

12

- 1) What are lanthanides ? Give the Electron configuration for lanthanides.

- 2) Discuss Wilkinson's Hydrogenation cycle.
- 3) Write note on Misch Metal.
- 4) Discuss in short the synthesis of Benzoic acid from toluene.

Q.3 Attempt any two of the following

- 1) Give in detail band theory for Sodium metal.
- 2) Define Transuranic elements? Give the synthesis method for transuranic elements.
- 3) Calculate the lattice energy of NaI from the following data.

$$\Delta H_f \text{ of NaI} = -287.6 \text{ kJ mol}^{-1}, S_{\text{Na}} = +108.7 \text{ kJ mol}^{-1}, I_{\text{Na}} = +493.8 \text{ kJ mol}^{-1}$$

$$\frac{1}{2} D_{\text{I}_2} = +106.6 \text{ kJ mol}^{-1}, E_f = -305.9 \text{ kJ mol}^{-1},$$

Q.4 Attempt any two of the following

- 1) Explain in detail Vitamin B₁₂.
- 2) Give the Ion Exchange method for separation of Lanthanides .
- 3) Discuss in brief the synthesis of p-aminophenol from nitrobenzene. Give Reactions.

Q.5 Attempt any one of the following

- 1) Define Semiconductor ? How many types of semiconductors explain with suitable examples, give the applications of semiconductors.
- 2) What are the function of Haemoglobin and myoglobin ? What are the Similarities and differences in their structure?

[Total No. of Questions: 3]

Seat No-

[Total No. of pages: 2]

Anekant Education Society's
Tuljaram Chaturchand Arts, Science and Commerce College, Baramati,
(Empowered Autonomous)
Affiliated to Savitribai Phule Pune University, Pune

T.Y.B.Sc
CHEMISTRY
SEMESTER-VI
USCH-363: Organic Chemistry-II
(2022 Pattern)

Time: 2.00 hr.)

(No. of credits=03)

(Max. Marks: 60)

Instructions to candidates:

- IV. *All questions are compulsory.*
- V. *Figures on the right indicate full marks.*
- VI. *Neat diagrams must be drawn wherever necessary.*

Q.1 (A) Attempt **each** of the following

[4]

- i) Define auxochrome.
- ii) What do you mean by synthon.
- iii) Formaldehyde does not undergo Aldol condensation reaction.
- v) In which rearrangement reaction soda-azide and acyl halide are used?

(B) Attempt **each** of the following

[8]

- i) Calculate the fundamental modes of vibrations of- 1. CH₄ 2. CO₂
- ii) Convert 2.5 μ into cm⁻¹.
- iii) Write the reagents used in Bayer-Villiger oxidation.
- iv) State the anti-Markovnikoffs rule with a suitable example.

Q.2 Attempt **any three** of the following

[12]

- i) Define special isoprene rule. Give evidence for presence of unsaturation in citral.
- ii) Explain any two applications of UV spectroscopy.
- iii) Write a note on Reformatsky reaction.
- iv) Discuss the mechanism of Cannizzaro's reaction.

Q.3 Attempt **any two** of the following

[12]

- i) Discuss the mechanism of the Favorskii reaction with a suitable example.
- ii) What is the Claisen rearrangement reaction? Explain the mechanism of this reaction with a suitable example.

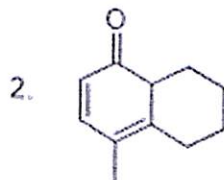
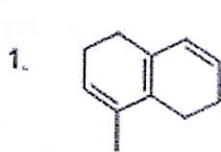
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iii) What is addition reaction? Discuss the mechanism of addition of hydrochloric acid to propene.

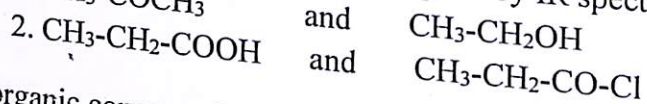
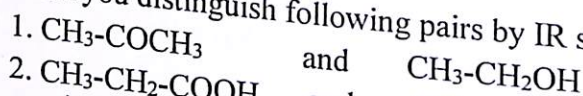
Q.4 Attempt any two of the following

- i) Write the retrosynthesis and synthesis of- 1. Ph-CH₂-OCO-Ph 2. Cyclohexene
ii) Calculate the λ_{max} of-

[12]



iii) a) How will you distinguish following pairs by IR spectroscopy-



b) An organic compound having molecular formula C₃H₆O shows IR band at 1720 and 2720 cm⁻¹. Suggest the possible structure of the compound.

Q.5 Attempt any one of the following

[12]

i) Propose structures of compounds from the following spectroscopic data.

1. Molecular formula: C₈H₈O

UV λ_{max} : 292 nm

IR: 1722, 2740 cm⁻¹

NMR: a) s, 7.27 δ , 5H

b) s, 2.80 δ , 2H

c) s, 9.88 δ , 3H

2. Molecular formula: C₇H₇Br

UV λ_{max} : 250 nm, 288 nm

IR: 1620, 1510, 855 cm⁻¹

NMR: a) s, 2.3 δ , 3H

b) d, 7.2 δ , 2H

c) d, 6.8 δ , 2H

3. Molecular formula: C₄H₈O₂

UV λ_{max} : 280 nm

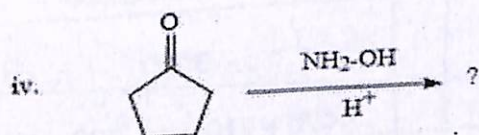
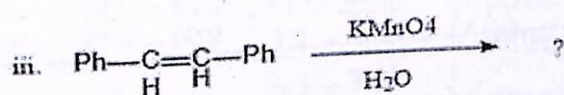
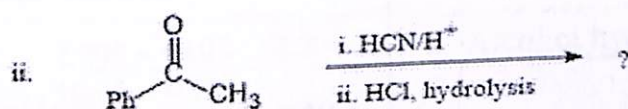
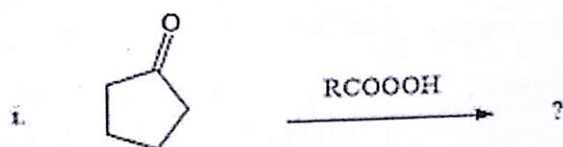
IR: 1740 cm⁻¹

NMR: a) t, 1.1 δ , 3H

b) s, 2.1 δ , 3H

c) q, 3.4 δ , 2H

ii) Predict the product with mechanism



APPENDIX

Table 1 : Characteristic Infrared Absorptions of Functional Groups

	Group	Frequency Range cm^{-1}	Intensity
A.	Alkyl C-H (stretching) Isopropyl - $\text{CH}(\text{CH}_3)_2$ tert - Butyl - $\text{C}(\text{CH}_3)_3$	2853 - 2962 1380 - 1385 and 1365 - 1370 1385 - 1395 and - 1365	(m-s) (s) (m) (s)
B.	Alkenyl C-H (stretching) C = C (stretching) R-CH = CH ₂ R ₂ C = CH ₂ cis - RCH = CHR trans - RCH = CHR (out-of-plane C-H bendings)	3010 - 3095 1620 - 1680 985 - 1000 and 905 - 920 880 - 900 675 - 730 960 - 975	(m) (v) (s) (s) (s) (s)
C.	Alkynyl $\equiv \text{C} - \text{H}$ (stretching) C \equiv C (stretching)	- 3300 2100 - 2260	(s) (v)
D.	Aromatic Ar - H (stretching) Aromatic substitution type a) Monosubstituted b) o - Disubstituted c) m - Disubstituted d) p - Disubstituted	- 3030 690 - 710 and 730 - 770 735 - 770 680 - 725 and 750 - 810	(v) (very s) (s) (s)
E.	Alcohols, Phenols, Carboxylic Acids O-H (alcohols, phenols, dilute solutions) O-H (alcohols, phenols, hydrogen bonded) O-H (carboxylic acids, hydrogen bonded)	800 - 840 3590 - 3650 3200 - 3550 2500 - 3000	(very s) (sharp v) (broad s) (broad v)
F.	Aldehydes, Ketones, esters and Carboxylic acids a) C = O stretch b) aldehydes c) ketones d) esters e) carboxylic acids f) amides	1630 - 1780 1690 - 1740 1680 - 1750 1735 - 1750 1710 - 1780 1630 - 1690	(s) (s) (s) (s) (s) (s)
G.	Amines N - H	3300 - 3500	(m)
H.	Nitriles C \equiv N	2220 - 2260	(m)
I.	-C-O stretch (alcohol, ether, phenol)	1000 - 1300	(s)
J.	Nitro - N = O	1350 - 1550	(s)
K.	Halides (-X)	1000 - 1400 540 - 750 < 667	(s) (s) (s)

1° Alkyl, RCH ₂ R (methyl)	1.2 - 1.4	Vinyl R ₂ C = CH - R	5.2 - 5.5
2° Alkyl, RCH ₂ R (methylene)	1.2 - 1.4	Aromatic, ArH	6.0 - 9.5
3° Alkyl R ₃ CH (methyne)	1.4 - 1.7	Acetylenic, RC ≡ CH	2.5 - 3.1
Allylic R ₂ C = $\underset{\text{R}}{\underset{ }{\text{C}}} - \text{CH}_3$	1.6 - 1.9	Alcohol hydroxyl, R-OH	0.5 - 6.0 ^a
Benzylic, ArCH ₂	2.2 - 2.5	Carboxylic, R- $\overset{\text{O}}{\parallel}{\text{C}}-\text{OH}$	10 - 13 ^a
Alkyl chloride RCH ₂ -Cl	3.6 - 3.8	Phenolic, Ar - O - H	4.5 - 7.7 ^a
Alkyl bromide, RCH ₂ -Br	3.4 - 3.6	Amino R - NH ₂	1.0 - 5.0
Alkyl iodide, RCH ₂ -I	3.1 - 3.3		
Ether, ROCH ₂ R	3.3 - 3.9		
Alcohol, HOCH ₂ R	3.3 - 4.0		
Ketone, R- $\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$	2.1 - 2.6	R- $\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_2-$	2.4
Ester R- $\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\text{CH}_2-\text{R}$	4.0 - 4.5	R- $\overset{\text{O}}{\parallel}{\text{C}}-\underset{ }{\text{CH}}-$	2.5
Aldehyde, R- $\overset{\text{O}}{\parallel}{\text{C}}-\text{H}$	9.5 - 9.6		

^a The chemical shifts of these groups vary in different solvents and with temperature and concentration.

Table 3 : U. V. Absorption rules for Diene chromophores

1) Parent	→	215 nm	6) - halogen	5 nm
2) Each extra conjugation	→	30 nm	7) - SR	30 nm
3) Homoannular	→	39 nm	8) - NR ₂	60 nm
4) Exocyclic double bond	→	05 nm	9) - OH, - OR	5 nm
5) Each alkyl (R) substituent directly attached to double bonded carbon	→	05 nm		

U.V. Absorption rules for Enone System

1) Parent	→	215 nm (207 nm for aldehyde) (202 for five membered ring)	6) - Cl	→	α 15 nm
2) Each extra conjugation	→	30 nm	7) - OH, - OR	→	β 12 nm
3) Homoannular	→	39 nm	8) -SR	→	α 35 nm
4) Substituents			9) - NR ₂	→	α 30 nm
a) Alkyl group at α	→	10 nm			β 85 nm
b) Alkyl group at β	→	12 nm			γ 95 nm
c) Alkyl group at γ, δ and higher	→	18 nm			
5) Each extra conjugation	→	05 nm			

Seat No.:

[Total No. of pages:-2]

Total No. of Questions:-5]

Anekant Education Society's
Tuljaram Chaturchand Arts, Science and Commerce College, Baramati,
(Empowered Autonomous)
Affiliated to Savitribai Phule Pune University, Pune
T.Y.B.Sc. Subject:- Analytical Chemistry-II

Paper Code:- USCH364

Semester-(VI) Examination (2022 Pattern)

(No of Credits 03)

[Max. Marks:-60]

Time-2.00 Hours]

Instructions to the candidates:

- i. All questions are compulsory and carry equal marks.
- ii. Figures to the right indicates full marks
- iii. Neat diagram must be drawn wherever necessary.
- iv. Use of calculator / logarithmic table is allowed

[04]

Q.1) A) Attempt the following. (1 mark each)

- i. What is R_s value ?
- ii. Define migration velocity in electrophoresis.
- iii. What is synergistic agent?
- iv. Define-masking agent.

[08]

B) Attempt the following. (2 marks each)

- i. Calculate the turbidity of the solution if the radiant power of incident radiation is 100% and that of the transmitted radiation is 43.2 %.
- ii. Give any two similarities of chromatography with solvent extraction.
- iii. What is the difference between electrophoresis and chromatography?
- iv. Draw labeled diagram of turbidimeter.

[12]

Q.2) Answer the following. (Any THREE)

- i. Explain in detail thin layer chromatography (TLC).
- ii. What is principle of HPLC? Sketch schematic diagram of the apparatus used in HPLC.
- iii. Explain advantages and disadvantages of chromatography
- iv. Discuss the various steps in Paper chromatography.

P.T.O.

Seat No.:

[Total No. of pages:-2]

Total No. of Questions:-5]

Anekant Education Society's

Tuljaram Chaturchand Arts, Science and Commerce College, Baramati,
(Empowered Autonomous)

Affiliated to Savitribai Phule Pune University, Pune
T.Y.B.Sc.

Subject:- Analytical Chemistry-II

Paper Code:- USCH364

Semester-(VI) Examination (2022 Pattern)

(No of Credits 03)

[Max. Marks:-60]

Time-2.00 Hours]

Instructions to the candidates:

- i. All questions are compulsory and carry equal marks.
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- iii. Neat diagram must be drawn wherever necessary.
- iv. Use of calculator / logarithmic table is allowed

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- iii. What is synergistic agent?
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- iv. Draw labeled diagram of turbidimeter.

[12]

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- ii. What is principle of HPLC? Sketch schematic diagram of the apparatus used in HPLC.
- iii. Explain advantages and disadvantages of chromatography
- iv. Discuss the various steps in Paper chromatography.

P.T.O.

Q.3) Attempt the following (Any TWO)

[12]

- Explain the term 'percent extraction'. Discuss the factor affecting it.
- Sketch the schematic diagram of the double beam type turbidimeter and describe its construction and working.
- What do you understand by zone electrophoresis? Explain it with neat diagram. Discuss different modes of zone electrophoresis.

Q.4) Attempt the following (Any TWO)

[12]

- In the separation of compounds of Ga, In & Tl by TLC, the respective spots are at 10, 15 & 20 cm from the base line with the solvent front at 28 cm. An unknown compound has R_f value of 0.6. Does it any of the above metal?
- A metal chelate has a distribution ratio of 5.98 for extractions from aqueous solution at pH-3 into methyl ethyl ketene. Calculate number of extraction necessary using 25 ml portion of organic solvent to extract the 99.9% of the metal from 50 ml of a solvent.
- In the turbidimetric analysis of sulphate using a Beckmann DU spectrophotometer at a wavelength of 355 nm, a certain sample of concentration 6.9×10^{-5} moles/lit. in a 1 cm cell is found to have a transmittance T of 0.7568. What is the turbidity coefficient of sulphate ion at 355 nm in the given concentration region?

Q.5) Attempt the following (Any ONE)

[12]

- Derive the relation $D = K \frac{[HR]_{org}}{[H^+]_{aq}}$
- Describe the major difference between GC (GLC & GSC) and HPLC. In what situations would SGC be preferred over GC or HPLC? Justify your answer with examples.

Seat No.

Total No of Pages: 02

Total No of Questions: 5]

Anekant Education Society's
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Affiliated to Savitribai Phule Pune University, Pune

T.Y.B.Sc

Chemistry

Semester: VI

USCH-365 : Industrial Chemistry II
(2022 Pattern)
(No of Credits 03)

[Max.Marks:60]

Time: 2. Hrs]

Instructions to the candidates:

1. All questions are compulsory.
2. Neat diagram must be drawn wherever necessary.
3. Figures to the right indicates full marks.

(1Marks each)

Q.1.(A) Attempt each of the following .

- i. What are Pigments?
- ii. What do you meant by atom economy?
- iii. Define antipyretics drugs.
- iv. What are polymers?

(2 Marks each)

(B) Attempt each of the following

- i. Write a note on Inorganic Process Waste.
- ii. Give any four uses of PVC polymer.
- iii. Define biodegradable Waste .Give one example of it .
- iv. Define Surfactants .

(4 marks each)

Q.2. Attempt any three of the following

- i. Give the synthesis and application of paracetamol .
- ii. Give synthesis and uses of polystyrene Polymer.
- iii. Distinguish between soap and detergents?
- iv. Give broad classification of polymer on the basis of origin and linkage .

Q. 3. Attempt any two of the following.

(6 marks each)

- i. Discuss Manufacturing of Propanol .
- ii. Write a note on polyethylene polymers.
- iii. Discuss in brief Washing action of soap.

Q. 4. Attempt any two of the following

(6 marks each)

- i. What is drugs ? What are the importance of the drugs ?.
- ii. Discuss synthesis and application of acetone .
- iii. Explain the characteristics and uses of Titanium dioxide and Lithopone' .

Q. 5. Attempt any one of the following questions

(12 marks)

- i. Write down industrial synthesis of Methanol with flow chart, give the uses and properties of Methanol .
- ii. Give use and synthesis of i) Crystal violet dye ii) Indigo Dye
- iii) Phenolphthalein dyes

Exam. Seat No.

Total No. of Pages: 02

Total No. of Question: 05

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science & Commerce Baramati
(Empowered Autonomous)
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T.Y.B.Sc. Chemistry (Sem.VI)

Course Code: USCH- 366D

Course Title: Environmental and Green Chemistry -II
(2022 Pattern)

(No. of credits 03)

Max. Marks: 60

Time: 02 Hours

Instruction to students:

1. All questions are compulsory and carry equal marks.
2. Figures to the right indicate full marks.
3. Neat and labeled diagram must draw wherever necessary.

Q.1. A) Attempt each of the following

(4 Marks)

- a) What are colloidal particles?
- b) What is Lithosphere?
- c) Renewable sources of energy areand.....
- d) Define Soil Profile.

B) Answer the following

(8 Marks)

- a) Explain role of furnace in AAS. .
- b) Explain profile of podsol.
- c) What is reverse osmosis?
- d) Define green house effect and name any two green house gases.

Q.2 Attempt any three of the following

(12 Marks)

- a) Explain the importance of properties of water.
- b) What is geothermal energy? Give the uses and application of it.
- c) Explain spectrophotometric determination of cyanide.
- d) Write a note on radiative forcing.

Exam. Seat No.

Total No. of Pages: 02

Total No. of Question: 05

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science & Commerce Baramati
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Affiliated to Savitribai Phule Pune University, Pune

T.Y.B.Sc. Chemistry (Sem.VI)

Course Code: USCH- 366D

Course Title: Environmental and Green Chemistry -II
(2022 Pattern)

Time: 02 Hours

(No. of credits 03)

Max. Marks: 60

Instruction to students:

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Exam. Seat No.

Total No. of Question: 05

Total No. of Pages: 0 2

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science & commerce Baramati
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Affiliated to Savitribai Phule Pune University, Pune

T.Y.B.Sc. Chemistry (Sem. V) Examination

Course Code: CHEM- 3506(D)

Course Title: Environmental and Green Chemistry –I
(2019 Pattern)

Time: 02 Hours

[No. of Credits: 03]

Max.Marks: 60

Instruction to the candidates:

1. All questions are compulsory and carry equal marks.
2. Figures to the right indicate full marks.
3. Neat and labeled diagram must draw wherever necessary.

Q.1. A) Attempt each of the following

(4 Marks)

- a) Define sink.
- b) Name any two major components of atmosphere.
- c) Give the formula of % atom economy.
- d) Name any two renewable energy sources.

B) Answer each of the following

(8 Marks)

- a) Explain the term contaminant.
- b) What is nitrification?
- c) What are the 4 R's on which waste management based?
- d) Define i) Biosphere ii) Green energy

Q.2 Attempt any three of the following

(12 Marks)

- a) Explain the nitric oxide and nitrogen dioxide chemistry in atmosphere.
- b) What are the major classes of pesticides? Give at least one example of each class.
- c) Write a note on conventional method for synthesis of catechol.
- d) What is meant by risk? How can it be reduced?

Q.3 Answer any two of the following

(12 Marks)

- a) Give schematic representation of municipal waste water treatment and explain it.
- b) Explain acid-base and ion exchange reactions in soil.
- c) How are pesticides analyzed?

Q.4 Attempt any two of the following

(12 Marks)

- a) Explain the sources and sinks of CO_2 .
- b) Explain activated sludge process for waste water.
- c) Solar energy is the best renewable energy source, Explain.

Q.5 Attempt any one of the following

(12 Marks)

- a) Describe two processes for industrial waste water treatment with the help of suitable diagrams.
- b) Write a note on :
 - a) Incinerators
 - b) Sanitary landfills

Exam. Seat No.

Total No. of Question: 05

Total No. of Pages: 0 2

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science & commerce Baramati
(Empowered Autonomous)
Affiliated to Savitribai Phule Pune University, Pune

T.Y.B.Sc. Chemistry (Sem. V) Examination

Course Code: CHEM- 3506(D)

Course Title: Environmental and Green Chemistry –I
(2019 Pattern)

Time: 02 Hours

[No. of Credits: 03]

Max.Marks: 60

Instruction to the candidates:

1. All questions are compulsory and carry equal marks.
2. Figures to the right indicate full marks.
3. Neat and labeled diagram must draw wherever necessary.

Q.1. A) Attempt each of the following

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- a) Define sink.
- b) Name any two major components of atmosphere.
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- b) What are the major classes of pesticides? Give at least one example of each class.
- c) Write a note on conventional method for synthesis of catechol.
- d) What is meant by risk? How can it be reduced?

Q.3 Answer any two of the following

(12 Marks)

- a) What is acid rain? Explain its effects.
- b) Write a note on Eutrophication.
- c) Give an account of primary pollutant as carbon monoxide (CO) with respect to sources and chemical processes involved in it.

Q.4 Attempt any two of the following

(12 Marks)

- a) Write a note on: i) supercritical liquid ii) Green solvent from plants
- b) Explain in brief green chemistry.
- c) Write a note on photo catalysis.

Q.5 Attempt any one of the following

(12 Marks)

- a) Write a note on:-
 - i. Nitrogen transformation by bacteria.
 - ii. Chlorofluorocarbons.
- b) Explain in brief the new methodologies for sustainable development.

Exam Seat No.:

Total No. of pages: 02

Total No. of Questions: 5

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Empowered Autonomous)

Affiliated to Savitribai Phule Pune University, Pune

Class: T.Y.B.Sc

Subject: Chemistry

Semester: VI

Course Code: CHEM3601 Course Title: Physical Chemistry II
(2019 Pattern)

(No. of Credits 03)

Max. Marks: 60

Time: Two Hours

Instructions to the candidates:

- a. All questions are compulsory.
- b. Figures to the right indicate full marks.
- c. Neat diagrams must be drawn wherever necessary.
- d. Use of log table and scientific calculator is allowed.
- e. Actual calculations must be shown while solving problems.

Q1. A) Attempt ALL of the following. (1 mark each)

[04]

- i. Define catalyst.
- ii. What is oxidation potential?
- iii. Define Isotope. Give one example.
- iv. Write conditions for well-behaved wave function.

B) Attempt ALL of the following. (2 marks each)

[08]

- i. Write the function of salt bridge.
- ii. Define half-life period of radionuclide. Give one example.
- iii. What do you mean by adsorbate and adsorbent?
- iv. Explain homogeneous catalysis with one example.

P.T.O.

Q2. Attempt **ANY THREE** of the following.

[12]

- Write the cell reaction of the following cell.
 - $\text{Cd} | \text{Cd}^{2+} || \text{H}^+ | \text{H}, \text{Pt}$
 - $\text{Ag} | \text{AgCl}_{(s)}, \text{CuCl}_2_{(aq)} | \text{Cu}$
- The emf of the cell, $\text{Cd} | \text{CdCl}_2 \cdot \frac{5}{2} \text{H}_2\text{O} (\text{sat}) | \text{AgCl} (s) | \text{Ag}$ is 0.6753 V at 25 °C and 0.6915 V at 0 °C. in which the cell reaction is $\text{Cd} + 2\text{AgCl} (s) + \frac{5}{2} \text{H}_2\text{O} \rightleftharpoons \text{CdCl}_2 \cdot \frac{5}{2} \text{H}_2\text{O} + 2 \text{Ag} (s)$. Calculate ΔG and ΔH at 25 °C of the cell.
- What is the mean binding energy of $^{31}_{15}\text{P}$ if its mass defect is 0.261 a.m.u.?
- Calculate the half-life period of ^{28}Mg , if it decays 50 % in 42 hours.

Q3. Attempt **ANY TWO** of the following.

[12]

- Explain the assumption of the Langmuir adsorption isotherm.
- Explain the characteristics of catalytic reactions.
- Discuss the classification of concentration cell by giving suitable example of each.

Q4. Attempt **ANY TWO** of the following.

[12]

- How radiotracers are used in age determination? Explain in detail the Carbon-14 dating technique.
- Explain the term- Binding energy and Mean binding energy. How is the stability of the nucleus explained by the curve of binding energy versus mass number?
- State and explain any two postulates of quantum mechanics.

Q5. Attempt **ANY ONE** of the following.

[12]

- What do you mean by electrochemical cell? Explain the different methods which combine two half-cells internally. Write the cell reaction and calculate the emf of the following cell at 25 °C.
 $\text{Zn} | \text{Zn}^{2+} (a=0.1) || \text{Ag}^+ (a=0.1) | \text{Ag}$
 Given: $E_{\text{Zn}}^0(\text{ox}) = 0.760 \text{ V}$ and $E_{\text{Ag}}^0(\text{ox}) = -0.799 \text{ V}$
- What is radioactivity? Explain its types with examples. Explain in detail the construction and working of G.M. Counter.

[Total No. of Questions: 5]

Seat No-

[Total No. of pages: 3]

Anekant Education Society's
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Affiliated to Savitribai Phule Pune University, Pune
T.Y.B.Sc
SEMESTER-VI
CHEMISTRY
CHEM-3603: Organic Chemistry
(2019 Pattern)

Time: 2.00 hr.)

(No. of credits=03)

(Max. Marks: 60)

Instructions to candidates:

- I. All questions are compulsory.
- II. Figures on the right indicate full marks.
- III. Neat diagrams must be drawn wherever necessary.

Q.1) A) Attempt **each** of the following

[4]

- i) What are terpenoids?
- ii) Give two uses of citral.
- iii) Define synthon.
- iv) Express 2.5μ in cm^{-1}

B) Attempt **each** of the following

[8]

- i) Define the special isoprene rule.
- ii) What is electrophilic addition reaction?
- iii) Define the term - 1. Chromophore 2. Hypochromic shift
- iv) Calculate the fundamental modes of vibrations of- 1. CO_2 2. C_6H_6

Q.2) Attempt **any three** of the following

[12]

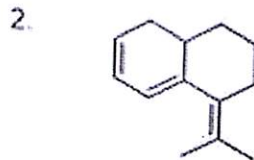
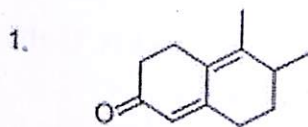
- i) Write Nagai synthesis of ephedrine.
- ii) Discuss the mechanism of the Pinacol-Pinacolone rearrangement reaction.
- iii) Explain the $\pi-\pi^*$ and $n-\pi^*$ transitions with example.
- iv) How will you distinguish following pairs by IR spectroscopy?

1. $\text{CH}_3\text{-CH}_2\text{-OH}$ and $\text{CH}_3\text{-COOH}$
2. Ph-CHO and Ph-CN

Q.3) Attempt any two of the following

[12]

i) Calculate the λ_{\max} –

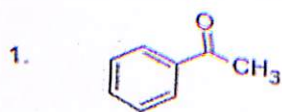


ii) Solve the following–

1. An organic compound having molecular formula C_3H_6O shows IR absorption at 1720 and 2720 cm^{-1} . Suggest the possible structure.

2. How IR spectroscopy is useful for the determination of H-bonding in a molecule?

iii) Write retrosynthesis and synthesis of–



Q.4) Attempt any two of the following

[12]

i) What is the Curtius rearrangement reaction? Explain the mechanism of this reaction with a suitable example.

ii) What is the molecular formula of citral? Give the synthesis of Citral starting from methyl heptenone.

iii) What is aldol condensation reaction? Discuss the mechanism of aldol condensation reaction.

Q.5) Attempt any one of the following

[12]

i) Propose structures of compounds from the following spectroscopic data.

1. Molecular formula: $C_4H_8O_2$

UV λ_{\max} : 280 nm

IR: 1740 cm^{-1}

NMR: a) t, 1.1δ , 3H

b) q, 2.4δ , 2H

c) s, 3.2δ , 3H

2. Molecular formula: C_8H_{10}

UV λ_{\max} : 255 nm

IR: $1600, 750\text{ cm}^{-1}$

NMR: a) t, 1.5δ , 3H

b) q, 2.3δ , 2H

c) s, 7.3δ , 5H

3. Molecular formula: $C_{10}H_{14}$

UV λ_{max} : 255 nm

IR: 3100, 2910, 1600, 1500, 750 cm^{-1}

NMR: a) t, 1.3 δ , 9H

b) s, 7.3 δ , 5H

ii) What is Ozonolysis? Discuss the mechanism of addition of O_3 molecule to propene and 2-butene.

APPENDIX

Table 1 : Characteristic Infrared Absorptions of Functional Groups

Group	Frequency Range cm^{-1}	Intensity
A. Alkyl C-H (stretching) Isopropyl - $\text{CH}(\text{CH}_3)_2$ tert - Butyl - $\text{C}(\text{CH}_3)_3$	2853 - 2962 1380 - 1385 and 1365 - 1370 1385 - 1395 and - 1365	(m-s) (s) (m) (s)
B. Alkenyl C-H (stretching) C=C (stretching) R-CH=CH ₂ R ₂ C=CH ₂ cis - RCH=CHR trans - RCH=CHR (out-of-plane C-H bendings)	3010 - 3095 1620 - 1680 985 - 1000 and 905 - 920 880 - 900 675 - 730 960 - 975	(m) (v) (s) (s) (s) (s)
C. Alkynyl $\equiv\text{C}-\text{H}$ (stretching) C $\equiv\text{C}$ (stretching)	- 3300 2100 - 2260	(s) (v)
D. Aromatic Ar-H (stretching) Aromatic substitution type a) Monosubstituted b) o - Disubstituted c) m - Disubstituted d) p - Disubstituted	- 3030 690 - 710 and 730 - 770 735 - 770	(v) (very s) (s)
E. Alcohols, Phenols, Carboxylic Acids O-H (alcohols, phenols, dilute solutions) O-H (alcohols, phenols, hydrogen bonded) O-H (carboxylic acids, hydrogen bonded)	800 - 840 3590 - 3650 3200 - 3550 2500 - 3000	(s) (very s) (s) (s)
F. Aldehydes, Ketones, esters and Carboxylic acids a) C=O stretch b) aldehydes c) ketones d) esters e) carboxylic acids f) amides	1630 - 1780 1690 - 1740 1680 - 1750 1735 - 1750 1710 - 1780 1630 - 1690	(sharp v) (broad s) (broad v) (s) (s) (s) (s) (s)
G. Amines N-H	3300 - 3500	(s)
H. Nitriles C $\equiv\text{N}$	2220 - 2260	(m)
I. -C-O stretch (alcohol, ether, phenol)	1000 - 1300	(m)
J. Nitro - N=O	1350 - 1550	(s)
K. Halides (-X)	1000 - 1400 540 - 750 < 667	(s) (s) (s) (s)

Type of Proton	Chemical Shift, Delta, PPM (δ)	
1° Alkyl, RCH_3 (methyl)	0.8 - 1.0	Vin
2° Alkyl, RCH_2R (methylene)	1.2 - 1.4	Vin
3° Alkyl R_3CH (methyne)	1.4 - 1.7	Aro
Allylic $\text{R}_2\text{C}=\underset{\text{R}}{\text{C}}-\text{CH}_3$	1.6 - 1.9	Ace
Benzylic, ArCH_3	2.2 - 2.5	Alc
Alkyl chloride $\text{RCH}_2\text{-Cl}$	3.6 - 3.8	Car
Alkyl bromide, $\text{RCH}_2\text{-Br}$	3.4 - 3.6	Ph
Alkyl iodide, $\text{RCH}_2\text{-I}$	3.1 - 3.3	Am
Ether, ROCH_2R	3.3 - 4.0	
Alcohol, HOCH_2R	2.1 - 2.6	
Ketone, $\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$	4.0 - 4.5	
Ester $\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\text{CH}_2-\text{R}$	9.5 - 9.6	
Aldehyde, $\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{H}$		

* The chemical shifts of these groups vary in different solvents

Table 3 : U. V. Absorption rules

U.V. Absorption rules		
1) Parent	→	215 nm
2) Each extra conjugation	→	30 nm
3) Homoannular	→	39 nm
4) Exocyclic double bond	→	05 nm
5) Each alkyl (R) substituent directly attached to double bonded carbon	→	05 nm

Type of Proton	Chemical Shift, Delta, PPM (δ)	Type of Proton	Chemical Shift, Delta, PPM (δ)
1° Alkyl, RCH ₃ (methyl)	0.8 – 1.0	Vinylic, R ₂ C = CH ₂	4.6 – 5.0
2° Alkyl, RCH ₂ R (methylene)	1.2 – 1.4	Vinylic R ₂ C = CH – R	5.2 – 5.7
3° Alkyl R ₃ CH (methyne)	1.4 – 1.7	Aromatic, ArH	6.0 – 9.5
Allylic R ₂ C = $\underset{\text{R}}{\underset{ }{\text{C}}} - \text{CH}_3$	1.6 – 1.9	Acetylenic, RC \equiv CH	2.5 – 3.1
Benzylic, ArCH ₃	2.2 – 2.5	Alcohol hydroxyl, R–OH	0.5 – 6.0 ^a
Alkyl chloride RCH ₂ –Cl	3.6 – 3.8	Carboxylic, R– $\overset{\text{O}}{\parallel}{\text{C}}-\text{OH}$	10 – 13 ^a
Alkyl bromide, RCH ₂ –Br	3.4 – 3.6	Phenolic, Ar – O – H	4.5 – 7.7 ^a
Alkyl iodide, RCH ₂ –I	3.1 – 3.3	Amino R – NH ₂	1.0 – 5.0
Ether, ROCH ₂ R	3.3 – 3.9		
Alcohol, HOCH ₂ R	3.3 – 4.0		
Ketone, R– $\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$	2.1 – 2.6	R– $\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_2-$	2.4
Ester R– $\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\text{CH}_2-\text{R}$	4.0 – 4.5	R– $\overset{\text{O}}{\parallel}{\text{C}}-\underset{ }{\text{CH}}-$	2.5
Aldehyde, R– $\overset{\text{O}}{\parallel}{\text{C}}-\text{H}$	9.5 – 9.6		

^a The chemical shifts of these groups vary in different solvents and with temperature and concentration.

Table 3 : U. V. Absorption rules for Diene chromophores

1) Parent	→	215 nm	6) – halogen	5 nm
2) Each extra conjugation	→	30 nm	7) – SR	30 nm
3) Homoannular	→	39 nm	8) – NR ₂	60 nm
4) Exocyclic double bond	→	05 nm	9) – OH, – OR	5 nm
5) Each alkyl (R) substituent directly attached to double bonded carbon	→	05 nm		

U.V. Absorption rules for Enone System

1) Parent	→	215 nm (207 nm for aldehyde) (202 for five membered ring)	
2) Each extra conjugation	→	30 nm	6) – Cl → α 15 nm
3) Homoannular	→	39 nm	7) – OH, – OR → β 12 nm
4) Substituents			8) –SR → α 35 nm
a) Alkyl group at α	→	10 nm	9) – NR ₂ → α 30 nm
b) Alkyl group at β	→	12 nm	β 85 nm
c) Alkyl group at γ , δ and higher	→	18 nm	γ 95 nm
5) Exocyclic double bond	→	05 nm	

Exam. Seat No.

Total No. of Question: 05

Total No. of Pages: 02

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science & commerce Baramati
(Empowered Autonomous)
Affiliated to Savitribai Phule Pune University, Pune

T.Y.B.Sc. Chemistry (Sem. V) Examination

Course Code: CHEM- 3506(D)

Course Title: Environmental and Green Chemistry –I
(2019 Pattern)

Time: 02 Hours

[No. of Credits: 03]

Max.Marks: 60

Instruction to the candidates:

1. All questions are compulsory and carry equal marks.
2. Figures to the right indicate full marks.
3. Neat and labeled diagram must draw wherever necessary.

Q.1. A) Attempt each of the following

(4 Marks)

- a) Define sink.
- b) Name any two major components of atmosphere.
- c) Give the formula of % atom economy.
- d) Name any two renewable energy sources.

B) Answer each of the following

(8 Marks)

- a) Explain the term contaminant.
- b) What is nitrification?
- c) What are the 4 R's on which waste management based?
- d) Define i) Biosphere ii) Green energy

Q.2 Attempt any three of the following

(12 Marks)

- a) Explain the nitric oxide and nitrogen dioxide chemistry in atmosphere.
- b) What are the major classes of pesticides? Give at least one example of each class.
- c) Write a note on conventional method for synthesis of catechol.
- d) What is meant by risk? How can it be reduced?

Q.3 Answer any two of the following

(12 Marks)

- a) What is acid rain? Explain its effects.
- b) Write a note on Eutrophication.
- c) Give an account of primary pollutant as carbon monoxide (CO) with respect to sources and chemical processes involved in it.

Q.4 Attempt any two of the following

(12 Marks)

- a) Write a note on: i) supercritical liquid ii) Green solvent from plants
- b) Explain in brief, green chemistry.
- c) Write a note on photo catalysis.

Q.5 Attempt any one of the following

(12 Marks)

- a) Write a note on:-
 - i. Nitrogen transformation by bacteria.
 - ii. Chlorofluorocarbons.
- b) Explain in brief the new methodologies for sustainable development.

Total No. of Questions: 05]

Seat No.

[Total No. of pages: 02]

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and
Commerce, Baramati
(Autonomous)
Affiliated to Savitaribai Phule Pune University, Pune
T.Y.B.Sc (Sem V)
USST: 351: Distribution theory
(2022 Pattern)

Time Allowed: 2.00 Hrs.

(No. of credits 03)

Max Marks: 60

Instructions:

- I. All questions are compulsory.
- II. Figures to the right indicate full marks.
- III. Symbols and abbreviation have their usual meaning.
- IV. Use of statistical tables and calculators is allowed.

[1each]

Q.1) Attempt each of the following:

(A) In each of the following cases, Choose correct alternative:

i) If $X \sim W(\alpha, \beta)$ then the distribution of $Y = (x/\alpha)^\beta$ is,

- a) Exponential with mean α
- b) Exponential with mean α/β
- c) Exponential with mean 1
- d) Exponential with mean β

ii) If $X \rightarrow \beta_1(3, 12)$ then $Y = \frac{X}{1-X}$ follows ,

- a) $\beta_1(3, 12)$
- b) $\beta_2(3, 12)$
- c) $\beta_1(12, 3)$
- d) $\beta_2(12, 3)$

iii) If $LN(0, \mu, \sigma^2)$ then median of X is,

- a) μ
- b) e^μ
- c) $e^{\mu - \sigma^2}$
- d) $e^{\mu + \frac{1}{2}\sigma^2}$

iv) If $X \rightarrow C(\mu=0, \lambda=1)$ then distribution of X^2 is,

- a) $\beta_1(0, 1)$
- b) $\beta_1(\frac{1}{2}, \frac{1}{2})$
- c) $\beta_2(\frac{1}{2}, \frac{1}{2})$
- d) $\beta_2(\frac{1}{2}, 1)$

B) Define the following terms:

[2 each]

- i) Order Statistics.
- ii) Beta distribution of First kind
- iii) Pareto Distribution
- iv) Laplace Distribution

[P.T.O.]

Q.2) Attempt any three of the following:

[4 each]

- i) Let X and Y are i.i.d. random variables having $\beta_1(1,1)$ distribution. Obtain the distribution of $X+Y$.
- ii) Obtain probability distribution of smallest (i.e. $X_{(1)}$) order statistics.
- iii) Let X_1, X_2, \dots, X_n follows $LN(0, \mu, \sigma^2)$. Obtain the mode of Log-Normal distribution.
- iv) Let $X \sim \text{Pareto}(\alpha, \beta)$. Obtain the variance of Pareto distribution.

Q.3) Attempt any two of the following:

[6 each]

- i) Let $X \rightarrow C(\mu=0, \lambda=1)$. Obtain distribution function of X , hence find quartile deviation.
- ii) For Bivariate Normal Distribution with following p.d.f. Obtain the values of parameters

$$f(x,y) = C \cdot \exp \left\{ \frac{-1}{216} [16(x-2)^2 - 12(x-2)(y-3) + 9(y-3)^2] \right\}$$
- iii) Let $X \rightarrow W(\alpha=6.4, \beta=2.3)$. Obtain the median and $P(X > 8)$.

Q.4) Attempt any two of the following:

[6 each]

- i) If $X \sim L(\mu=0, \lambda=1)$ then find, a) $P(X < 2)$ b) $P(|X| < 1)$.
- ii) If $X \sim \beta_2(m, n)$. Obtain the variance of Beta distribution of second kind.
- iii) If $(X, Y) \rightarrow BN(\mu_1, \mu_2, \sigma_1^2, \sigma_2^2, \rho)$ then find conditional distribution of X given $Y=y$.

Q.5) Attempt any one of the following:

[12 each]

- a) i) Let $X_{(1)}, X_{(2)}, \dots, X_{(n)}$ denote the order statistics of a random sample of size 4 from the distribution having p.d.f.

$$f(x) = 2x, 0 < x < 1.$$

$$= 0 \quad \text{O.W.}$$

$$\text{Find } P\left(\frac{1}{2} < X_{(3)}\right).$$

[6]

- ii) Derive the relationship between Bivariate Normal distribution and Cauchy distribution.

[6]

- b) i) Let X and Y are independent random variables having $N(0, 1)$ distribution. Show that $\frac{X}{Y}$ has Cauchy distribution.

[6]

- ii) If $X \sim L(\mu=0, \lambda=1)$ then obtain its mean deviation about mean.

[6]

Total No. of Questions: 05

Seat No.

Total No. of Pages: 02

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)
Affiliated to Savitribai Phule Pune University, Pune
T. Y. B. Sc (Statistics) (Sem V)
USST-354: Design of Experiments
(2022 Pattern)

Time: 2:00 Hours

No. of Credits: 03

Max. Marks: 60

Instructions:

- i) All questions are compulsory.
- ii) Figures to the right indicate full marks.
- iii) Use of scientific calculator and statistical tables is allowed.
- iv) Symbols and abbreviations have their usual meanings.

Q1) Attempt each of the following:

A) Select the correct option for each of the following:

[1 each]

- i) Errors in statistical model are always taken to be
 - a) Independent
 - b) Distributed as $N(0, \sigma_e^2)$
 - c) Both a and b
 - d) Either a or b
- ii) Local control in experimental designs is meant to
 - a) Increase the efficiency of design
 - b) To form heterogeneous blocks
 - c) Both a and b
 - d) None of these
- iii) Replication in an experiment means
 - a) the number of blocks
 - b) total number of treatments
 - c) the number of times a treatment occurs in an experiment
 - d) either a or b
- iv) With usual notation the error in CRD is given by
 - a) $n - t$
 - b) $n - 1$
 - c) $t - 1$
 - d) $(nt) - 1$

B) Attempt each of the following: -

[2 each]

- i) Define orthogonal contrast with one illustration.
- ii) Explain mathematical model of Latin Square Design.
- iii) Construct the layout of 5 treatments A, B, C, D, E in RBD
- iv) Check whether $T_2 - T_3$ and $T_1 - T_4$ pair of treatment combination is orthogonal contrast or not?

P.T.O.

Q2) Answer any three questions.

[4 each]

- i) Consider CRD with 4 treatments each replicated 5 times. The total sum of squares and mean squares due to error are equal to 905.2 and 20.1 respectively. Construct ANOVA table and give conclusion based on it.
- ii) Write a note on Yate's Method of computing factorial effect totals in 2^3 factorial experiment
- iii) What is ANOCOVA? Give a real-life situation where it is used. Also state estimators of parameters in CRD with ANOCOVA.
- iv) Compute the relative efficiency of LSD with respect to corresponding CRD. Given that $SSR = 72$, $MSC = 36$, $MSE = 12$, error d.f. = 6.

Q3) Answer any two questions.

[6 each]

- i) Discuss the basic principles of Design of Experiments.
- ii) With usual notation prove the following identities in RBD.

a) $\overline{X}_{i.} = \mu + \alpha_i + \overline{\varepsilon}_{i.}$

b) $\overline{X}_{..} = \mu + \overline{\varepsilon}_{..}$

- iii) Show that mean sum of squares due to treatment is unbiased estimator of error variance σ^2 under H_0 ($H_0: \alpha_i = 0$) in CRD.

Q4) Answer any two questions.

[6 each]

- i) Explain the concept of efficiency of design. Derive the efficiency of RBD over CRD.
- ii) Derive an expression for two factor interaction effect AB in a 2^2 factorial experiment.
- iii) Write a note on size and shape of the plot.

Q5) Answer any one question.

[12]

- i) a) Define orthogonal contrast. Also describe Scheffe's method for comparing treatment contrast.
- b) Distinguish between total confounding and partial confounding in factorial experiment.

[8+4]

- ii) a) Describe the mathematical model of LSD. State the hypothesis that can be tested in the analysis of LSD. Give the ANOVA table for LSD.
- b) Write a note on Kruskal Wallis H test.

[6+6]

Total No. of Questions: 05]

Exam Seat No.

[Total No. of Pages: 03

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Empowered Autonomous)
Affiliated to Savitribai Phule Pune University, Pune
T.Y.B.Sc. (STATISTICS)
Semester – V
USST356(A) Introduction to Stochastic Processes
(2022 Pattern)
(No. of Credits 03)

[Max. Marks:60

Time: 2 Hours]

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Use of scientific calculators and statistical tables is allowed.
- 4) Symbols and abbreviations have their usual meaning.

Q1) Attempt each of the following:

[1 each]

A) Choose the correct alternative in each of the following

- i) If a closed set contain only one state, then that state is
a) absorbing
b) transient
c) communicable
d) reducible
- ii) A persistent state is non null persistent if mean recurrence time is
a) finite
b) infinite
c) 0
d) 1
- iii) Let $\{N(t), t \geq 0\}$ be a Poisson process with parameter λ , then mean number of occurrences in an interval of length t is
a) λt
b) $\frac{1}{\lambda t}$
c) $\frac{1}{\lambda}$
d) $\lambda^2 t$
- iv) Consider a Markov chain $\{X_n, n \geq 1\}$ with discrete state space S . If the transition probabilities are independent on n , the Markov chain is said to be
a) homogenous Markov chain
b) reducible Markov chain
c) non homogenous Markov chain
d) independent Markov chain

B) Attempt each of the following:

[2 each]

- i) State Markov property.
- ii) Define probability of ultimate.
- iii) What is meant by aperiodic state of a Markov chain?
- iv) Define ergodic Markov chain.

P.T.O.

Q2) Attempt any three question from the following:

[4 each]

- Suppose that the probability of a dry day (No rain day) followed by rainy day is 0.7 and the probability of a rainy day followed by a dry day (No rain day) is 0.4. If $\{X_n, n \geq 1\}$ is the two state Markov chain with X_n denotes weather condition on n^{th} day, either dry day (No rain) or rainy day. Construct the transition probability matrix and calculate the probability that it will rain on fourth day from today given that it is raining today.
- Explain Ehrenfest model with one example.
- What do you mean by an absorbing Markov chain? Give an example of it.
- Consider that customers arrive at a bank according to a Poisson process with an average rate of 10 customers per hour. What is the probability that
 - no customers will arrive in the first 30 minutes?
 - at least 2 customers will arrive in the first 30 minutes?

Q3) Attempt any two question from the following:

[6 each]

- State and prove Chapman-Kolmogorov equation.
- Consider Markov chain $\{X_n, n \geq 0\}$ with states $S = \{0, 1, 2\}$, has the transition probability matrix $P = \begin{bmatrix} \frac{3}{4} & \frac{1}{4} & 0 \\ \frac{1}{4} & \frac{1}{2} & \frac{1}{4} \\ 0 & \frac{3}{4} & \frac{1}{4} \end{bmatrix}$. If $P(X_0 = i) = \frac{1}{3}$ for $i = 0, 1, 2$. Find $E(X_3)$ and $\text{Var}(X_3)$.
- Distinguish between persistent state and transient state of a Markov chain. Explain with suitable example.

Q4) Attempt any two question from the following:

[6 each]

- Define Stationary distribution. Find all stationary distribution for the following transition matrix, $P = \begin{bmatrix} 0 & \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & 0 & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$
- Define state space and parameter space of a stochastic process? Explain different type of stochastic process according to state space and parameter space with one illustration of each type.
- Explain the following terms
 - First return probability.
 - Time homogenous stochastic process.
 - Stationary independent increment.

Q5) Attempt any one question from the following:

- i) a) Define three postulates of the Poisson process. Consider two independent series of events E and F occurring in accordance with Poisson processes with mean αt and βt respectively. Then show that number N of occurrences of event E between two successive occurrences of event F has a geometric distribution. [8+4]

b) Define Compound Poisson process. State its mean and variance.

- ii) Consider a Markov chain with state space $S = \{1, 2, 3\}$ and one step transition probability

matrix P as $P = \begin{bmatrix} 0 & 1 & 0 \\ \frac{3}{4} & 0 & \frac{1}{4} \\ 0 & 1 & 0 \end{bmatrix}$. Determine the following for this Markov chain. [3 each]

- a) closed set
- b) probability of ultimate return to the all states
- c) periodicity of all states
- d) mean recurrence time of the all states

Total No. of Questions: 05]

Seat No.

[Total No. of pages: 02

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Empowered Autonomous)
Affiliated to Savitribai Phule Pune University, Pune
T.Y.B. Sc. Statistics
(Sem-VI)

USST361: Introduction to Regression Analysis
(2022 Pattern)
(No. of credits 03)

Max Marks: 60

Time Allowed: Two Hrs.

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Use of scientific calculator and statistical tables is allowed.
- 4) Symbols and abbreviations have their usual meaning.

Q.1) Attempt each of the following:

[1 each]

a) In each of the following cases, choose the correct alternative:

- i) In Simple linear regression model, if we multiply each x value by constant c , then the value of residual and fitted value of
 - a) Remains unchanged
 - b) Residual changes but not fitted value
 - c) Fitted value changes but not residual
 - d) Both of them change
- ii) Errors (ε_{ij}) in regression analysis are
 - a) Independent
 - b) $N(\mu, \sigma^2)$
 - c) Both a) and b)
 - d) None of these
- iii) If the Linear regression model is adequate, then the residual shows
 - a) Outward opening funnel
 - b) Inward opening funnel
 - c) double bow structure
 - d) horizontal band
- iv) In multiple regression analysis involving 5 regressors based on 30 observations, the total variation in Y is 900 and variation unexplained by regression is 300 then adjusted R^2 is
 - a) 0.59
 - b) 0.49
 - c) 0.79
 - d) 0.69

[2 each]

b) Attempt each of the following:

- i) Standardised residual
- ii) Influence point
- iii) Mallows' C_p Statistics
- iv) Adjusted R^2

P.T.O

Q.2) Attempt any three of the following:

[each 4]

- In a simple linear regression problem with sample size 20, the slope was found to be 2.5 and standard error estimate (σ^*) is equal to 10.15. The quantity $\sum_{i=1}^{20} x_i^2 - n\bar{x}^2 = 400$. Compute the standard error of the regression slope coefficient (β_1). Test whether the regression coefficient is different from zero at a 5% level of significance.
- Discuss in brief Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC).
- Describe the procedure of testing significance of individual regressors in multiple linear regression model.
- Explain variance stabilizing transformations used to deal with problem of non constant variance in regression analysis.

Q. 3) Attempt any two of the following:

[each 6]

- Explain how residual plots are useful in verifying the assumptions in linear regression model.
- Write a note on the backward selection method for regression model.
- Show that the sum of residuals weighted by corresponding fitted values is always zero.

Q. 4) Attempt any two of the following:

[each 6]

- For a multiple linear regression model, $y = X\beta + \varepsilon$ with $\varepsilon \sim N_p(0, \sigma^2 I)$. Obtain the mean and variance of the least squares estimator of β .
- Consider the simple linear regression model, $y = \beta_0 + \beta_1 x + \varepsilon$, find the least squares estimator of β_0 and β_1 .
- Explain the procedure of estimating the parameters in simple logistic regression model.

Q.5) Attempt any one of the following:

[each 12]

- State multiple linear regression model with k regressors also its assumptions.
 - In a multiple linear regression model, derive 95% confidence interval for regression coefficient β_j , $j=0,1,2,\dots,k$. Also explain the notations used in it.
- Write multiple logistic regression model, Explain the procedure of fitting this model.
 - Given the data points on (y, x1, x2) as follows

[6+6]

Y	10	17	9	16	26
x1	2	3	7	8	6
x2	1	2	3	4	4

And $(X'X)^{-1}$ with usual notation. Fit regression analysis $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \varepsilon$ and check the significance of regression with constructing ANOVA.

[8+4]

No. of Questions: 05]

Seat No.

[Total No. of pages: 03]

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Empowered Autonomous)
Semester VI

T.Y.B.Sc.(STATISTICS)
USST362: STATISTICAL INFERENCE II
(2022 Pattern)

Max Marks: 60

Time Allowed: 2.00 Hrs

No. of Credits: 03

Instructions:

- i) All questions are compulsory.
- ii) Figures to the right indicate full marks.
- iii) Use of scientific calculator and statistical tables is allowed.
- iv) Symbols and abbreviations have their usual meanings.

Q 1) Attempt each of the following:

[1 each]

a) Choose the correct alternative in each of the following:

i) Which of the most powerful test from the following:

- A) $\alpha=0.09$, $1-\beta = 0.93$
- B) $\alpha=0.10$, $1-\beta = 0.95$
- C) $\alpha=0.08$, $1-\beta = 0.98$
- D) $\alpha=0.09$, $1-\beta = 0.90$

ii) A random sample of size n drawn from a distribution with distribution function $F_X(\cdot)$. Which of the following test can be used for testing $H_0: M = M_0$, where M is median of the distribution of X .

- | | |
|----------------------------|----------------------|
| A) Sign test | B) Mann-Whitney test |
| C) Kolmogorov-Smirnov test | D) Run test |

iii) The probability of committing type I error (α) and type II error (β) should be given in advance for carrying out

- | | |
|------------|-------------|
| A) LRT | B) SPRT |
| C) MP test | D) UMP test |

iv) If X_1, X_2, \dots, X_n is a random sample of size n from $N(\mu, 64)$ distribution, then UMP test does not exist for testing,

- A) $H_0: \mu = 100$ against $H_1: \mu < 100$
- B) $H_0: \mu = 100$ against $H_1: \mu > 100$
- C) $H_0: \mu = 110$ against $H_1: \mu > 110$
- D) $H_0: \mu = 110$ against $H_1: \mu \neq 110$

P.T.O.

No. of Questions: 05]

Seat No.

[Total No. of pages: 03]

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Empowered Autonomous)
Semester VI

T.Y.B.Sc.(STATISTICS)
USST362: STATISTICAL INFERENCE II
(2022 Pattern)

Max Marks: 60

Time Allowed: 2.00 Hrs

No. of Credits: 03

Instructions:

- i) All questions are compulsory.
- ii) Figures to the right indicate full marks.
- iii) Use of scientific calculator and statistical tables is allowed.
- iv) Symbols and abbreviations have their usual meanings.

Q 1) Attempt each of the following:

[1 each]

a) Choose the correct alternative in each of the following:

i) Which of the most powerful test from the following:

- A) $\alpha=0.09$, $1-\beta = 0.93$
- B) $\alpha=0.10$, $1-\beta = 0.95$
- C) $\alpha=0.08$, $1-\beta = 0.98$
- D) $\alpha=0.09$, $1-\beta = 0.90$

ii) A random sample of size n drawn from a distribution with distribution function $F_X(\cdot)$. Which of the following test can be used for testing $H_0: M = M_0$, where M is median of the distribution of X .

- A) Sign test
- B) Mann-Whitney test

- C) Kolmogorov-Smirnov test
- D) Run test

iii) The probability of committing type I error (α) and type II error (β) should be given in advance for carrying out

- A) LRT
- B) SPRT
- C) MP test
- D) UMP test

iv) If X_1, X_2, \dots, X_n is a random sample of size n from $N(\mu, 64)$ distribution, then UMP test does not exist for testing,

- A) $H_0: \mu = 100$ against $H_1: \mu < 100$
- B) $H_0: \mu = 100$ against $H_1: \mu > 100$
- C) $H_0: \mu = 110$ against $H_1: \mu > 110$
- D) $H_0: \mu = 110$ against $H_1: \mu \neq 110$

P.T.O.

b) Attempt each of the following.

[2 each]

i) Define the term size of the test.

ii) Let X have binomial distribution with $n = 4$ and P , if $X > 3$, is the critical region for testing $H_0: P = 0.6$ against $H_1: P = 0.7$, then obtain probability of type I error.

iii) Define the term Likelihood Ratio Test (LRT) statistic

iv) Let $X \sim U(0, \theta)$ distribution, if $0.8 \leq x \leq 1$, is the critical region for testing $H_0: \theta = 2$ against $H_1: \theta = 1$, then obtain power of the test.

Q 2) Attempt any three of the following:

[4 each]

a) A person flips a coin 15 times and records the outcomes:

H T H H T T H H T H T H H T T.

Test whether the sequence of coin toss outcomes is random at a 5% level of significance.

b) Define the following terms:

i) Simple hypothesis

ii) Level of the significance

iii) Power of the test

iv) Type II error

c) Distinguish between usual test (fixed sample size test) and sequential probability ratio test (SPRT).

d) Let $H_0: p = \frac{1}{2}$ against $H_1: p = \frac{2}{3}$. Where p be the probability of success when Coin is tossed once. The experiment is performed twice and H_0 is accepted if and only if we get two success. Find the values of α and β .

Q 3) Attempt any two of the following:

[6 each]

a) Following is a random sample of size 5 drawn from a continuous distribution with distribution function $F_X(\cdot)$.

12, 14, 15, 18, 19.

Test whether the sample can be regarded as drawn from $U(10, 20)$ distribution. Use 5% level of significance.

b) A sample of size 25 is drawn from $N(\mu, \sigma^2=4)$ to test the hypothesis $H_0: \mu = 0$ against $H_1: \mu = 1$. So that the size of type I error is 0.05. We reject if $\bar{x} \geq d$ find the value of d and power of test.

c) Construct SPRT of strength (α, β) for testing $H_0: m = m_0$ against $H_1: m = m_1$ ($m_1 > m_0$) for Poisson variate with parameter m .

[6 each]

Q.4) Attempt any two of the following:

- Construct SPRT of strength (α, β) for testing $H_0: \theta = \theta_0$ against $H_1: \theta = \theta_1, (\theta_1 > \theta_0)$ for an exponential variate with mean $\frac{1}{\theta}$.
- Construct likelihood ratio test of level of significance α for testing, $H_0: \sigma^2 = \sigma_0^2$ against $H_1: \sigma^2 \neq \sigma_0^2$, where σ^2 is the variance of normal distribution with known mean μ_0 based on random sample X_1, X_2, \dots, X_n drawn from it.
- Define Non-parametric tests and distinguish between non-parametric and parametric tests.

Q.5) Attempt any one of the following:

- Suppose $X \sim N(\mu, \sigma^2=25)$ take $\alpha=0.05$ and $n=25$. Obtain Most powerful test for testing $H_0: \mu = 10$ against $H_1: \mu = 20$. [6]
 - Describe Wilcoxon Signed rank test procedure. [6]
- Construct likelihood ratio test of level of significance α for testing $H_0: \mu = \mu_0$ against $H_1: \mu \neq \mu_0$, where μ is the mean of normal distribution with unknown variance σ^2 based on random sample X_1, X_2, \dots, X_n drawn from it. [6]
 - Let X_1, X_2, \dots, X_n be random sample of size n from exponential distribution with p.d.f.

$$f(x, \theta) = \theta e^{-\theta x}; X \geq 0, \theta \geq 0$$

$$= 0, \text{ otherwise.}$$

Obtain BCR for testing $H_0: \theta = \theta_0$ against $H_1: \theta = \theta_1 (\theta_1 > \theta_0)$

[6]

Exam seat No.

Total No. of pages: 2

Total No. of questions: 05

Anekant Education Society's
Tuljaram Chaturchand College of Art's Science and Commerce, Baramati
(Autonomous)

Affiliated Savitaribai Phule Pune University, Pune
T.Y.B.Sc (Sem VI)

USST-363: Statistical quality control and reliability
(2022 Pattern)
(No. of Credits 03)

Max Marks: 60

Time Allowed: 2 Hrs.

Instructions:

1. All questions are compulsory.
2. Figures to right indicate full marks.
3. Symbols and abbreviation have their usual meaning.
4. Use of statistical table and calculator is allowed.

[1 each]

Q.1) Attempt each of the following:

A) In each of the following cases, Choose the correct alternative:

a)chart shows the centering of the process.

a) \bar{X}

b) R

c) P

d) C

b) LTPD is considered to be

a) A good quality of a lot produced by the producer.

b) A good quality of a lot acceptable to consumer.

c) The worst quality of a lot acceptable to consumer.

d) The worst quality of a lot produced by the producer.

c) Which of the following process tools uses 80:20 principle?

a) Parato Diagram

b) Histogram

c) Control Chart

d) Cheek Sheet

d) Consumer's risk is probability of accepting a lot of quality

a) AQL

b) AOQ

c) AOQL

d) LTFD

[1 each]

B) State whether the given statement is true or false.

a) $C_p \geq C_{pk}$ always.

b) The points out of control on R chart are also considered while constructing \bar{X} chart.

[P.T.O]

C) Define the following terms:

- Assignable Causes & Chance Causes
- Producer's Risk & Consumer's Risk
- Traditional & modern definition of quality

Q.2) Attempt any three of the following:

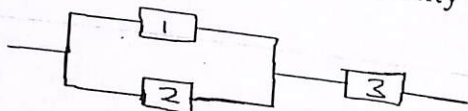
- For a single sampling plan $n=100$, $c=1$, lot quality $p=0.3$, then find the value of AOQ assuming population size $N=1000$.
- Write a short note on Pareto diagram.
- Draw fault tree diagram for a 2 out of 3 system. And also find its minimal path sets.
- Explain the construction of P-chart when standards are not given for fixed sample size.

Q.3) Attempt any two of the following:

- An aero plane has four pro-pillars, 2 of each wing aero plane can fly at least one pro-pillar on each wing functions. Draw reliability block diagram and its structure function.
- For the following double sampling plan $N=100$, $n_1=36$, $c_1=0$, $n_2=59$, $c_2=3$. Compute the probability of acceptance of 1% defective and also calculate ATI & AOQ.
- Define Specification limit and Natural tolerance limits. Also compare it.

Q.4) Attempt any two of the following:

- Prove that, Hazard rate of series of components having independent life-time is summation of the Hazard rate of its component.
- Consider the following Reliability Block Diagram :



- Draw its system redundancy & component redundancy.
 - Find the structure function of the above system.
- c) i) Distinguish between control charts for variables and control charts for attributes.
 ii) Distinguish between defect and defective.

Q.5) Attempt any one of the following:

- i) Write the note on a) Parallel system b) Essentially series system.
 - ii) Explain the role of normal distribution and Chebychev's inequality in establishing 3σ limits on control chart.
- b) i) What is the purpose of Statistical Quality Control? State eight dimensions of quality.
 ii) Define survival function. Obtain the survival function and hazard rate of a life time (T) Which follows exponential distribution.

Exam Seat No.

[Total No. of Pages: 03]

Total No. of Questions: 05]

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Empowered Autonomous)
Affiliated to Savitribai Phule Pune University, Pune
T.Y.B.Sc. (STATISTICS)

Semester – V

USST356(A) Introduction to Stochastic Processes
(2022 Pattern)

(No. of Credits 03)

[Max. Marks:60]

Time: 2 Hours]

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Use of scientific calculators and statistical tables is allowed.
- 4) Symbols and abbreviations have their usual meaning.

Q1) Attempt each of the following:

[1 each]

A) Choose the correct alternative in each of the following

- i) If a closed set contain only one state, then that state is
a) absorbing
b) transient
c) communicable
d) reducible
- ii) A persistent state is non null persistent if mean recurrence time is
a) finite
b) infinite
c) 0
d) 1
- iii) Let $\{N(t), t \geq 0\}$ be a Poisson process with parameter λ , then mean number of occurrences in an interval of length t is
a) λt
b) $\frac{1}{\lambda t}$
c) $\frac{1}{\lambda}$
d) $\lambda^2 t$
- iv) Consider a Markov chain $\{X_n, n \geq 1\}$ with discrete state space S . If the transition probabilities are independent on n , the Markov chain is said to be
a) homogenous Markov chain
b) reducible Markov chain
c) non homogenous Markov chain
d) independent Markov chain

B) Attempt each of the following:

[2 each]

- i) State Markov property.
- ii) Define probability of ultimate.
- iii) What is meant by aperiodic state of a Markov chain?
- iv) Define ergodic Markov chain.

P.T.O.

Q2) Attempt any three question from the following:

[4 each]

- Suppose that the probability of a dry day (No rain day) followed by rainy day is 0.7 and the probability of a rainy day followed by a dry day (No rain day) is 0.4. If $\{X_n, n \geq 1\}$ is the two state Markov chain with X_n denotes weather condition on n^{th} day, either dry day (No rain) or rainy day. Construct the transition probability matrix and calculate the probability that it will rain on fourth day from today given that it is raining today.
- Explain Ehrenfest model with one example.
- What do you mean by an absorbing Markov chain? Give an example of it.
- Consider that customers arrive at a bank according to a Poisson process with an average rate of 10 customers per hour. What is the probability that
 - no customers will arrive in the first 30 minutes?
 - at least 2 customers will arrive in the first 30 minutes?

Q3) Attempt any two question from the following:

[6 each]

- State and prove Chapman-Kolmogorov equation.
- Consider Markov chain $\{X_n, n \geq 0\}$ with states $S = \{0, 1, 2\}$, has the transition probability matrix $P = \begin{bmatrix} \frac{3}{4} & \frac{1}{4} & 0 \\ \frac{1}{4} & \frac{1}{2} & \frac{1}{4} \\ 0 & \frac{3}{4} & \frac{1}{4} \end{bmatrix}$. If $P(X_0 = i) = \frac{1}{3}$ for $i = 0, 1, 2$. Find $E(X_3)$ and $\text{Var}(X_3)$.
- Distinguish between persistent state and transient state of a Markov chain. Explain with suitable example.

Q4) Attempt any two question from the following:

[6 each]

- Define Stationary distribution. Find all stationary distribution for the following transition matrix, $P = \begin{bmatrix} 0 & \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & 0 & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$
- Define state space and parameter space of a stochastic process? Explain different type of stochastic process according to state space and parameter space with one illustration of each type.
- Explain the following terms
 - First return probability.
 - Time homogenous stochastic process.
 - Stationary independent increment.

Q5) Attempt any one question from the following:

- i) a) Define three postulates of the Poisson process. Consider two independent series of events E and F occurring in accordance with Poisson processes with mean αt and βt respectively. Then show that number N of occurrences of event E between two successive occurrences of event F has a geometric distribution.

[8+4]

- b) Define Compound Poisson process. State its mean and variance.

- ii) Consider a Markov chain with state space $S = \{1, 2, 3\}$ and one step transition probability

matrix P as $P = \begin{bmatrix} 0 & 1 & 0 \\ \frac{3}{4} & 0 & \frac{1}{4} \\ 0 & 1 & 0 \end{bmatrix}$. Determine the following for this Markov chain. [3 each]

- a) closed set
- b) probability of ultimate return to the all states
- c) periodicity of all states
- d) mean recurrence time of the all states

Seat No.

Total No. of Questions: 05]

[Total No. of pages: 03

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Empowered Autonomous)

Affiliated to Savitribai Phule Pune University, Pune

T. Y. B. Sc. Statistics

Semester- VI

STAT 3601: Introduction to Regression Analysis
(2019 Pattern)

Max Marks: 60

Time Allowed: 2.00 Hrs

Instructions:

- i) All questions are compulsory.
- ii) Figures to the right indicate full marks.
- iii) Use of scientific calculator and statistical tables is allowed.
- iv) Symbols and abbreviations have their usual meanings.

Q.1) Attempt each of the following:

a) In each of the following cases, choose the correct alternative: [1 each]

i) In multiple linear regression which test statistic used to test significance of regression

- a) χ^2 statistic b) t statistic c) F statistic d) Z statistic

ii) An outlier is detected by

- a) large value of MS_{Res} b) large value of Studentised residual
c) Small value of Mallows' C_p statistic d) large value of R^2

iii) In multiple regression analysis involving 5 regressors based on 30 observations, the total variation in Y is 900 and variation unexplained by regression is 300 then adjusted R^2 is ...

- a) 0.59 b) 0.69 c) 0.49 d) 0.40

iv) Hat matrix H is given by

- a) $X(X'X)^{-1}$ b) $X'(X'X)^{-1}$ c) $X'(X'X)^{-1}X$ d) $X(X'X)^{-1}X$

P.T.O

b) State True or False.

- i) Value of R^2 is always lies between 0 and 1.
- ii) Standardized residuals have mean zero and approximate variance one.

[1each]

c) Attempt the following

- i) Explain multicollinearity.
- ii) Write any two real life situation of logistic regression.
- iii) Show that the sum of residuals in simple linear regression model that contains an intercept term β_0 is always zero.

[2each]

Q.2) Attempt any three of the following:

[4each]

- a) In simple linear regression model, describe the procedure of testing significance of regression using t test.
- b) What are outliers? Discuss how outliers are to be treated in regression analysis.
- c) For a data set containing 18 observations on response Y and four regressors, correlation coefficient between Y and each of the regressor X_1, X_2, X_3, X_4 is calculated as follows: $\text{Corr}(Y, X_1) = 0.6321$, $\text{Corr}(Y, X_2) = 0.8721$, $\text{Corr}(Y, X_3) = 0.7721$ and $\text{Corr}(Y, X_4) = 0.5143$ then which regressor is included in the first step model by forward selection method.
- d) Define residuals. Also show that sum of residual weighted by the corresponding fitted value is always equal to zero.

Q.3) Attempt any two of the following:

[6 each]

- a) Explain how residual plots are useful in verifying assumptions in linear regression model.
- b) In simple linear regression model $y = \beta_0 + \beta_1 x + \epsilon$ show that $E(MS_{\text{res}}) = \sigma^2$.
- c) Explain K^{th} order polynomial model in one variable. Discuss in brief the model building strategy in polynomial regression model.

Q.4) Attempt any two of the following:

[6 each]

- a) Define deviance statistics D. What is role in testing significance of Univariate logistic regression?
- b) Write a note on the backward elimination for regression model.
- c) In multiple linear regression model describe the procedure of constructing $(1-\alpha)$ 100% confidence interval for regression coefficient β_j

[12 each]

Q.5) Attempt any one of the following:

- (6)
- (6)
- a) i) Describe any two criteria for evaluating subset regression model.
ii) Explain the procedure of fitting Univariate logistic regression model.
- b) For simple linear regression model $y = \beta_0 + \beta_1 x + \varepsilon$ with $E(\varepsilon) = 0$, $\text{var}(\varepsilon) = \sigma^2$ and ε uncorrelated. Explain the procedure of fitting this model on the given data on (X, Y) .
Also Show that $\hat{\beta}_0$ and $\hat{\beta}_1$ is an unbiased estimator of model parameters β_0 and β_1 .

Total No. of Questions: 05]

Seat No.

[Total No. of Pages: 03

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Empowered Autonomous)
Affiliated to Savitribai Phule Pune University, Pune
T.Y.B.Sc. STATISTICS (Semester – V)
(2019 Pattern)

STAT3506(A): Introduction to Stochastic Processes

[Max. Marks: 60

Time: 2 hours

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Use of scientific calculators and statistical tables is allowed.
- 4) Symbols and abbreviations have their usual meaning.

Q1) Attempt each of the following:

a) Choose the correct alternative in each of the following

[1 each]

- i) An absorbing state of a Markov chain is one in which the probability of
 - A) moving out of that state is 0
 - B) moving into that state is 0.5
 - C) moving into that state is 0
 - D) moving out of that state is 1
- ii) A recurrent state i of a Markov chain is null recurrent if the mean recurrence time is
 - A) finite
 - B) infinite
 - C) 0
 - D) 1
- iii) A state j of a Markov chain is persistent if
 - A) it is aperiodic
 - B) it is ergodic
 - C) it return to state j is certain
 - D) it return to state j is uncertain
- iv) Suppose for a Markov chain higher step transition probabilities are free from n then Markov chain is
 - A) Markov chain with homogeneous time
 - B) aperiodic Markov chain
 - C) recurrent Markov chain
 - D) stationary Markov Chain

b) Define the following with one illustration:

[2 each]

- i) Recurrent State
- ii) State Space
- iii) Markov property
- iv) Ergodic State

[P.T.O.]

Q2) Attempt any three question from the following:

[4 each]

a) Prove that the interarrival time of a Poisson process follows an exponential distribution.

b) A Markov chain $\{X_n, n \geq 0\}$ with states $\{0, 1, 2\}$, has the transition probability

$$\text{matrix } P = \begin{bmatrix} \frac{3}{4} & \frac{1}{4} & 0 \\ \frac{1}{4} & \frac{1}{2} & \frac{1}{4} \\ 0 & \frac{3}{4} & \frac{1}{4} \end{bmatrix}. \text{ If } P(X_0 = 0) = P(X_0 = 1) = \frac{1}{3}, \text{ Find } E(X_3) \text{ and } \text{Var}(X_3).$$

c) Discuss the Non-null recurrent state and Mean recurrent time of a Markov chain.

d) Discuss random walk with absorbing barrier.

Q3) Attempt any two question from the following:

[6 each]

a) Consider a game of "ladder climbing". There are 6 levels in the game, level 1 is the lowest (bottom) and level 6 is the highest (top). A player starts at the bottom. Each time, a fair coin is tossed. If it turns up head, the player moves up one run. If tail, the player moves down to the very bottom. Once at the top level, the player moves to the very bottom if a tail turns up, and stays at the top if head turns up. Find the transition probability matrix.

b) State and prove additive properties of Poisson Process.

c) Consider a Markov chain with state space $S = \{1, 2, 3\}$ and one step transition

$$\text{probability matrix } P \text{ as } P = \begin{bmatrix} \frac{1}{2} & \frac{1}{2} & 0 \\ \frac{1}{3} & \frac{1}{3} & \frac{1}{3} \\ 0 & 0 & 1 \end{bmatrix}. \text{ Show that the Markov chain is irreducible.}$$

Compute $f_{33}^{(2)}$ and $f_{33}^{(3)}$.

Q4) Attempt any two question from the following:

[6 each]

a) A fair dice is tossed repeatedly. If X_n denotes the maximum of the numbers occurring in the first n tosses, find the transition probability matrix P of the Markov chain $\{X_n\}$. Also find P^3 and $P(X_2 = 5)$.

b) What is state space and parameter space of a stochastic process? Discuss different type of stochastic process according to state space and parameter space with one illustration of each type.

c) State and prove the Chapman-Kolmogorov theorem.

Q5) Attempt any one question from the following:

- a) i) The transition probability matrix of a Markov chain $\{X_n\}$, having three states 1, 2 and 3 is $P = \begin{bmatrix} 0.5 & 0.3 & 0.2 \\ 0.2 & 0.4 & 0.4 \\ 0.1 & 0.5 & 0.4 \end{bmatrix}$ and the initial distribution is $p^{(0)} = (0.7, 0.2, 0.1)$. Find $P(X_3 = 3)$, $P(X_3 = 2, X_2 = 1, X_1 = 3, X_0 = 2)$, $p_{23}^{(4)}$ and show that given Markov chain is irreducible Markov chain.

- ii) Discuss the Non-null recurrent state and Mean recurrent time of a Markov chain. [8+4]

- b) i) A fair dice is tossed repeatedly. If X_n denotes the maximum of the numbers occurring in the first n tosses, find the two step transition probability matrix of the Markov chain $\{X_n\}$. Also find $P(X_2 = 6)$ and $E(X_2)$.

- ii) Find the Stationary Distribution of the TPM $P = \begin{bmatrix} 0 & 2/3 & 1/3 \\ 1/2 & 0 & 1/2 \\ 1/2 & 0 & 1/2 \end{bmatrix}$. [8+4]

(Autonomous)
T.Y.B.Sc. (2019 Pattern)
STAT3605: STATISTICAL COMPUTING USING R-SOFTWARE

Time: 2 hours 30 minutes]

[Max. Marks: 60

- N.B.
- 1) All questions are compulsory.
 - 2) Figures to the right indicate full marks.
 - 3) Use of statistical tables and calculator is allowed.
-

Q1

a) Attempt *each* of the following: (1 each)

- i) Compute mean deviation from mean for the following data: 135, 125, 122, 129, 142, 111, 115, 120, 111, 127.
- ii) Draw a random sample of size 10 from Cauchy distribution with parameters $\lambda=2.4$ and $\mu=3.6$.
- iii) Let $X \sim N(15, 4.5)$, find k such that $P(X < k) = 0.3$.
- iv) Find 2nd quartile of the following observations: 17, 10, 9, 10, 12, 12, 16, 19, 120, 21.

b) Attempt *each* of the following: (2 each)

- i) Draw a box plot for the following data: 25, 20, 23, 40, 26, 28, 18, 14, 19, 49.
- ii) Create a file in MS-Excel containing Item number, Price for three items and save it as text file. Import this text file in R.
- iii) Compute mean deviation from mean for the following data: 350, 250, 220, 290, 420, 110, 150, 200, 101, 207.
- iv) Write a R-program script to obtain sum of squares of numbers 1 to 10 using for statement.

Q2

Attempt any **three** of the following:

- a) Draw the graph of probability curve of Exponential distribution with mean 3.5.

- b) Each person in a random sample of 10 students was asked about the daily time activities such as surfing the internet and emailing friends etc. The resulting data in minutes are as follows:
117, 113, 113, 105, 128, 130, 111, 131, 108, 112.
Use Kolmogorov - Smirnov test to test whether these data come from a normal distribution with mean 122 and standard deviation 10.5.
- c) Compute Karl Pearson's coefficient of skewness and Bowley's coefficient of skewness for the following data and comment: 2.3, 2.9, 2.4, 2.1, 1.2, 1.9, 1.9, 1.8, 1.9.
- d) Following table presents the test hitting target of varying distance. The result of each test is either a hit ($y=1$) or miss ($y=0$).

Q4

Attempt any **two** of the following:

- a) A group of 500 girls and 400 boys was asked to give their preferences of laptops. The results obtained are as follows:

	Company-I	Company-II
Boys	230	170
Girls	200	300

Test at 5% level of significance whether preference of a laptop is independent of sex.

- b) In a survey a random sample of 50 students were asked how far they travelled daily. The results of the survey are shown in the following table:

Distance	0-5	5-10	10-15	15-20
	10	18	14	8

Q4

Attempt any **two** of the following:

12

- a) A group of 500 girls and 400 boys was asked to give their preference between two companies of laptops. The results obtained are as follows:

	Company-I	Company- II
Boys	230	170
Girls	200	300

Test at 5% level of significance whether preference of a particular company, is independent of sex.

- b) In a survey a random sample of 50 students were asked the distance they travelled daily. The results of the survey are shown in the following table.

Distance	0-5	5-10	10-15	15-20	20-25
Count	10	18	14	6	2

Compute the median for the above data.

- c) Fit a second degree curve $Y = a + bX + cX^2$
 Year : 1999 2000 2001 2002 2003 2004 2005
 Profit ; 124 127 132 138 145 120 117
 ('0000)

Q5

Attempt **any** one of the following:

- a) i) Following data represent length (cm) recorded for the product produced by 4 product lines.

8

Line I	Line II	Line III	Line IV
250	310	250	340
260	330	230	270
270	360	260	320

Write R-script to test for equality of variances using Bartlett's test. Check normality of observations using Shapiro-Wilk's test.

4

- ii) Weekly sales of departmental stores (in '000) are as follows: 810, 820, 805, 865, 835, 846, 835, 875, 863, 885. Use Wilcoxon's signed rank test to test the hypothesis that average pocket money is Rs. 855.

- b) Write R script for carry out the ANOVA for the following data by verifying the underlying assumptions:

Treatment	Observations					
X	213	209	218	207		
Y	206	222	208	204	203	
Z	202	208	213	216	223	244

-00-00-

Total No. of Questions: 05]

Seat No.

[Total No. of Pages: 04

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Empowered Autonomous)
Affiliated to Savitribai Phule Pune University, Pune
T.Y.B.Sc. STATISTICS (Semester – VI)
USST365: STATISTICAL COMPUTING USING R-SOFTWARE
(2022 Pattern)
(3 Credits) [Max. Marks: 60

Time: 2 hours]

- N.B. 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of statistical tables and calculator is allowed.

Q1) Attempt each of the following:

- a) In each of the following cases, choose the correct alternative: (1 each)
- i) Draw a random sample of size 20 from gamma distribution with $\alpha = 2.5$ and $\lambda = 3.5$. Also, its mean.
- ii) Compute mean deviation from median for the following data: 25, 19, 22, 29, 23, 28, 25, 20, 21, 27.
- iii) Let $X \sim N(10, 4)$, find $P(9 < X < 12)$
- iv) Obtain maximum of 510 and 810 using if-else statement.
- b) Attempt each of the following: (2 each)
- i) Draw a box plot to represent the heights (in ft.) of girls and boys in a class for the following data:
Boys : 5.8, 5.8, 5.1, 5.4, 5.6, 5.8, 5.8, 5.7, 5.9, 5.9
Girls : 5.5, 5.5, 5.8, 5.4, 5.6, 5.8, 5.9, 5.4, 5.9, 5.4
- ii) Create a file in MS-Excel containing Name of Teacher, Department for three teachers and save it as text file. Import this text file in R.
- iii) Create a vector x of following observations by using scan function. 50, 43, 24, 27, 45, 61, 50, 55, 71, 42. Find the summary statistics.
- iv) Write a R-program script to display numbers 1 to 5 by using for statement.

P.T.O.

-2-

Q2) Attempt any *three* of the following:

- Check whether the given data is from Poisson distribution with parameter 3.5 by using nonparametric test. 1, 1, 5, 11, 2, 5, 4, 3, 6, 2.
- Draw a probability curve of normal distribution with $\mu = 15$ and $(\sigma = 1.2, \sigma = 2.1)$ on same graphics window.
- Following are the data on the number of hours that a rechargeable hedge trimmer operates before a recharge is required:
1.5, 2.2, 0.9, 1.3, 2.0, 1.6, 1.8, 1.5, 2.0, 1.2, 1.7.
Use Wilcoxon's signed rank test to test the hypothesis that this particular trimmer operates with median of 1.8 hours before requiring a recharge. Use $\alpha = 0.05$.
- Fit a second degree curve $Y = a + bX + cX^2$

Year (X)	2018	2019	2020	2021	2022	2023
Sales(in crores) (Y)	33	31	35	39	40	48

Q3) Attempt any *two* of the following:

- Data on percentage subsidy under diff.

(12)

-3-

Q4) Attempt any *two* of the following:

- The following table shows the classification of 1200 w according to the disciplinary action taken by the ma promotional experience:

Promotional experience

Disciplinary action

Non-offenders

Offenders

Test whether promotional experience is independent 5% level of significance.

- The following figures relate to age distribution of v

Age	18-22	22-26	26-30	30-34
				48

(12)

Q4) Attempt any *two* of the following:

(12)

- a) The following table shows the classification of 1200 workers in a factory according to the disciplinary action taken by the management and their promotional experience:

Promotional experience	Promoted	Not promoted
Disciplinary action		
Non- offenders	200	250
Offenders	50	700

Test whether promotional experience is independent of disciplinary action. Use 5% level of significance.

- b) The following figures relate to age distribution of workers of certain company.

Age	18-22	22-26	26-30	30-34	34-38
No. of Workers	25	50	53	48	36

Calculate Bowley's coefficient of skewness.

- c) Following table presents the test firing results for 25 surface to-air anti air (craft missiles at target of varying speed. The result of each test is either a hit ($y=1$) or miss ($y=0$).

Test	1	2	3	4	5	6	7	8	9	10
Target Speed in m/s(X)	400	220	490	210	500	270	200	470	480	310
Y	0	1	0	1	0	0	1	0	0	1

Fit a logistic regression model to the response variable y . Use simple linear regression model as the structure for the linear predictor

Q5) Attempt any *one* of the following:

(6)

- a) i) The following are the weights in kg from group A and Group B

Person	1	2	3	4	5	6	7	8
Group A	62	77	81	78	83	91	74	69
Group B	78	89	96	71	81	89	74	

P.T.O.

Write R script to test whether the population mean of two groups are same at 5% l.o.s. using suitable parametric test by verifying the underlying assumptions. (6)

ii) Suppose X_1, X_2, \dots, X_n is a random sample from a Poisson distribution with mean $= 2.5$. Write a R script to verify whether sample mean is consistent form by taking $n = 500, 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000$.

b) i) The following data shows the life of electric bulbs (in hours): (8)

Batch No.	Life of bulbs				
I	2130	2090	2180	2070	
II	2060	2220	2080	2040	2030
III	2020	2080	2130	2160	2230 2440

Write R script for carry out the ANOVA for the following data by verifying the underlying assumptions.

ii) The time in minutes that a patient has to wait in a consulting room for the treatment for 12 patients is recorded as follows: (4)

15, 17, 21, 20, 32, 28, 12, 26, 25, 24, 30, 35.

Write a R script to conclude that whether average waiting time in consulting room is 20 minutes. Use 4% level of significance.

Total No. of Questions: 05]

Seat No.

[Total No. of pages: 02]

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati.
(Empowered Autonomous)
Affiliated to Savitribai Phule Pune University, Pune.

T.Y.B.Sc. (Statistics)
Semester-VI
USST366(B) : ACTUARIAL STATISTICS
(2022 Pattern)
(No. of Credits: 03)

[Max. Marks: 60]

Time Allowed: 2.00 Hours]

Instructions:

- i) All questions are compulsory.
- ii) Figures to the right indicate full marks.
- iii) Use of scientific calculator and statistical table is allowed.
- iv) Symbols and abbreviations have their usual meaning.

[1 each]

A) Choose the correct alternative of the following:

a) Which of the following is a correct expression for $E(L)$ is ____.

- A) $(P_x - 0.05) \ddot{a}_x$
- B) 0
- C) $P_x \ddot{a}_x - A_x$
- D) $(0.05 - P_x) \ddot{a}_x$

b) Net single premium for one unit benefit under any life insurance plan is always ____.

- A) ≥ 1
- B) ≤ 1
- C) = 1
- D) < 1

c) With compound interest i per rupee per annum, effective rate of interest in n^{th} year is ____.

- A) $< i$
- B) $> i$
- C) i
- D) Both a) and b)

d) It is given that $\ddot{a}_x = 7$ for all integers x and $i = 5\%$. Then ${}_7q_{40}$ is ____.

- A) 0.5217
- B) 0.4228
- C) 0.4712
- D) 0.3728

[2 each]

B) Answer each of the following:

- a) Define deferred probability.
- b) Suppose $P_{25} = 0.629$, under the assumption of constant force of mortality find ${}_{1/3}P_{75}$.
- c) State any two characteristics of insurable risk.
- d) Define the term endowment insurance.

P.T.O.

Q.2) Attempt any three of the following:

- Suppose force of interest per annum is 8%. Find d , v , $i^{(12)}$. [4 each]
- What is risk? Explain its types.
- Explain the equivalence principle to calculate premium.
- A loan of Rs.50 lakhs is taken on January 1, 2020. It has to be repaid in equal monthly installments payable at the beginning of month for 30 years. Based on a 7% annual rate of interest, determine the amount of installment.

Q.3) Attempt any two of the following:

- For a certain insect population, the probabilities q_x obtained for five weeks are $q_0=0.4$, $q_1=0.1$, $q_2=0.2$, $q_3=0.4$, $q_4=0.7$ and $q_5=1$. Taking $l_0=100$. Construct life table with values for l_x, d_x, L_x, T_x and e_x . [6 each]
- Suppose the life length random variable model by distribution with force of mortality is specified by $\mu_s = \begin{cases} 0.01 & \text{if } 0 \leq s \leq 15 \\ 0.08 & \text{if } 15 \leq s \leq 25 \\ 0.12 & \text{if } 25 \leq s \leq 35 \\ 0.18 & \text{if } s \geq 35 \end{cases}$
Find i) $S(x)$ ii) $f(x)$ iii) $g(t)$ of $T(32)$
- Prove that $H \geq \mu$. Where μ is expected loss for both parties and H is minimum acceptable premium to insurer.

Q.4) Attempt any two of the following:

- Write a short note on fully discrete premium. [6 each]
- Define curated future lifetime random variable and find its probability mass function.
- It is given that $q_{28} = 0.175$, $q_{29} = 0.186$, $q_{30} = 0.189$, $q_{31} = 0.193$, $q_{32} = 0.198$ and $i = 5\%$. Find the APV of benefit of 1000 in a 4 year term insurance, 4 year endowment insurance issued to (28).

Q.5) Attempt any one of the following:

- I) Write a benefit function and PVRV corresponding to:
 - n year term increasing annually with benefit payable at the end of year of death.
 - Endowment insurance with benefit payable at the moment of death.
 - m -year deferred whole life insurance which provides benefit at the moment of death.
 Also obtain the Net Single Premium (NSP) under the above insurance policies.
- II) State and prove that relation between effective rate of interest and nominal rate interest. [8 + 4]
- b) I) Explain the concept of annuity with its types. [8 + 4]
- II) Define the following terms:
 - Beneficiary
 - Actuarial present value
 - Policy term
 - level benefit

No. of Questions: 04]

Seat No.

[Total No. of pages: 03

Anekant Education Society's
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T.Y.B.Sc.(STATISTICS)

Semester- VI

STAT3602: STATISTICAL INFERENCE II
(2019 Pattern)

Max Marks: 60

Time Allowed: 2.00 Hrs

Instructions:

- i) All questions are compulsory.
- ii) Figures to the right indicate full marks.
- iii) Use of scientific calculator and statistical tables is allowed.
- iv) Symbols and abbreviations have their usual meanings.

Q 1) Attempt each of the following:

[1 each]

a) Choose the correct alternative in each of the following:

- i) Let $X \sim N(\mu, \sigma^2)$, where σ^2 is unknown. If $H_0: \mu = 1$ against $H_1: \mu = 2$, then
(A) H_0 and H_1 both are simple hypotheses.
(B) H_0 and H_1 both are composite hypotheses.
(C) H_0 is simple hypothesis and H_1 is composite hypothesis.
(D) H_0 is composite hypothesis and H_1 is simple hypothesis.
- ii) Which of the following test is considered as a test of goodness of fit?
A) Sign test
B) Mann-Whitney test
C) Kolmogorov-Smirnov test
D) Run test
- iii) For carrying out SPRT of strength (α, β) which of the following should be fixed in advance?
A) Both α and β
B) Only α
C) Only β
D) Neither α nor β
- iv) A falling student is passed by an examiner, it is an example of
A) Type I error
B) Type II error
C) Unbiased Decision
D) correct Decision

b) Attempt each of the following.

[2 each]

- i) Define the term MP test.
- ii) Let X have Poisson distribution with mean θ , if $x < 1$, is the critical region for testing $H_0: \theta = 2$ against $H_1: \theta = 1$ then obtain power of the test.
- iii) State Neyman-Pearson's lemma.
- iv) Define non-parametric tests.

P.T.O.

Find BCR of size 0.1 for testing $H_0: \theta = 0$ against $H_1: \theta \neq 0$.
Bases on single observation. Check whether UMPCR exist for this test. [6]

II) Following is a random sample of size 5 drawn from a continuous distribution with distribution function $F_X(\cdot)$.

0.5, 0.45, 0.75, 0.50, 0.80

Test whether the sample can be regarded as drawn from $U(0, 1)$ distribution. Use 5% level of significance. [6]

b) I) Describe Wilcoxon Signed rank test procedure. [6]

II) Construct SPRT of strength (α, β) for testing $H_0: \theta = \theta_0$ against $H_1: \theta = \theta_1$,

$(\theta_1 > \theta_0)$ for an exponential variate with mean $\frac{1}{\theta}$. [6]

[Total No. of pages: 03

**STAT3603: Statistical Quality Control and Reliability
(2019 Pattern)**

Instructions:

- All questions are compulsory.
- Figures to the right indicate full marks.
- Use of scientific calculator and statistical tables is allowed.
- Symbols and abbreviations have their usual meanings.

Answer the following:

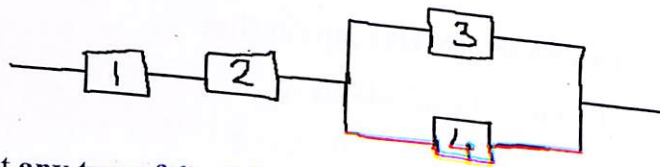
-2-

- ii) Define the terms "Consumer's risk" and "Producer's risk"
- iii) State any one advantage and disadvantage of double sampling plan over single sampling plan.
- iv) Define the terms Acceptable Quality Level and Lot Tolerance Fraction Defective with respect to a Single Sampling Plan

Q.2) Attempt any three of the following:

[4 each]

- a) i) Distinguish between control charts for variables and control charts for attributes.
- ii) Distinguish between defect and defective.
- b) Explain the role of Pareto diagram as one of the seven Process Control (PC) tools.
- c) For a single sampling plan with $N = 12000$, $n = 90$, $c = 3$ compute Average Outgoing Quality (AOQ) if the incoming lots are of quality 0.01.
- d) Find the structure function and minimal path sets of the system for the following Reliability Block Diagram :



Q.3) Attempt any two of the following:

[6 each]

- a) For a production process with $n=5$, $k=25$, $\sum_{i=1}^{25} R_i = 850$, and $\sum_{i=1}^{25} \bar{X}_i = 5750$. Assuming that the process is under statistical control, estimate the process average and process standard deviation. If the specifications limits are 240 ± 25 , calculate process capability index (C_p) and hence conclude whether or not the process meets specifications?
- b) Show that structure function of any coherent system having n components is bounded below by the structure function of the corresponding series system and is bounded above by the structure function of the corresponding parallel system.
- c) Write a note on Specification limit and Natural tolerance limits.

Q.4) Attempt any two of the following:

[6 each]

- a) For a double sampling plan with $N = 10000$, $n_1 = 50$, $n_2 = 100$, $c_1 = 0$ and $c_2 = 2$, lot of quality $p = 6.5\%$. Compute the value of Average Total Inspection (ATI).
- b) Explain the role of normal distribution and Chebychev's inequality in establishing 3σ limits on control chart.

- c) Define the terms IFR distribution and DFR distribution. Show that the exponential distribution serves as a boundary of IFR and DFR classes of distributions.

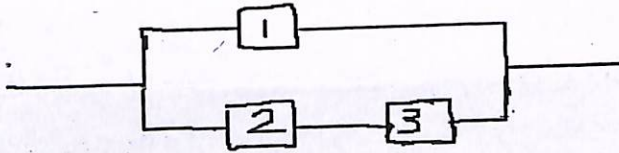
Q.5) Attempt any one of the following:

- a) i) 25 samples each of size 4 were inspected for a quality characteristics X. It was found that mean of the sample means ($\bar{\bar{X}}$) is 0.43 and the mean range (\bar{R}) is 0.01, obtain 3σ control limits for \bar{X} and R chart. If the process average shifts to 0.435, what would be the probability of catching the shift on first sample after the shift?

ii) Write a note on OC curve of a single sampling plan. [7+5]

- b) i) Show that redundancy of component level is more effective than redundancy at the system level.

ii) Consider the following Reliability Block Diagram (RBD):



- 1) Draw fault tree diagram of the above RBD.
- 2) Draw the block diagram of component redundancy and system redundancy.

[6+6]

[Total No. of pages: 02]

STAT3606(B) : ACTUARIAL STATISTICS
(2019 Pattern)
(No. of Credits:03)

[Max. Marks: 60]

Instructions:

- Instructions:**
- All questions are compulsory.
 - Figures to the right indicate full marks.
 - Use of scientific calculator and statistical table is allowed.
 - Symbols and abbreviations have their usual meaning.

[1 each]

a) If $S(x)$ is survival function of X then $S(0)$ is _____.

- A) 0 B) $\frac{1}{2}$ C) 1 D) $\frac{3}{2}$

- b) Range set of possible values of curtate future life time of (x) is

- A) $(0, \infty)$
B) $(-\infty, \infty)$
C) $\{0, 1, 2, \dots\}$
D) $\{x, x+1, \dots\}$

- c) The rate of discount is _____.

- A) $i-v$ B) $i+v$ C) $i-v$ D) $\frac{i}{v}$

- d) The approach of constructing life table using specific survival function is known as _____

- A) deterministic approach
- B) random survivorship approach
- C) non- random survivorship approach
- D) non-deterministic survivorship approach

[2 each]

- State assumptions of annuity certain.
- Write the formula for fully discrete premium for n -year endowment insurance with actuarial notations.
- Define premium and policyholder.
- State the interpretation of e_x^0 from life table.

P.T.O.

Total No. of Questions: 05

Seat No:

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)
Class: T.Y.B.Sc. (Mathematics)
USMT361: Complex Analysis
(2022 Pattern) (Paper-I) (Semester-VI)

Total Marks: 60

Time: 2 Hours

Instructions to the Candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.

Q.1] A) Attempt Each of the following.

[4]

- i) Verify $1 - i$ satisfies the equation $2 - 2z + z^2 = 0$.
- ii) Is $f(x, y) = 2y^2x - 3x^2y$ a harmonic function? Justify.
- iii) Prove that $\cos(iy) = \cosh y$.
- iv) Write the Maclaurin's series representation of $f(z) = \frac{z}{z^2+1}$, ($|z| < \sqrt{3}$).

B) Attempt Each of the following.

[8]

- i) Show that $f(z) = z - \bar{z}$ is nowhere analytic.
- ii) Verify that $f(z) = 3z$ is entire.
- iii) Find $\int_C f(z)dz$, if $f(z) = \frac{z}{(z-10)}$ and C is the circle $|z| = 5$ in positive sense.
- iv) Determine whether the point is pole, a removable singular point or an essential singular point for the function $f(z) = \exp\left(\frac{1}{z^2}\right)$.

Q.2] Attempt any Three of the following.

[12]

i) If

$$f(z) = \frac{\bar{z}}{z}$$

, show that $\lim_{z \rightarrow 0} f(z)$ does not exist.

- ii) Find harmonic conjugate of the harmonic function $u(x, y) = e^x \cos y$.
- iii) Show that $\sin(\bar{z}) = \overline{\sin(z)}$
- iv) Find square roots of $3i$.

Q.3] Attempt any Two of the following.

[12]

- i) State and prove Cauchy Reimann equations at a point z_0 , if a function $f(z)$ is analytic at z_0 .
- ii) Derive the Laurent series expansion of

$$f(z) = z \cos \left(\frac{1}{z^2} \right)$$

in the domain $0 < |z| < \infty$.

- iii) Find the residue at $z = 0$ of the function $\frac{1}{z+z^3}$.

Q.4] Attempt any Two of the following.

[12]

- i) Explain the three types of isolated singular points with examples.
- ii) Determine the order of pole and find the corresponding residue for $f(z) = \frac{1 - \cos(2z)}{z^4}$.
- iii) Compute $\left(\frac{1}{3-5i} \right) \left(\frac{1}{5-i} \right)^2$.

Q.5] Attempt any One of the following.

[12]

- i) State and prove Cauchy Integral Formula and evaluate $\int_C \frac{\cos z}{z(z^2+16)} dz$, where C is the square whose sides lie along the lines $x = \pm 1$ and $y = \pm 1$.
- ii) Evaluate the improper integral

$$\int_0^{\infty} \frac{dx}{x^4 + 1}$$

Seat No.:

Total No. of Pages: 02

Total No. of Questions: 05

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T.Y.B.Sc.

MATHEMATICS

Semester – VI

USMT362: Real Analysis 2
(2022 Pattern) (Paper – II)

[Max. Marks: 60]

Time: 2 Hours]

Instructions to the Candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Use of Non-programmable scientific calculator is allowed.

[04]

Q1) A) Attempt the following. (1 mark each)

- a) Define set of measure zero.
- b) Define improper integral of second kind.
- c) State Dini's theorem.
- d) Define uniform convergence of series of real valued functions.

[08]

B) Attempt the following. (2 mark each)

- a) True or false: If $f \in \mathcal{R}[a, b]$ and $f(x) = g(x)$ except for a countable number of points $x \in [a, b]$, then $g \in \mathcal{R}[a, b]$.
- b) If A and B are two sets such that A is not of measure zero, $B \subset A$, and B is of measure zero, then prove that $A - B$ is not of measure zero.
- c) Test the convergence of $\int_1^{\infty} \frac{dx}{\sqrt{x}}$.
- d) Let $f_n(x) = \frac{x^n}{n}$, $(0 \leq x \leq 1)$. Find $\lim_{n \rightarrow \infty} f_n(x)$, $(0 \leq x \leq 1)$.

[12]

Q2) Attempt any THREE of the following. (4 mark each)

- a) Let $f(x) = x$, $(0 \leq x \leq 1)$, let $\sigma_n = \{0, \frac{1}{n}, \frac{2}{n}, \dots, \frac{n-1}{n}, 1\}$ be subdivision of $[0, 1]$, then find $\lim_{n \rightarrow \infty} U[f, \sigma_n]$ and $\lim_{n \rightarrow \infty} L[f, \sigma_n]$.
- b) Prove that $\int_0^1 \frac{\sin x}{x^2} dx$ is divergent.
- c) If $f_n(x) = \frac{1}{1+x^n}$ for $0 \leq x < \infty$, then find f such that $\lim_{n \rightarrow \infty} f_n(x) = f(x)$, $(0 \leq x < \infty)$.
- d) If $\sum_{n=0}^{\infty} |a_n| < \infty$, then prove that $\int_0^1 (\sum_{n=0}^{\infty} a_n x^n) dx = \sum_{n=0}^{\infty} \frac{a_n}{n+1}$.

P.T.O.

Q3) Attempt any TWO of the following. (6 mark each)

- a) State and prove first fundamental theorem of calculus.
- b) State and prove μ -test for improper integral of first kind.
- c) If $\{f_n\}_{n=1}^{\infty}$ is a sequence of continuous real valued functions on the metric space M that converges uniformly to f on M , then prove that f is continuous on M .

[12]

Q4) Attempt any TWO of the following. (6 mark each)

- a) Prove that $\frac{1}{3\sqrt{2}} \leq \int_0^1 \frac{x^2}{\sqrt{1+x}} dx \leq \frac{1}{3}$.
- b) If f is continuous in $(-\infty, \infty)$ and if $\int_{-\infty}^{\infty} f(x) dx$ converges to A , then prove that C.P.V. $\int_{-\infty}^{\infty} f(x) dx = A$.
- c) State and prove the Weierstrass M test for uniform convergence of series of functions.

[12]

Q5) Attempt any ONE of the following.

- a) Let f is bounded on $[a, b]$. Then prove that $f \in \mathcal{R}[a, b]$ if and only if f is continuous at almost every point in $[a, b]$.
- b) For $n \in I$, let $f_n(x) = nx(1-x^2)^n$, ($0 \leq x \leq 1$).
 - i) Show that $\{f_n\}_{n=1}^{\infty}$ converges on $[0, 1]$.
 - ii) Find $\lim_{n \rightarrow \infty} \int_0^1 f_n$.
 - iii) Comment about the uniform convergence of $\{f_n\}_{n=1}^{\infty}$ on $[0, 1]$.

[12]



- Seat No.:

Total No. of Questions: 05

Total No. of Pages: 02

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T.Y. B.Sc.

MATHEMATICS

Semester – VI

USMT 363: Ring Theory

(2022 Pattern) (Paper – III)

[Max. Marks: 60]

Time: 2 Hours]

Instructions to the Candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Use of non-programmable scientific calculator is allowed.

[04]

Q1) A) Attempt the following. (1 mark each)

- a) The set of Gaussian integers $Z[i] = \{a + ib \mid a, b \in Z\}$ is subring of the _____.
- b) The ring of Z_n of integer modulo n is not an integral domain when n is _____.
- c) Let a, b and c belong to an integral domain. If $a \neq 0$ and $ab = ac$ then _____.
- d) The characteristic of ring of complex number is _____.

[08]

B) Attempt the following. (2 mark each)

- a) Define ring homomorphism.
- b) Define integral domain.
- c) Define principal ideal domain (PID).
- d) Define maximal ideal.

[12]

Q2) Attempt any THREE of the following. (4 mark each)

- a) Let a, b and c belong to an integral domain. If $a \neq 0$ and $ab = ac$ then prove that $b = c$.
- b) Prove that for every prime p , Z_p the ring of integer modulo p is a field.
- c) Consider the map $f: C \rightarrow C$ such that $f(a + ib) = a - ib$. Then show that f is a homomorphism, where C is a complex number.
- d) Let $(Z, +, \cdot)$ be the ring of integer then prove that $E =$ set of even integers is an ideal of Z .

P.T.O.

Q3) Attempt any **TWO** of the following. (6 mark each)

[12]

- Prove that characteristic of an integral domain is 0 or prime.
- Let $f(x) = 4x^3 + 2x^2 + x + 3$ and $g(x) = 3x^4 + 3x^3 + 3x^2 + x + 4$ in $Z_5[x]$. Then compute (i) $f(x) + g(x)$ (ii) $f(x)g(x)$.
- Let $f(x) = x^3 + 2x + 4$ and $g(x) = 3x + 2$ be in $Z_5[x]$. Find $q(x)$ and $r(x)$ in $Z_5[x]$ such that $f(x) = g(x)q(x) + r(x)$ with $\deg r(x) < 1$.

Q4) Attempt any **TWO** of the following. (6 mark each)

[12]

- Prove that the cyclotomic polynomial

$$\phi_p(x) = \frac{x^p - 1}{x - 1} = x^{p-1} + x^{p-2} + \dots + x + 1$$

is irreducible over Q for any prime p .

- Show that $f(x) = 2x^5 - 5x^4 + 5 \in Z[x]$ is irreducible over Q .
- Let ϕ be a homomorphism from a ring R to a ring S . Let A be a subring of R . Then prove that $\phi(A) = \{\phi(a) | a \in A\}$ is a subring of S .

Q5) Attempt any **ONE** of the following. (12 mark each)

[12]

- If $f: R \rightarrow R'$ be onto homomorphism, then R is isomorphic to a quotient ring of R . In fact, $R' \cong \frac{R}{\text{Ker } f}$.
- Let F be a field and let $f(x)$ and $g(x) \in F[x]$ with $g(x) \neq 0$. Then prove that there exist unique polynomials $q(x)$ and $r(x)$ in $F[x]$ such that $f(x) = g(x)q(x) + r(x)$ and either $r(x) = 0$ or $\deg r(x) < \deg g(x) < 1$.



Seat No.:

Total No. of Pages: 02

Total No. of Questions: 05

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MATHEMATICS

Semester – VI

USMT 364: Partial Differential Equations
(2022 Pattern) (Paper – IV)

[Max. Marks: 60]

Time: 2 Hours]

Instructions to the Candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Use of non-programmable scientific calculator is allowed.

[04]

Q1) A) Attempt the following. (1 mark each)

a) The order and degree of the partial differential equation $\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y} = z + xy$ is _____.

b) The Jacobian $\frac{\partial(u,v)}{\partial(x,y)} =$ _____.

c) Let $\phi(x, y, z)$ be a scalar point function. Then $\nabla \phi =$ _____.

d) If $\vec{a} = a_1\vec{i} + a_2\vec{j} + a_3\vec{k}$ and $\vec{b} = b_1\vec{i} + b_2\vec{j} + b_3\vec{k}$. Then $\vec{a} \times \vec{b} =$ _____

[08]

B) Attempt the following. (2 mark each)

a) Solve $p + q = 1$.

b) If $u = e^x \cos y$, $v = e^x \sin y$. Then the Jacobian $\frac{\partial(u,v)}{\partial(x,y)} =$ _____.

c) Classify first order partial differential equation $(x^2 - yz)p + (y^2 - zx)q = (z^2 - xy)$.

d) Define compatible system of first order partial differential equations.

[12]

Q2) Attempt any **THREE** of the following. (4 mark each)

a) Solve $p^2 + q^2 = x + y$.

b) Solve $p^2 = qz$.

c) Solve $xzp + yzq = xy$.

d) Solve $(2z - y)p + (x + z)q = -(2x + y)$.

P.T.O.

Q3) Attempt any **TWO** of the following. (6 mark each)

[12]

- a) Find the general integral of the partial differential equations

$$z(xp - yp) = y^2 - x^2.$$

- b) Solve the Pfaffian differential equations

$$yz \, dx + xz \, dy + xy \, dz = 0.$$

- c) Find the complete integral of

$$(p^2 + q^2)y - qz = 0.$$

by Charpit's method.

Q4) Attempt any **TWO** of the following. (6 mark each)

[12]

- a) Find a PDE by eliminating a and b from $z = ax + by + a^2 + b^2$.

- b) Show that the equation

$$f = p^2 + q^2 - 1 \text{ and } g = (p^2 + q^2)x - pz = 0$$

are compatible and find the one parameter family of common solution.

- c) Find the complete integral of the partial differential equations

$$2(z + xp + yq) = yp^2.$$

Q5) Attempt any **ONE** of the following. (12 mark each)

[12]

- a) If $\bar{X} = (P, Q, R)$ is a vector such that $\bar{X} \cdot \text{Curl } \bar{X} = 0$ and μ is an arbitrary differential function of x, y and z , then prove that

$$\mu \bar{X} \cdot \text{Curl } (\mu \bar{X}) = 0.$$

- b) Show that a necessary and sufficient condition for the partial differential equations

$$f(x, y, z, p, q) = 0 \text{ and } g(x, y, z, p, q) = 0$$

to be compatible is that

$$[f, g] = \frac{\partial(f, g)}{\partial(x, p)} + p \frac{\partial(f, g)}{\partial(z, p)} + \frac{\partial(f, g)}{\partial(x, q)} + q \frac{\partial(f, g)}{\partial(z, q)} = 0.$$



Total No. of Questions: 05

Seat No:

Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati

(Autonomous)

Class: T.Y.B.Sc. (Mathematics)

USMT365: Lebesgue Integration

(2022 Pattern) (Paper-V) (Semester-VI)

Total Marks:60

Time: 2 Hours

Instructions to the Candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.

Q.1]A) Attempt Each of the following.

[4]

- i) Define measurable set.
- ii) Define measurable function.
- iii) Define Lebesgue integrable function.
- iv) Give an example of bounded and unbounded function on $[0,1]$.

B) Attempt Each of the following.

[8]

- i) If $f(x) = \frac{1}{2x}$ ($0 < x \leq 1$) find ^{100}f .
- ii) What is the measure of the set of Rational numbers in $[0, 5]$? Justify.
- iii) True/False: Union of measurable sets is measurable? Justify.
- iv) Give an example of an almost everywhere continuous function on $[0,1]$.

Q.2] Attempt any Three of the following.

[12]

- i) If G is an open subset of $[a, b]$ then prove that G is measurable and $mG = |G|$
- ii) If E_1 and E_2 are subsets of $[a, b]$ then prove that
$$\bar{m}(E_1 \cup E_2) + \bar{m}(E_1 \cap E_2) \leq \bar{m}E_1 + \bar{m}E_2$$
- iii) $f(x) = x$ if $0 \leq x \leq 1$ and $f(x) = x^2$ if $1 \leq x \leq 2$. Is $f \in L[0,2]$? If so find $L \int_0^2 f$.
- iv) $f(x) = x^4 - 81$, $x \in [-3,3]$ then find f^+ and f^- .

Q.3] Attempt any Two of the following.

[12]

- i) Show that the length of a countable set is zero.
- ii) Prove that every Riemann integrable function is a Lebesgue integrable function.
- iii) Show that every continuous function defined on $[a, b]$ is measurable. Is converse true?

Q.4] Attempt any Two of the following.

[12]

- i) If $f \in L[a, b]$ is bounded and $E \subset [a, b]$ such that $mE = 0$, show that $\int_E f = 0$
- ii) If $f \in L[a, b]$ is bounded then prove that $\int_a^b \lambda f = \lambda \int_a^b f$
- iii) Prove that the characteristic function of Cantor set is Riemann integrable on $[0, 1]$.

Q.5] Attempt any One of the following.

[12]

- i) If f and g are nonnegative valued unbounded functions on $[a, b]$ and $f, g \in L[a, b]$ then prove that $f + g, f - g \in L[a, b]$ and $\int_a^b f + g = \int_a^b f + \int_a^b g$
- ii) Prove that union, intersections and symmetric difference of two measurable sets is again a measurable set.

Seat No.:

Total No. of Questions: 05

Total No. of Pages: 03

Anekant Education Society's
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(Autonomous)

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T.Y.B.Sc.

MATHEMATICS

Semester – VI

USMT366 (A): Optimization Techniques

(2022 Pattern) (Paper – VI)

Time: 2 Hours]

[Max. Marks: 60

Instructions to the Candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Use of Non-programmable scientific calculator is allowed.

Q1) A) Attempt the following. (1 mark each)

[04]

- a) Define float.
- b) What is mean by gradual failure?
- c) Define value of the game.
- d) What is mean by idle time on a machine?

B) Attempt the following. (2 mark each)

[08]

- a) Distinguish between CPM and PERT.
- b) Examine the function $f(x) = x^4 + x^2$ for extreme points.
- c) Explain any two assumptions made while dealing with sequencing problems.
- d) State assumptions of the game.

Q2) Attempt any THREE of the following. (4 mark each)

[12]

- a) Use arithmetic method to solve the following game.

		Player B	
		B ₁	B ₂
Player A	A ₁	4	0
	A ₂	0	8

- b) A firm is considering replacement of a machine of cost Rs. 9,000 and annual operating costs are Rs. 200 for first year and then increase by Rs. 2,000 every year. Determine the best age at which to replace the machine and average yearly costs of owning and operating the machine.

- c) Determine the extreme points of the function:

$$f(x_1, x_2) = x_1^3 + x_2^3 - 3x_1x_2.$$

P.T.O.

c) Express the following game as Linear Programming Problem. (only for minimization)

		Player B		
		B ₁	B ₂	B ₃
Player A	A ₁	5	3	7
	A ₂	7	9	1
	A ₃	10	6	2

[12]

Q5) Attempt any ONE of the following.

a) A project consists of ten activities, the details of which are given below:

Activity	A	B	C	D	E	F	G	H	I	J
Predecessor	-	A	B	B	B	C	C	F, G	D, E, H	I
Duration	14	22	10	16	12	10	6	8	24	16

- Draw the network diagram.
- Identify the critical path and find project completion time.
- Find total float for each non-critical activity.

b) A small project consists of seven activities, the details of which are given below:

Activity	:	A	B	C	D	E	F	G
Immediate Predecessor	:	-	A	A	B, C	B	D, E	D
Optimistic time	:	1	2	3	4	3	2	4
Most likely time	:	3	6	3	10	7	5	4
Pessimistic time	:	7	14	3	22	15	14	4

- Draw the network diagram.
- Find the critical path and project completion time.
- What project duration will have 95% confidence of project completion?



Total No. of Questions: 5

Exam. Seat No.

Total No. of Pages: 1

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)
Affiliated to Savitribai Phule Pune University, Pune

Class: T. Y. B.Sc.
Subject: Microbiology
Semester: VI
USMB361: Medical Microbiology-II
(2022 Pattern)

Time: Two Hours

Max. Marks: 60

Instructions to the candidates:

- i. All questions are compulsory
- ii. Draw neat and well-labeled diagrams wherever required

Q.1 (A) Attempt each of the following

(1 Marks each)

- i. Define -Chemotherapy.
- ii. Name the producer organism of Penicillin.
- iii. State -True or False-rabies virus has bullet shape.
- iv. disease is caused by *Entamoeba*.

(B) Attempt each of the following

(2 Marks each)

- i. Name the vaccines used to treat poliomyelitis.
- ii. Name the antibiotics which act on bacterial protein synthesis.
- iii. Name the any two examples of *Aspergillus* species.
- iv. Write the symptoms of amoebiasis.

Q.2 Attempt any three of the following

(4 Marks each)

- i. Explain mode of action of Acyclovir.
- ii. Enlist the reasons of drug resistance acquired in bacteria.
- iii. Explain the pathogenesis of dengue virus.
- iv. Explain morphological characters of *Candida*.

Q.3 Attempt any two of the following

(6 Marks each)

- i. Diagrammatically illustrate the life cycle of malaria parasite.
- ii. Give short note on minimum inhibitory concentration of drug.
- iii. Explain the mode of action of Amphotericin-B.

Q.4 Attempt any two of the following

(6 Marks each)

- i. Draw a neat labelled diagram of Influenza virus.
- ii. Explain in detail about pathogenesis, Symptoms and treatment of poliomyelitis.
- iii. Explain the mode of action of any two drugs targeting on bacterial cell membrane.

Q.5 Attempt any one of the following

(12 Marks each)

- i. Explain morphology, laboratory diagnosis, symptoms and pathogenesis of HIV virus.
- ii. Explain in detail the factors affecting bioavailability of the drug.

*****BEST OF LUCK*****

Exam. Seat No:

Total No. of Questions: 03

Total No. of pages: 02

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)
T. Y. B. Sc.
MICROBIOLOGY
Semester - V
USMB351: Medical Microbiology-I
(2022 Pattern)

Time: Two hours

(No. of Credits 03)

Max. Marks: 60

Instructions to the candidates:

1. All questions are compulsory.
2. Draw neat and labelled diagrams wherever necessary.

Q.1 (A) Attempt each of the following:

(1 Marks each)

- i) Define: Epidemiology
- ii) Name the causative agent of typhoid.
- iii) What is prevalence?
- iv) Write the symptoms of poliomyelitis.

(B) Attempt each of the following:

(2 Marks each)

- i) Enlist the virulent species of *E.coli*.

ii) State whether true or false:

- i) Scarlet fever is caused by *streptococcus pyogens*.
- ii) Q fever is an viral disease of digestive system .

iii) Match the following:

'Disease'	'Vaccine'
i)BCG	A)Rabies
ii)DTP	B)Whooping cough
	C)Tuberculosis

iv) Fill in the blanks:

- i) Causative agent of peptic ulcer is
- ii) Tetanus is a disease of.....system.

Q.2 Attempt any Three of the following:

(4 Marks each)

- i) Explain pathogenesis of salmonellosis.
- ii) Enlist the phases of Dental caries
- iii) Describe the pathogenesis of helicobacter.
- iv) explain morphological and biochemical characterization of *vibrio*.

Q.3 Attempt any two of the following:

(6 Marks each)

- i) Explain the pathogenesis of syphilis.
- ii) Draw a neat labelled diagram of digestive system
- iii) Write a note on source and reservoir of disease.

Q.4 Attempt any two of the following:

(6 Marks each)

- i) Write the defense mechanism of respiratory system.
- ii) Explain pathogenesis of Pneumonia.
- iii) Explain cohort study in detail.

Q.5 Attempt any one of the following:

(12 Marks each)

- i) Explain in detail morphology, biochemical characterization and pathogenesis of *mycobacterium tuberculosis*.
- ii) Describe disease distribution on the basis of time, place and person.

Total No. of Questions : 05

Exam seat No.

Total No. of pages :01

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)
Affiliated to Savitribai Phule Pune University, Pune
T.Y.B.Sc.
MICROBIOLOGY
SEMESTER V
MICRO3501: Medical Microbiology-I
(2019 pattern)

Time: Two Hours

(No of Credits 04)

Max. Marks: 60

Instructions to the candidate:

- All questions are compulsory.
- Draw neat and labelled diagram whenever necessary.

Q.1 (A) Attempt each of the following

(1 Marks each)

- i. Name the vaccine used for the treatment of pertussis.
- ii. Name the causative agent of syphilis.
- iii. Strawberrylike appearance of tongue is characteristic feature of ...disease.
- iv. State true or false: Tetanus is a type of food poisoning caused by clostridium.

(2 Marks each)

(B) Attempt each of the following

- i. Define: Epidemiology.
- ii. Name any two species of *streptococcus*.
- iii. Write the symptoms of mumps disease.
- iv. Name any two prion diseases of nervous system.

(4 Marks each)

Q.2 Attempt any three of the following

- i. Explain mortality & morbidity rates.
- ii. Explain the pathogenesis of shigellosis.
- iii. Enlist the phases of periodontal disease.
- iv. Describe the defense mechanism of central nervous system.

(6 Marks each)

Q.3 Attempt any two of the following

- i. Explain pathogenesis of tuberculosis.
- ii. Explain pathogenesis of tetanus.
- iii. Write short note on source and reservoir of disease.

(6 Marks each)

Q.4 Attempt any two of the following

- i. Explain disease prevention and control measures
- ii. Explain case-control study
- iii. Explain the mode of transmission of the infection.

(12 Marks each)

Q.5 Attempt any one of the following

- i. Draw a neat labeled diagram of respiratory system along with its defense mechanisms.
- ii. Explain in detail Descriptive epidemiology.

Exam. Seat No.

Total No. of Questions: 5

Total No. of Pages: 2

Anekant Education Society's
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T. Y. B.Sc.

MICROBIOLOGY

Semester - V

USMB353: Enzymology

(2022 Pattern)

Time: 02.00 Hours

Max. Marks: 60

Instructions to the candidates: (If any)

- i. *All questions are compulsory.*
- ii. *All questions have equal marks.*
- iii. *Draw neat labeled diagram where ever necessary.*

Q.1 (A) Attempt each of the following. (1 Mark each)

- i. What is the full form of SDS-PAGE?
- ii. Define K_m .
- iii. Enlist the methods used to determine molecular weight of enzyme.
- iv. Give any two examples of allosteric enzymes.

(B) Attempt each of the following. (2 Marks each)

- i. Define active site of enzyme.
- ii. What is law of mass action?
- iii. Enlist any four methods used to purify enzymes.
- iv. Write the occurrence and biochemical function of flavin mononucleotide.

Q.2 Write short notes on any three of the following. (4 Marks each)

- i. SDS-PAGE
- ii. Applications of Immobilized enzymes
- iii. Metal ions as cofactors
- iv. Pyridoxal phosphate as cofactors.

Q.3 Attempt any two of the following. (6 Marks each)

- i. Explain with help of one example the biochemical function of Nicotinamide nucleotides.
- ii. Explain in brief proteolytic activation of zymogens.
- iii. Explain in brief use of trapping of enzyme-substrate complex in determining amino acid residues in active site.

Q.4 Attempt any two of the following. (6 Marks each)

- i. Explain the role of Flavin nucleotides in metabolism with the help of one example.
- ii. Diagrammatically explain Hans plot.
- iii. Write a short note on Gel filtration.

Q.5 Attempt any one of the following (Long answer questions).

(12 Marks each)

- Derive Michaelis Menten equation for the initial velocity of single substrate enzyme.
- The relative molecular mass M_r of a protein was investigated by gel filtration using sephacryl S300 column and using following proteins as standards.

Marker molecule	M_r	Retention volume (cm^3)
Aldolase	153000	27.5
Catalase	213000	26.4
Ferritin	443000	23.2
Thyroglobulin	663000	21.4
Blue Dextran	2010000	18.6
Unknown	?	24.5

What is the approximate M_r of the unknown protein?

Exam. Seat No :

Total No. of Questions: 05

Total No. of Pages: 1

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
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Affiliated to Savitribai Phule Pune University, Pune
T.Y.B.Sc. Microbiology

SEMESTER V

USMB 356 A : FOOD & DAIRY MICROBIOLOGY
(2022 Pattern)

Time: Two Hour.

(No. of Credits 03)

Max. Marks: 60

Instructions to the candidate:

- All questions are compulsory.
- Draw neat and labelled diagram whenever necessary.

Q.1 (A) Attempt the following:

(1 Mark each)

1. Define – Food spoilage.
2. Define – Pasteurization.
3. State True or False : The pH of milk is alkaline outside the cow.
4. Fill in the blank :denotes the decimal reduction time for reduction of microbial population by one decimal.
A. D-value B. Z-value C. F- value D. P-value

(B) Attempt the following:

(2 Marks each)

1. Define – Titratable acidity.
2. Define – TDP.
3. What is skimmed milk ?
4. What is FSSAI ?

Q.2 Attempt ANY THREE of the following :

(4Marks each)

1. Explain the role of common microorganisms found in milk.
2. Write classification of food based on stability.
3. Write a short note on- Clean Milk concept.
4. Explain food poisoning caused by *Clostridium botulinum*.

Q.3 Attempt ANY TWO of the following :

(6Marks each)

1. Explain the nutritive values of milk.
2. Write the detrimental effects of microbes associated with milk.
3. Write the principles of food preservation.

Q.4 Attempt ANY TWO of the following :

(6Marks each)

1. Explain the factors affecting quality and quantity of milk.
2. Write a short note on – Phosphatase test.
3. Describe food infection by *Salmonella typhimurium*.

Q.5 Attempt ANY ONE of the following :

(12 Marks each)

1. Explain the dye reduction tests used in analysis of milk.
2. Describe the physical and chemical properties of food affecting microbial growth.

Exam. Seat No.

Total No. of Pages: 2

Total No. of Questions: 5

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
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Affiliated to Savitribai Phule Pune University, Pune
T. Y. B.Sc.

MICROBIOLOGY

Semester - V

USMB352: Genetics and Molecular Biology I
(2022 Pattern)

Time: 02.00 Hours

Max. Marks: 60

Instructions to the candidates: (If any)

- i. All questions are compulsory.
- ii. All questions have equal marks.
- iii. Draw neat labeled diagram where ever necessary.

Q.1 (A) Attempt each of the following. (1 Mark each)

- i. Give list of different histone proteins found in eukaryotic chromosome
- ii. State whether true or false: Bacterial chromosome is highly organized similar to eukaryotic chromosome.
- iii. What is abortive initiation?
- iv. Define origin

(B) Attempt each of the following. (2 Marks each)

- i. Define transcription unit.
- ii. Which are different termination codons?
- iii. For the separation of double stranded DNA _____ and for synthesis of primer _____ is required.
A) Helicase and primase B) Ligase and SSB
C) Helicase and ligase D) SSB and primase
- iv. Match the following.
Cytosine Thymine
Adenine Xanthine
Guanine Hypoxanthine
5-methylcytosine Uracil

Q.2 Write short notes on any three of the following. (4 Marks each)

- i. Translesion DNA synthesis.
- ii. Structure of nucleosome
- iii. DNA damage by radiation.
- iv. Prokaryotic promoter.

Q.3 Attempt any two of the following. (6 Marks each)

- i. Diagrammatically explain Base excision repair (BER).
- ii. Write a short note on shine-dalgarno sequence.
- iii. Write a short note on mismatch repair.

Q.4 Attempt any two of the following.

(6 Marks each)

- i. Diagrammatically explain non homologous end joining.
- ii. Diagrammatically explain how DNA ligase seals Nick.
- iii. Diagrammatically explain initiation of translation in prokaryotes

Q.5 Attempt any one of the following (Long answer questions).

(12 Marks each)

- i. Explain in detail intrinsic and Rho-dependent termination of transcription in prokaryotes with the help of appropriate diagrams.
- ii. Describe in detail coordinated synthesis of leading and lagging strand in prokaryotes.

Exam seat No.

Total No. of Questions: 5

Total No. of Pages: 2

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T. Y. B.Sc.
Microbiology
Semester VI
USMB362 : Genetics and molecular biology II
(2022 Pattern)

Time: Two Hours

Max. Marks: 60

Instructions to candidate:

- I. All questions carry equal marks.
- II. Use of scientific calculator is allowed.
- III. Draw neat labelled diagrams wherever necessary.

- Q1. (A) Attempt **each** of the following (1 Mark each)
- (i) What does a recombination frequency of 50% indicate?
 - (ii) Define: Transformosome
 - (iii) Which kind of life cycle is followed by phage during generalised transduction?
 - (iv) In which phase does segregation of replicated genetic material occur in the eukaryotic cell cycle?
- (B) Attempt **each** of the following (2 Marks each)
- (i) Mention any two methods used for transfer of recombinant DNA in to host cell.
 - (ii) Define: Recombination
 - (iii) Who discovered the process of transduction?
 - (iv) What are the main stages of the eukaryotic cell cycle?
- Q2. Attempt any **three** of the following (4 Marks each)
- (i) Draw a neat labelled diagram showing Hfr formation.
 - (ii) Write a short note on cosmid.
 - (iii) Write a short note on artificial transformation.
 - (iv) DNA from a strain of *Streptococcus pneumoniae* with the genotype trp⁺ tyr⁺ is used to transform a recipient strain with the genotype trp⁻ tyr⁻. The following numbers of transformed cells were recovered.
trp⁺ tyr⁻ : 160
trp⁻ tyr⁺ : 320
trp⁺ tyr⁺ : 360. Calculate the percent (%) frequency of co-transformation of trp and tyr genes.

- Q3. Attempt any **two** of the following (6 Marks each)
- (i) With the help of diagram describe PBR 322 vector with respect to: i) Origin of Replication ii) Selective marker iii) Cloning site
 - (ii) Diagrammatically represent of specialized transduction.
 - (iii) With the help of diagram describe the discovery of transformation.

- Q4. Attempt any **two** of the following (6 Marks each)
- (i) Describe screening of recombinant DNA by Blue white assay.
 - (ii) Diagrammatically represent mitosis.
 - (iii) Diagrammatically explain conjugation between F+ and F-.

- Q5. Attempt any **one** of the following (12 Marks each)
- (i) Discuss the use of linkers, adaptors, and homopolymer tailing in DNA manipulation and their functions in cloning.
 - (ii) Consider three genes on the same chromosome, geneD, geneE and geneF. To determine the distance between and order of these three genes, you conduct a test cross between a heterozygote DEF / def and a def / def homozygous recessive. The offspring produced from the cross are shown in the table. What is the distance between the genes? Draw a map showing the position and distance between the three loci.

Offspring class	Number of offspring
DEF	100
def	102
Def	57
dEF	59
DEf	31
deF	43
DeF	21
dEf	21

Exam seat No.

Total No. of Questions: 5

Total No. of Pages: 2

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T. Y. B.Sc.
Microbiology
Semester VI
USMB363 : Metabolism
(2022 Pattern)

Time: Two Hours

Max. Marks: 60

Instructions to candidate:

- I. *All questions carry equal marks.*
- II. *Use of scientific calculator is allowed.*
- III. *Draw neat labelled diagrams wherever necessary.*

- Q1. (A) Attempt **each** of the following (1 Mark each)
- (i) Define oxygenic photosynthesis.
 - (ii) Define free energy.
 - (iii) _____ and _____ are the polymers found in starch.
 - (iv) Net gain per molecule of palmitate is _____ ATP.
- (B) Attempt **each** of the following (2 Marks each)
- (i) State first law of thermodynamics.
 - (ii) Draw the structure of malonyl-CoA.
 - (iii) What is plasmolysis?
 - (iv) Enlist the enzymes involved in breakdown of starch.
- Q2. Attempt any **three** of the following (4 Marks each)
- (i) Draw a neat labelled diagram of electron flow in reaction centre of purple photosynthetic bacteria.
 - (ii) Write a short note on phosphoenol pyruvate as a high energy compound.
 - (iii) Draw a neat labelled diagram showing structure of phycobilisome.
 - (iv) Draw a neat labelled diagram of mitochondria ATP synthase complex.
- Q3. Attempt any **two** of the following (6 Marks each)
- (i) Diagrammatically explain synthesis of glycogen from UDP-glucose.
 - (ii) Describe in detail how electron transport in the reaction centre of cyanobacteria happens?
 - (iii) What is entropy? Explain how entropy of universe increase with any two suitable examples.
- Q4. Attempt any **two** of the following (6 Marks each)
- (i) Write a short note on group translocation.

- (ii) Diagrammatically explain fluid mosaic model of the biological membrane.
- (iii) Explain how starch synthase polymerises ADP-glucose into starch.

Q5. Attempt any one of the following (12 Marks each)

- (i) Explain in detail urea cycle and draw the appropriate structures of intermediate molecules.
- (ii) Explain in detail energetics of mitochondrial electron transport chain (ETC).

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Tuljaram Chaturchand College Baramati (Empowered Autonomous)

Affiliated to Savitribal Phule Pune University, Pune

Department of Microbiology

Class: T.Y. B.Sc.

(2019 Pattern)

Subject: MICRO 3504 Immunology – I (Semester- V)

Time: 2. hours]

[Max marks: 60]

N.B.

1. All questions are compulsory
2. All questions carry equal marks
3. Draw neat labeled diagram wherever necessary

Q1) Answer the following:	12
a. Define , "Antigen"	01
b. Half life period of Ig M is 8-10 days. True/False	01
c. What are complements	01
d. A molecule which Lacks immunogenicity but possesses antigenicity are named as Adjuvant True/False	01
e. What are Antigenic determinants	02
f. Define Allografts.	02
g. Enlist any two antigen presenting cell .	02
h. Draw the structure of IgG.	02

Q2 Write short note on any three of the following	12
A. Structure and function of Spleen.	
B. Natural immunity.	
C. Phagocytosis.	
D. Activation and differentiation of B cells.	

Q3 Answer **any two** of the following.

12

A. Describe Epitopes of Immunoglobulin.

B. Describe Hematopiosis.

C. Explain Alternative path- way of complement activation.

Q4. Diagrammatically represent **any two** of the following.

12

A. ADCC

B. Apendix

C Humoral immune response

Q 5 Attempt **any one** of the following.

12

A. What is immunoglobulins? Describe different properties of immunoglobulins.

OR

B. What is transplantation? Describe different types of grafts. Add a note on allograft rejection mechanism

.....

Anekant Education Society's

Tuljaram Chaturchand College Baramati

(Empowered Autonomous)

Affiliated to Savitribai Phule Pune University, Pune

Department of Microbiology

Class: T.Y. B.Sc.

(2022 Pattern)

Subject: USMB 354 Immunology – I (Semester- V)

Time: 2 hours]

[Max marks: 60

N.B.

1. All questions are compulsory
2. All questions carry equal marks
3. Draw neat labeled diagram wherever necessary

Q1.A) Answer the following:

(One mark each)

- a) A molecule which Lacks immunogenicity but possesses antigenicity is named as Haptens T/F
- b) Half life period of IgG is 8-10 days T/F
- c) T cells that are not prior interacted with any antigen are referred as..... Cells
- d) Proteins are the best antigens T/F

Q1.B) Answer in short:

(2 marks each)

- a) What are Xenografts
- b) Draw the structure of IgA
- c) What are Linear determinants
- d) Enlist antigen presenting cells.

Q2 Write short note on **any three** of the following

(4 marks each)

- A. Structure and function of Thymus
- B. Passive Immunity
- C. First and second set of Allograft rejection
- D. Factors affecting Immunogenicity

Q3 Answer **any two** of the following.

(6 marks each)

- A. Describe antigenic determinants of Immunoglobulin.
- B. Justify: Immune sera offered short lived Immunity
- C. Describe Alternative path way of complement activation

Q4 Describe with the help of diagram. **Any two** of the following

(6 marks each)

- A. Types of tonsils
- B. Activation and differentiation of B Cells
- C. Humoral Immune response

Q 5 Attempt **any one** of the following.

(12 marks each)

- A. What are immunoglobulins? Describe different chemical and biological properties of different immunoglobulins

OR

- B. What are antigens? Describe different types of antigen in detail

Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science and commerce, Baramati

(Empowered Autonomous)

T.Y.B.Sc (Semester-VI) MICROBIOLOGY

Paper- USMB 364 (Immunology II)

(2022 Pattern)

Marks: 60

Time 2 hrs

Instructions to the candidates:

- *All questions are compulsory*
- *Figures to the right indicate marks*
- *Draw neat labeled diagrams wherever necessary*

Q.1 Attempt the following (Short answer questions)

(12)

A] Answer the following.

(1 Mark each)

- a) MHC class I molecule constitute
- i) α -chains & β 2 microglobulin ii) α -chain & β -chain iii) 2 α -chains iv) 2 β -chains
- b) Define, antibody avidity.
- c) Tuberculin test is the example of type of hypersensitivity
- d) Father has AB blood group and mother has O blood group Which of the following Genotype is possible in the offspring.....
- i) AB ii) BB iii) BO iv) OO

B) Answer the following.

(2 Mark each)

- a) What is Agglutination inhibition? Give its suitable example
- b) Define interferons. Name its types.
- c) What are vaccines, give any one example of bacterial live vaccine.
- d) What is ELISA? Name its types.

Q. 2 Write short notes on any three of the following.

(12)

- a) Immunodiffusion
- b) Contact dermatitis
- c) Arthus reaction
- d) Toxoids

Q.3 Describe in detail any two of the following

(12)

- a) Agglutination Inhibition
- b) Types of cytokines
- c) Structure and function of MHC-II molecule

Q.4 Explain any two of the following

(12)

- a) Cross matching
- b) Microcytotoxicity test
- c) Rheumatoid Arthritis

Q.5 What are autoimmune diseases, Describe types of autoimmune diseases.

(12)

OR

Q.5 what is ABO blood group system? Describe biochemistry of ABO blood group substances in detail.

Total No. of Questions: 05

Exam Seat No.

Total No. of pages: 02

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
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Affiliated to Savitribai Phule Pune University, Pune

T. Y. B. Sc.

MICROBIOLOGY

Semester: VI

USMB365: Fermentation Technology - II

(2022 Pattern)

Time: 02 Hours

(No. of Credits – 03)

Max. Marks: 60

Instructions to the candidates:

1. All questions are compulsory.
2. Draw neat labelled diagrams wherever necessary.

Q1. (A) Attempt each of the following:

[1 Mark each]

- i) Name the bacterium used in the production of tetanus toxoid.
- ii) State the use of renin-type protease in cheese manufacturing.
- iii) Explain the role of chill-proofing agents in finished.
- iv) Name the bacterium used in the production of streptomycin.

(B) Attempt each of the following:

[2 Marks each]

i) Match the following:

- | | |
|-------------|----------------|
| i) Hops | Chill-proofing |
| ii) Caramel | Color |
| | Flavor |

ii) Fill in the blanks:

- i) ____ is the raw material used to produce yoghurt.
- ii) Acetator and cavitator type fermenters are associated with the production of ____.
- iii) State whether the following statement is true or false.
 - a) Edible mushrooms belong to the class of basidiomycetes of fungi.
 - b) In continuous fermentation, a fixed volume of production medium is used.
- iv) Name the substrates used in the production of mushrooms.

Exam Seat No.

Q2. Attempt any three of the following:

[4 Marks each]

- i) Steroid transformation
- ii) Uses of lactic acid
- iii) Production of antisera
- iv) Malting

Q3. Attempt any two of the following:

[6 Marks each]

- i) Explain the process of mashing in brewing of beer.
- ii) Describe any one of the methods of production of vinegar.
- iii) Describe the production of amylase.

Q4. Attempt any two of the following:

[6 Marks each]

- i) Describe the by-products of ethanol fermentation.
- ii) Explain the steps of recovery of penicillin.
- iii) Describe the production of Salk-type polio vaccine.

Q5. Attempt any one of the following:

[12 Marks each]

- i) Describe the production of cheese.
- ii) Describe the large-scale production of white wine.

Exam. Seat No

Total No of Page: 1

Total No. of Questions : 5

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)
Affiliated to Savitribai Phule Pune University, Pune

Class -T. Y. BSc.

Subject - Microbiology

Semester- VI

Course Code :USMB 366 A

Course Title : Agricultural And Environmental Microbiology
(2022 Pattern)

Time : 2.00 Hours

(No. of Credits 03)

Max. Marks : 60

Instructions to the candidates:

- All questions are compulsory.
- All questions carry equal marks.
- Draw neat and labelled diagram whenever necessary.

Q. 1 (A) Attempt each of the following

(1 Marks each)

- i. Define : Iron chelation
- ii. Define :IPM (Integrated pest management)
- iii. Enlist two names of phosphate solubilizing microorganisms.
- iv. Define: Bioaugmentation

(B) Attempt each of the following

(2 Marks each)

- i. Enlist the names of pre-formed structures & compounds of plants.
- ii. What is systematic acquired resistance (SAR)?
- iii. Write any four Advantages of Biopesticides.
- iv. What is potassium mobilization?

Q. 2 Write a short note on any three of the following

(4 Marks each)

- i. Biopesticides.
- ii. Phosphate solubilization.
- iii. Eradication.
- iv. RNAi technology in controlling plant pathogens.

Q. 3 Attempt any two of the following

(6 Marks each)

- i. Explain the term Bioremediation in detail.
- ii. Describe Biological Nitrogen fixation.
- iii. Explain Biological control as a method of plant disease control.

Q. 4 Attempt any two of the following

(6 Marks each)

- i. Explain the term Bioaugmentation in detail.
- ii. Describe application of viral proteins in controlling plant viral diseases.
- iii. Explain the Antisense RNA technology in plant disease control.

Q. 5 Attempt any one of the following

(12 Marks each)

- i. Enlist the types of Biofertilizers. Explain in detail the Bacterial & Algal Biofertilizers with the help of suitable example.
- ii. Explain in detail Bioleaching process with the help of,
 - a. Microorganisms used
 - b. Bioleaching of Copper & Gold
 - c. Advantages of Bioleaching

Total No. of Questions: 5

Anekant Education Society's
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(Empowered Autonomous)

Affiliated to Savitribai Phule Pune University, Pune
T. Y. B.Sc. Botany, Paper-I, Semester- V, USBT 351: Cryptogamic Botany
(2022 Pattern)

Time 2.00 hours

(No. of Credits 03)

Total Marks 60

Instruction to candidates:

- i. All questions are compulsory.
- ii. Figures to right indicates full marks.
- iii. Neat labeled diagrams must be drawn wherever necessary.

(1 Mark each)

Q.1 (A) Attempt each of the following

- i. Define Mycology
- ii. Give systematic position of *Psilotum*.
- iii. Give occurrence of *Oscillatoria*.
- iv. What is the reserved food in Bryophytes?

(2 Marks each)

(B) Attempt each of the following

- i. Give any two economic importance of *Selaginella*.
- ii. Comment on habitat of *Anthoceros*.
- iii. Give any two economic importance of algae.
- iv. Comment on plasmodium of *Stemonitis*.

(4 Marks each)

Q. 2. Attempt any three of the following

- i. Give economic importance of fungi.
- ii. Comment on asexual reproduction in *Oscillatoria*.
- iii. Comment on general characters of *Polytrichum*.
- iv. Describe anatomy of *Psilotum* stem.

(6 Marks each)

Q. 3. Attempt any two of the following

- i. Give an account of classification of algae proposed by Chapman and Chapman (1973).
- ii. Comment on reproduction in *Mucor*.
- iii. Give life cycle pattern of *Selaginella* in brief.

(6 Marks each)

Q. 4. Attempt any two of the following

- i. Write note on asexual reproduction in fungi.
- ii. Discuss sexual reproduction in algae.
- iii. Give morphology and anatomy of sporophyte of *Anthoceros*.

(12 Marks each)

Q. 5. Attempt any one of the following

- i. Give an detailed account of life cycle of *Equisetum*.
- ii. Give an detailed account of life cycle of *Marchantia*.

Total No of Questions: 5

Exam No.

Total No. of Pages: 1

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce (Autonomous)
Affiliated to Savitribai Phule Pune University, Pune.

T. Y. B.Sc.

BOTANY

Semester V : (2022 Pattern)

USBT 352 : Spermatophyta and Palaeobotany

Time- 2.00.hrs.

No. of Credits: 03

Max. Marks: 60

Instructions for candidates:

- 1) All questions are compulsory.
- 2) Draw a neat labelled diagram wherever necessary.
- 3) Figures to the right indicate full marks.

Q.1 (A) Attempt each of the following.

(1Mark each)

- i) Define the term Fossil.
- ii) Give name of type of seed in family Asteraceae.
- iii) Give the long form of QR.
- iv) What is key?

(B) Attempt each of the following.

(2Marks each)

- i) Give any two uses of Gymnosperms.
- ii) Draw a floral diagram of family Magnoliaceae.
- iii) Give any two salient features of Calamitales.
- iv) Enlist types of wood in Gymnosperms.

Q.2 Attempt any three of the following.

(4Marks each)

- i) Comment on general characters of Gymnosperms.
- ii) Write a note on economic importance of family Fabaceae.
- iii) Sketch, label and describe Male cone of *Gnetum*.
- iv) Comment on Impression.

Q.3 Attempt any two of the following.

(6Marks each)

- i) Give the details of Geological time scale.
- ii) Explain Bennettitalean theory.
- iii) Comment on Alternation of generation in *Pinus*.

Q.4 Write a note on any two of following.

(6 Marks each)

- i) APG III System.
- ii) Use of flora
- iii) *Gnetum* seed.

Q.5 Write an essay on any one of following

(12 Marks each)

- i) Explain the process of fossil formation. Add a note on any one type of fossil.
- ii) Give distinguishing characters and economic importance of family Poaceae.

Seat No.

Total No. of Questions : 5

Total no. of Pages : 1

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)
T. Y. B. Sc. BOTANY
(Semester -V)
USBT 353 : Cell Biology and Molecular Biology
(2022 Pattern)

Time : 2.00 Hours)

(No. of Credits 03)

(Max. Marks : 60

Instructions to the candidates :

- i. All questions are compulsory
- ii. Figures to right indicate full marks
- iii. Draw neat labeled diagrams wherever necessary

Q.1 Attempt the following : (12)

- i) Give definition of cell biology. (1)
- ii) Which organelle of the cell contains cristae? (1)
- iii) Which organelle is known as the power house of the cell? (1)
- iv) Define nucleus. (1)
- v) Mention the components of cell wall. (2)
- vi) Write forms of DNA. (2)
- vii) Define molecular biology and write central dogma of molecular biology. (2)
- viii) Give definition of transcription and translation. (2)

Q.2 Answer any three questions of the following : (12)

- i) Draw and describe ultra structure of mitochondria.
- ii) Functions of endoplasmic reticulum.
- iii) Semiconservative replication of DNA.
- iv) Repair Mechanism of DNA.

Q.3 Attempt any two questions of the following : (12)

- i) What is cell wall? Describe chemical composition and function of the plant cell wall.
- ii) What is Cytosol? Write a note on chemical organization of Cytosol.
- iii) What is genetic code? Explain in brief properties of genetic code.

Q.4 Answer any two questions of the following : (12)

- i) Describe structure and function of plasma membrane.
- ii) Describe structure and function of golgi apparatus.
- iii) Write a note on DNA damage.

Q.5 Answer any one question of the following : (12)

- i) What is the chloroplast? Describe the ultra structure and functions of the chloroplast.
- ii) Illustrate in brief Watson and Crick's model of DNA.

Exam. Seat No.

Total No. of Questions: 5

Total No. of Pages: 1

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Empowered Autonomous)

Department of Botany

Affiliated to Savitribai Phule Pune University, Pune

Class: T.Y. B.Sc.

Subject Botany

Semester V

Paper Code: USBT 354 Industrial Botany
(2022 Pattern)

Time: 02 Hours

Max. Marks: 60

Instructions for candidates:

- 1) All questions are compulsory.
 - 2) Draw neat labelled diagrams wherever necessary.
 - 3) Figure to right indicate full marks.
-

Q.1) A) Attempt each of the following

(1 Mark each)

- i. Define the term aeroponics.
- ii. Enlist various systems of hydroponic.
- iii. What is damage of food stuff?
- iv. What is Perlite?

B) Attempt each of the following

(2 Marks each)

- i. Write advantages of hydroponics.
- ii. Write any two advantages of nutrient film technique (NFT).
- iii. What are two main types of dehydration in Post harvest treatment?
- iv. Give major nutrients used in nutrient solution.

Q.2 Attempt any three of the following

(4 Marks each)

- i. Give the principles gardening.
- ii. Write about indoor gardening- Hugelkulture.
- iii. Write note on Bubbleponics.
- iv. Give the name of storage of fruits?

Q.3 Attempt any two of the following

(6 Marks each)

- i. Explain any two types of indoor gardening
- ii. Explain Run to waste technique.
- iii. What is storage in Post-Harvest technology? Explain its methods.

Q.4 Attempt any two of the following

(6 Marks each)

- i. What is Indoor gardening? Explain in detail – Bonsai garden.
- ii. What are plant nutrients and explain their role.
- iii. What is drying? Explain sun drying and machine drying.

Q.5 Attempt any one of the following

(12 Marks each)

- i. What is garden designing? Explain objectives and scope of garden designing.
- ii. Explain in detail Primary Processing Operation Vs. Secondary Operation of Post-Harvest technology.

Total No. of Questions: 5

Seat No.
Total no. of Pages : 1

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Empowered Autonomous)
T. Y. B. Sc. BOTANY
(Semester -V)
USBT 355: Biostatistics
(2022 Pattern)
(No. of Credits 03)

Time: Two Hours

Max. Marks: 60

Instructions to the candidates:

- i. All questions are compulsory
- ii. Figures to right indicate full marks
- iii. Draw neat labeled diagrams wherever necessary.

Q.1 (A) Attempt each of the following.

(1Mark each))

- i) Define the term Biostatistics.
- ii) What is meant by secondary data?
- iii) What is long form of LAI?
- iv) Give the formula for calculation of S.D.

(B) Attempt each of the following.

(2Marks each)

- i) What is meant by variable?
- ii) Give the formula for calculation of C.V.
- iii) Define the term data and discrete variable.
- iv) What is long form of RGR?

Q.2 Attempt any three of the following

(4 Marks each)

- i) What are characteristics of Binomial distribution.
- ii) Write a short note on kurtosis.
- iii) What are the merits and demerits of mode.
- iv) Enlist the plant growth indices used for computation of seed germination and seedling growth under stress.

Q.3 Attempt any two of the following.

(6 Marks each)

- i) Write a note on NDVI and RVI.
- ii) Define the term sampling and add a note on types of sampling.
- iii) Write on Chi square test.

Q.4 Answer any two of the following.

(6 Marks each)

- i) What is systematic sampling and give its merits and demerits
- ii) Write on skewness.
- iii) Give the merits and demerits of median.

Q.5 Answer any one of the following.

(12 Marks each)

- i) Explain in detail graphical representation of data.
- ii) What is meant by correlation? Explain its types.

Exam No.

Total No of Questions: 5

Total No. of Pages: 1

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce
(Empowered Autonomous)
Affiliated to Savitribai Phule Pune University, Pune.
T. Y. B.Sc.
BOTANY
Semester VI (2022 Pattern)
USBT 361: Plant Physiology and Biochemistry

Time- 2.00.hrs.

Number of Credits: 04

Max. Marks: 60

Instructions for candidates:

- 1) All questions are compulsory.
 - 2) Draw a neat labelled diagram wherever necessary.
 - 3) Figures to the right indicate full marks.
-

Q.1 (A) Attempt each of the following.

(1Mark each)

- i. What are chlorophylls?
- ii. What are lipids?
- iii. What are carbohydrates?
- iv. What is translocation?

(B) Attempt each of the following.

(2Marks each)

- i. Define the terms uniport and symport.
- ii. Give any two examples of amino acids.
- iii. Give any two examples of secondary metabolites.
- iv. Give any two characters of proteins?

Q.2 Attempt any three of the following.

(4marks each)

- i. Comment functions of amino acids.
- ii. Explain in brief synthesis of starch.
- iii. Write a short note on Cyanide Resistant respiration.
- iv. Comment on classification of lipids.

Q.3 Attempt any two of the following.

(6Marks each)

- i. Explain in detail pressure flow theory
- ii. Give detailed account of Biosynthesis of terpenes.
- iii. Give significance Glycolysis.

Q.4 Write a note on any two of following.

(6 Marks each)

- i. Phloem un-loading
- ii. Balance sheet of ATP generation in respiration.
- iii. Significance of lipids.

Q.5 Write an essay on any one of following

(12 Marks each)

- i. What is photosynthesis? Explain mechanism of CAM pathway with schematic representation.
- ii. Give detailed account of classification of enzymes. Add a note on Enzyme inhibitors.

Exam Seat No.

Total No. of Questions: 5

Total No. of Page: 1

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce College, Baramati
(Empowered Autonomous)
Affiliated to Savitribai Phule Pune University, Pune
T. Y. B.Sc. Botany, Semester- VI, USBT 362: Plant Biotechnology
(2022 Pattern)

Time: Two hours

(Number of Credits 03)

Total Marks: 60

Instruction to candidates:

- i. All questions are compulsory.
- ii. Figures to right indicates full marks.
- iii. Neat labeled diagrams must be drawn wherever necessary.

Q.1 (A) Attempt each of the following

(1 Mark each)

- i. Define the term of Plant biotechnology.
- ii. What is cybrid?
- iii. Define the term of Bioinformatics.
- iv. Enlist any two organism of symbiotic N₂ fixer.

(B) Attempt each of the following

(2 Mark each)

- i. What is biofertilizer? Give its one example.
- ii. Define the term of Transgenic Plant.
- iii. What is *Ex-situ* conservation?
- iv. What is function of Ti-plasmid?

Q. 2. Attempt any three of the following

(4 Marks each)

- i. Write note on micropropagation.
- ii. What are the application cryopreservation?
- iii. What are restriction endonucleases? Give its types.
- iv. Write note on GMO.

Q. 3. Attempt any two of the following

(6 Marks each)

- i. Write applications of Plant tissue culture.
- ii. Describe the technology of cryopreservation.
- iii. What is data base? Add note on BLASTA.

Q. 4. Attempt any two of the following

(6 Marks each)

- i. Write note on PCR.
- ii. What is proteomics? Give its types.
- iii. What are the applications of Bioinformatics?

Q. 5. Attempt any one of the following

(12 Marks each)

- i. Describe the microinjection and electroporation direct method of gene transfer.
- ii. What is Diazotrophs? Give the mechanism of N₂- fixation.

*

Exam. Seat No.

Total No. of Questions: 5

Total No. of Pages: 1

Anekant Education Society's
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(Empowered Autonomous)

Affiliated to Savitribai Phule Pune University, Pune

T. Y. B. Sc. Botany, Semester - VI
USBT 363: Genetics and Plant Breeding
(2022 Pattern)

Time: Two Hours

No. of Credits: 04

Max. Marks: 60

Instructions to the candidates:

- i. All questions are compulsory.
- ii. Figures to right indicate full marks.
- iii. Neat labeled diagrams must be drawn wherever necessary.

Q.1 (A) Attempt each of the following. (01 Marks each)

- i) Enlist any two branches of genetics.
- ii) Define phenotype and genotype.
- iii) What is back cross?
- iv) Define lethal genes.

(B) Attempt each of the following. (02 Marks each)

- i) Write Mendel's law of dominance.
- ii) Mention any two objectives of plant breeding.
- iii) What is sex linked inheritance?
- iv) Define Plant Introduction and Acclimatization.

Q.2 Attempt any three of the following. (04 Marks each)

- i) Explain masking gene interaction with example.
- ii) Write about color blindness in human.
- iii) Write a note on advantages of hybridization technique.
- iv) Explain blood group inheritance in human.

Q.3 Attempt any two of the following. (06 Marks each)

- i) What is pure line selection? Give its advantages and disadvantages.
- ii) What is multiple alleles? Enlist characteristics of multiple alleles.
- iii) What is monohybrid cross? Explain it with suitable example.

Q.4 Attempt any two of the following. (06 Marks each)

- i) Describe complementary gene interaction with suitable example.
- ii) Explain Mendel's law of inheritance.
- iii) What is mass selection? Write the procedure of mass selection.

Q.5 Attempt any one of the following. (12 Marks each)

- i) Explain the concept of cytoplasmic inheritance. Add a note on chloroplast inheritance in *Mirabilis jalapa*.
- ii) Define hybridization. Write in detail the procedure of hybridization technique.

Total No. of Questions: 5

Seat No.
Total no. of Pages : 1

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Empowered Autonomous)
T. Y. B. Sc. BOTANY, (Semester -VI)
USBT 365: Pharmacognosy
(2022 Pattern)

Time: Two Hours

(Number of Credits : 03)

Max. Marks: 60

Instructions to the candidates:

- i. All questions are compulsory.
- ii. Figures to right indicate full marks.
- iii. Draw a neat labeled diagrams wherever necessary.

Q.1 (A) Attempt each of the following.

(1Mark each)

- i) What is meant by Ayurveda?
- ii) Enlist any two names of herbal drugs.
- iii) Give botanical name of Amla.
- iv) Give the definition of ethnobotany.

(B) Attempt each of the following.

(2Marks each)

- i) Give any four properties of antioxidant.
- ii) What is meant by Ras and Guna?
- iii) Define the term drug adulteration. Enlist its evaluation methods.
- iv) Enlist any four branches of ethnobotany.

Q.2 Attempt any three of the following

(4 Marks each)

- i) Explain importance of herbal drugs in brief.
- ii) Write a short note on nutraceuticals.
- iii) Write macroscopic characters and uses of *Adulsa*.
- iv) Explain macroscopic characters and uses of *Ephedra* in brief.

Q.3 Attempt any two of the following.

(6 Marks each)

- i) Describe classification of crude drugs.
- ii) Give the definition and concept of Cosmeceuticals.
- iii) Explain Cultivation, processing and marketing of *Mentha*.

Q.4 Answer any two of the following

(6 Marks each)

- i) Describe ethnobotany of neem w.r.t taxonomy, Phytochemistry and uses.
- ii) Describe history and various systems of Ayurveda.
- iii) Explain cultivation methods and uses of Clove.

Q.5 Answer any one of the following.

(12 Marks each)

- i) Explain processing, packaging, storage and marketing of *Eucalyptus* in detail.
- ii) What is meant by sacred grooves? Add a note on its present status and importance.

Total No of Questions: 5

Exam No.

Total No. of Pages: 1

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce
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Affiliated to Savitribai Phule Pune University, Pune.
T. Y. B.Sc.
BOTANY
Semester VI (2022 Pattern)
USBT366: Botanical Techniques

Time- 2.00.hrs.

Number of Credits: 04

Max. Marks: 60

Instructions for candidates:

- 1) All questions are compulsory.
- 2) Draw a neat labelled diagram wherever necessary.
- 3) Figures to the right indicate full marks.

Q.1 (A) Attempt each of the following.

(1Mark each)

- i. Give the full of SEM and TEM.
- ii. What is chromatography?
- iii. What is the percentage and Normal solution?
- iv. Give the formula for calculation of RF value in chromatography.

(B) Attempt each of the following.

(2Marks each)

- i. Comment on application of microscopy.
- ii. Comment on the term soil texture.
- iii. What are the different types of stains?
- iv. What is spectroscopy?

Q.2 Attempt any three of the following.

(4 marks each)

- i. Comment on stage and ocular micrometer.
- ii. Write note on TLC.
- iii. Comment on Phase Contrast microscopy.
- iv. Sketch and label the spectroscopy-instrumentation.

Q.3 Attempt any two of the following.

(6 Marks each)

- i. Comment on physico-chemical properties of soil.
- ii. Comment on column chromatography.
- iii. Comment on types of rotors used in centrifuges.

Q.4 Write a note on any two of following.

(6 Marks each)

- i. Comment on instrumentation and working of fluorescence microscopy.
- ii. Write note on types of samplers used in aerobiology.
- iii. Discuss the Beer and Lambert law.

Q.5 Write an essay on any one of following

(12 Marks each)

- i. Discuss the methods of centrifugation and add a note on the types of centrifuges.
- ii. Discuss in the detail the principal, working and application of TLC with suitable diagram.

Total No of Questions: 5

Exam No.

Total No. of Pages: 1

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce
(Empowered Autonomous)
Affiliated to Savitribai Phule Pune University, Pune.
T. Y. B.Sc.
BOTANY
Semester V (2019 Pattern)
BOT3506: Research Methodology

Time- 2.00.hrs.

Number of Credits: 04

Max. Marks: 60

Instructions for candidates:

- 1) All questions are compulsory.
- 2) Draw a neat labelled diagram wherever necessary.
- 3) Figures to the right indicate full marks.

Q.1 (A) Attempt each of the following.

(1Mark each)

- i) Define the term Research.
- ii) What is case study?
- iii) What is survey?
- iv) Define the term Review of literature.

(B) Attempt each of the following.

(2Marks each)

- i) Give any two features of good design.
- ii) Give any two methods of research.
- iii) Enlist any two characters of good hypothesis.
- iv) Give any two objectives of research.

Q.2 Attempt any three of the following.

(4marks each)

- i) Write a short note Qualitative research.
- ii) Comment on Discussion of research project.
- iii) Describe in brief historical method of research.
- iv) Write a note on Research problem.

Q.3 Attempt any two of the following.

(6Marks each)

- i) Give significance of research in detail.
- ii) Explain in detail formulation of hypothesis.
- iii) Comment on significance of research.

Q.4 Write a note on any two of following.

(6 Marks each)

- i) Concept and need of research problem.
- ii) Principles of Experimental Design.
- iii) Bibliography

Q.5 Write an essay on any one of following

(12 Marks each)

- i) Describe the term data. Give detailed account of methods of data collection.
- ii) What are variables? Give detailed account of types of variables.