

M.Sc. (Physics) (Sem.-1) Examination

PHY 401 (Old & New)

Quantum Mechanics I and Mathematical Physics-I

Time : 2-30 Hours]

March 2019

[Max. Marks : 70

1 A(i) Write 1st order equation for the wave function of perturbation. Obtain 1st order correction to the energy and wave function. (7)

(ii) Discuss perturbation theory for degenerate states. (7)

OR

(i) With the help of variation method. Find out minimum energy of two electrons system. (7)

(ii) Discuss stark effect for the 1st excited state of hydrogen atom (7)

1B. Answer following questions (four out of six) (4)

(i) What is the unit of dipole moment?

(ii) When angle between dipole moment and applied electric field is 45°, then what will be the value of perturb Hamiltonian?

(iii) Show that unit of the Polarizability is m³.

(iv) What is the value of $\frac{1}{r_{12}}$, when $r_1 > r_2$?

(v) Degenerate states are orthogonal to each other (True/ False)

(vi) Show that $\Delta_{12} = \Delta_{21}$

2A(i). Obtain solution of time dependent schrodinger equation. What is green function? (7)

(ii) Write green function equation. Derive differential equation for green function and retarded green function. (7)

OR

(i) Find out WKB solution of schrodinger equation. (7)

(ii) Obtain Bohr- sommerfeld quantization condition. (7)

2B. Answer following questions in brief (four out of six) (4)

(i) Define heavy-side unit function.

(ii) What is the unit of action?

(iii) For non- classical region, total energy is less than potential energy [true/ false].

(iv) In sudden approximation, probability of transition is directly proportional to _____ [complete the statement].

(iii) What is the unit of centrifugal distortion term in radial schrodinger equation?

(iv) Why wave function is expanded in powder series of \hbar ?

3A. (i) Verify that $L\left\{\frac{\cos at - \cos bt}{b^2 - a^2}\right\} = s / (s^2 + a^2)(s^2 + b^2)$, $a^2 \neq b^2$ (7)

M 865 - 2

(ii) Solve the differential equation for a damped harmonic oscillator (7)

$$mX''(t) + bX'(t) + kX(t) = 0, \text{ for } b^2 < 4km,$$

with initial conditions $X(0) = X_0, X'(0) = 0$.
Given: $L\{e^{-at} \cos bt\} = s+a / (s+a)^2 + b^2$
 $L\{e^{-at} \sin bt\} = b / (s+a)^2 + b^2$

OR

(i) Prove that (i) $L\{t^n\} = n! / s^{n+1}, s > 0, n > -1$ and (ii) $L\{\sinh kt\} = k / (s^2 - k^2)$ (7)
(ii) Using Laplace transforms, solve the Bessel's equation with $n=0$,
 $x^2 y''(x) + xy'(x) + x^2 y(x) = 0$. Initial conditions are: $y(+0) = 1, y'(+0) = 0$.

Given: $L\{t^n\} = n! / s^{n+1}, s > 0, n > -1$.

3B. Short questions (attempt any three) (3)

- (i) What is the Laplace transform of t ?
- (ii) What is two sided Laplace Transform?
- (iii) What is the Lerch's theorem?
- (iv) Give the definition of Heaviside unit step function.
- (v) $L\{\cos kt\} =$ _____

4A (i) List the differences between Homomorphism and Isomorphism. Discuss (7)
various properties of a class.

(ii) What do you understand by second rank tensor? Prove that every tensor of second rank can be resolved in to *symmetric* and *anti-symmetric* part. (7)

OR

- (i) Define group and subgroup. Discuss various properties of subgroup. (7)
- (ii) What do you understand by contravariant and covariant vectors? Show that the sum and differences of two tensors of same rank results in a third tensor of the same rank. (7)

4 B. Answer any three of following (out of five) (3)

- (i) Give name of tensor having third rank
- (ii) How many components of third rank tensor?
- (iii) Why we study a group theory?
- (iv) Give a group table of three elements: E, A, B
- (v) What is a finite group?

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2/33

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Candidate's Seat No : _____

M.Sc. (Sem.-1) Examination

Botany 401

Microbiology, Mycology and Phycology

March 2019

[Max. Marks : 70

Time : 2-30 Hours]

Note: Draw the diagram where ever required.

- Q. 1 A General account of Phytoplasma. 14
- OR
- Q. 1 Write Short Notes
- A I Microbial ecology 07
- A II Plant disease due to Virus and its control 07
- Q. 1 B Short questions (Any 4 out of 6) 04
- I What is Bacteria?
- II Define probiotic food
- III Give the function of Microbial culture.
- IV Give any two names of Plant disease due to Bacteria.
- V Application of biofilm
- VI What is postharvest spoilage?
- Q. 2 A Give an account of Hyphal Growth 14
- OR
- Q. 2 Write Short Notes
- A I Heterothallism. 07
- A II General account of Ascomycetes. 07
- Q. 2 B Short questions (Any 4 out of 6) 04
- I Two Characters of Oomycetes
- II Give any two importance of fungi.
- III What is AM fungi?
- IV Significance of fungal disease.
- V What is Heterokaryosis
- VI Draw any one disease cycle.
- Q. 3 A Give the characteristics and classification of chlorophyta. 14
- OR
- Q. 3 Write Short Notes
- A I Cell Ultrastructure of Rhodophyta 07
- A II Distribution of Algae and its different habitats 07

P.T.O

- Q. 3 B Short questions (Any 3 out of 5) 03
- I What is Biofertilizer?
 - II Give one example (Name) of biofuel from algae
 - III Give names of any two economically important algae
 - IV Any two importance of pigments.
 - V Name any two algae used in Phytoremediation.
- Q. 4 A Explain: Culturing of Fungi or Algae. 14
- OR
- Q. 4 Write Short Notes
- A I Lignocelluloses 07
 - A II Large Scale Commercial Utilization of Fungi 07
- Q. 4 B Short questions (Any 3 out of 5) 03
- I Give full form of CBP
 - II What is Mushroom Cultivation?
 - III Biodiesel
 - IV Name any two factors affecting on growth of any culture.
 - V Bioplastic

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2/33

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Candidate's Seat No : _____

M.Sc. (Sem.-1) Examination

MIC 401

Diversity of Prokaryotic and Eukaryotic Microorganisms

Time : 2-30 Hours]

March 2019

[Max. Marks : 70

Q.1. (A) Discuss culturable and non-culturable approaches used to study microbial diversity and write their limitations. 14

OR

Q.1. (A) (i) Describe the concepts of metagenomics and give its significance. 07

(ii) Discuss strategies used for conservation of microbial diversity with examples. 07

Q.1. (B) Write 1-2 line answers to any four of the following 04

(i) Write two examples of chemolithoheterotrophs.

(ii) What is metabolic diversity?

(iii) Explain phylogenetic diversity.

(iv) What do you mean by species richness and evenness?

(v) What is 'biodiversity hotspot'?

(vi) Write the major difference between alpha diversity and beta diversity.

Q.2. (A) Discuss in detail the characteristic features and their applications of various groups of bacteria according to 2nd edition of Bergey's Manual of Systematic Bacteriology. 14

OR

Q.2. (A) (i) Describe occurrence, diversity and characteristics of actinomycetes. 07

(ii) Give a detail account on diversity of cyanobacteria and write its applications. 07

Q.2. (B) Write 1-2 line answers to any four of the following 04

(i) Write hierarchical ranks of bacteria from domain to species.

(ii) What is the basis of bacterial classification according to 1st and 2nd edition of Bergey's Manual of Systematic Bacteriology?

(iii) What is the difference between Bergey's Manual of Systematic Bacteriology and Bergey's Manual of Determinative Bacteriology?

(iv) Why actinomycetes are considered a transitional group between bacteria and fungi?

(v) What are thylakoids?

(vi) Explain – carboxysomes.

Q.3. (A) Write an essay on classification, properties, structure, reproduction and application of Ascomycetes. 14

OR

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- Q.3. (A) (i) Discuss types and applications of mycorrhiza. 07
(ii) Describe structure of yeast and write its industrial significance. 07
- Q.3. (B) Write 1-2 line answers to any three of the following 03
(i) Draw life cycle of basidiomycetes.
(ii) Explain – parasexuality
(iii) What do you mean by dikaryotic mycelium?
(iv) What is 'Pasteur effect' with reference to yeast?
(v) What is the major difference between 'baking' and 'brewing' yeasts?
- Q.4. (A) Discuss diversity, characteristics and applications of Archaea. Also write the difference between bacteria and archaea. 14
- OR**
- Q.4. (A) (i) Describe molecular and biochemical adaptation for survival found in thermophiles. 07
(ii) Discuss survival and adaptation mechanisms seen in acidophiles and write applications of acidophiles. 07
- Q.4. (B) Write 1-2 line answers to any three of the following 03
(i) What is the difference between halophilic and halotolerant bacteria?
(ii) Give name of two alkaliphilic bacteria with their optimum growth pH.
(iii) What is ARMAN
(iv) What is LUCA?
(v) What are compatible solutes?

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M.Sc. (Sem.-1) Examination

401 (New)

Mathematics

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

Instructions: All questions are compulsory. Normal Probability distribution tables are provided. Use of non-programmable scientific calculator is allowed

Q.1]

A] Attempt the following:

[14]

(i) State (only) the Bayes' theorem.

An insurance company believes that people can be divided into two classes: those who are accident prone and those who are not. Their statistics show that an accident-prone person will have an accident at some time within a fixed 1-year period with probability 0.4, whereas this probability is 0.2 for a non accident-prone person. If we assume that 30 percent of the population is accident prone,

(a) what is the probability that a new policyholder will have an accident within a year of purchasing a policy?

(b) Suppose that a new policyholder has an accident within a year of purchasing a policy. What is the probability that he or she is accident prone?

(ii) State and prove the Chebyshev's inequality. State its usefulness.

Given mean and standard deviation as 8 and 1.5 respectively and the shape of the distribution unknown, determine an interval such that the probability is at least $\frac{8}{9}$ that an observation will fall within that interval.

OR

(i) Determine the CDF for the random variable having the PDF $f(x) = 2\beta x e^{-\beta x^2}$, $x > 0$, where β is a positive constant. Hence derive the PDF of $Y = X^2$ if X has the above distribution.

(ii) A petrol pump is supplied with petrol once a day. If its daily volume X of sales in thousands of litres is distributed by $f(x) = 5(1-x)^4$, $0 \leq x \leq 1$

What must be the capacity of its tank in order that the probability that its supply will be exhausted in a given day shall be 0.01 (Use $\sqrt[5]{0.01} = 0.3981$)

B] Answer very briefly any FOUR:

[4]

- (i) Define the moment-generating function of the probability distribution of a random variable X .
- (ii) When sampling without replacement, the probability of obtaining a certain sample is best given by which probability distribution function?
- (iii) In the textile industry, a manufacturer is interested in the number of flaws occurring in each 100 feet of material. Which is the probability distribution that has the greatest chance of applying to this situation?
- (iv) If you are conducting an experiment where the probability of a success is .02 and you are interested in the probability of 4 successes in 15 trials, which is the most correct probability function to use?

- (v) Assume you have applied for two jobs A and B. The probability that you get an offer for job A is 0.23. The probability of being offered job B is 0.19. The probability of getting at least one of the jobs is 0.38. What is the probability that you will be offered both jobs?
- (vi) Assume you have applied for two jobs A and B. The probability that you get an offer for job A is 0.23. The probability of being offered job B is 0.19. The probability of getting at least one of the jobs is 0.38. Are events A and B mutually exclusive?

Q.2]

A] Attempt the following:

[14]

- (i) Find the distribution function associated with the pdf

$$f_X(x) = \frac{x}{t^2} e^{-x^2/2t^2}, t > 0, x \geq 0$$

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

Consider the probability density function, $g_X(x) = k \cdot \sin x$, $0 \leq x \leq \pi/2$. Find the appropriate value of k . Find the mean of the distribution.

- (ii) A random variable X has the pdf

$$f_X(x) = e^{-x}, x > 0$$

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

Develop the density function for $Y=2X^2$, $V=X^{1/2}$, $U=\ln X$

OR

- (i) If X is a continuous random variable with probability density function f_X that satisfies $f_X(x) > 0$ for $a < x < b$, and if $y = H(x)$ is a continuous strictly increasing or strictly decreasing function of x , then show that the random variable $Y = H(X)$ has density function

$$f_Y(y) = f_X(x) \cdot \left| \frac{dx}{dy} \right|$$

with $x = H^{-1}(y)$ expressed in terms of y .

Suppose that the random variable X has the following density function

$$f_X(x) = \frac{x}{8} \quad 0 \leq x \leq 4$$

$$= 0 \quad \text{otherwise}$$

For the random variable $Y = H(X)$ where $H(x) = 2x + 8$, find the probability density function f_Y of Y

- (ii) The probability density function of the random variables $[X_1, X_2]$ is given by

$$f(x_1, x_2) = \frac{k}{1000}, 0 \leq x_1 \leq 100, 0 \leq x_2 \leq 10$$

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

Find the appropriate value of k , marginal densities of X_1 and X_2 and the expression for the cumulative distribution function $F(x_1, x_2)$

B] Answer very briefly any FOUR:

[4]

- (i) Which are the distributions having the memoryless property?
- (ii) Write the probability mass function of the Pascal distributed random variable X . Write its mean and SD
- (iii) If a random variable X has a mean of 3 and standard deviation of 2. Calculate $E(2X-4)$, $\text{Var}(3X+2)$.

- (iv) An electric component is known to have a useful life represented by an exponential density with mean failure rate of 10^{-5} failures per hour. Find the percentage of such components that would fail before the mean life.
- (v) Find the marginal of X_1 if the joint density of $[X_1, X_2]$ is given by

$$f(x_1, x_2) = \begin{cases} 6x_1 & 0 < x_1 < x_2 < 1 \\ 0 & \text{otherwise} \end{cases}$$

- (vi) Find the marginal of X_2 if the joint density of $[X_1, X_2]$ is given by

$$f(x_1, x_2) = \begin{cases} 6x_1 & 0 < x_1 < x_2 < 1 \\ 0 & \text{otherwise} \end{cases}$$

Q.3]

A] Attempt the following:

[14]

- (i) State the pdf of a Poisson distribution. State its application. In standard notation, develop the Poisson distribution as a limiting form of the Binomial distribution.
- (ii) A telephone switch board receives 20 calls on an average during an hour. Find the probability that during a period of 5 minutes (a) no call is received, (b) exactly 3 calls received and (c) more than 5 calls are received. Assume that the time is measured in minutes.

OR

- (i) For a random variable that follows the binomial distribution, find the first and the second moments about the origin and the second central moment. For a random variable that follows the gamma distribution, find the first and the second moments about the origin.
- (ii) Write the pdf of the Weibull distribution. State its various parameters. State its one important area of application.
The diameter of steel shafts is Weibull distributed with parameters $\gamma=1.0$ inches, $\beta=2$, and $\delta=0.5$. Find the probability that a randomly selected shaft will not exceed 1.5 inches in diameter.

B] Answer very briefly any **THREE**:

[3]

- (i) The driving time for an individual from his home to his work is uniformly distributed between 300 to 480 seconds. Compute the probability that the driving time will be less than or equal to 435 seconds.
- (ii) The driving time for an individual from his home to his work is uniformly distributed between 300 to 480 seconds. Determine the expected driving time.
- (iii) The driving time for an individual from his home to his work is uniformly distributed between 300 to 480 seconds. Determine the variance and compute the standard deviation.
- (iv) State the pdf of a binomial distribution
- (v) State the pdf of a hypergeometric distribution.

Q.4]

A] Attempt the following:

[14]

- (i) Derive the mean and variance of both the uniform and exponential distributions.
 (ii) State the pdf of Gamma distribution. State its mean and variance.

A redundant system operates with three units. Initially unit 1 is on line, while unit 2 and unit 3 are on standby. When unit 1 fails, the unit 2 is switched on until it fails and then unit 3 is switched on. The system life is represented as the sum of the subsystem lives. If the subsystem lives are independent of one another, and if the subsystems each have a life X_j , $j=1,2,3$, having density $g(x) = \frac{1}{100} e^{-x/100}$, $x \geq 0$, then derive the reliability function of the total system.

OR

- (i) Explain the reproductive property of the Normal Distribution.

An assembly consists of three linkage components X_1 , X_2 and X_3 in series. Let $Y=X_1+X_2+X_3$.

The properties of X_1 , X_2 and X_3 are given below, with means in centimetres and variance in square centimetres.

$$X_1 \sim N(12, 0.02)$$

$$X_2 \sim N(24, 0.03)$$

$$X_3 \sim N(18, 0.04)$$

If X_1 , X_2 and X_3 are independent, determine $P(53.8 \leq Y \leq 54.2)$

- (ii)
- X_1, X_2, X_3
- and
- X_4
- are independent random variables. Let
- $Y_1 = \ln X_1 \sim N(4, 1)$
- ,

$$Y_2 = \ln X_2 \sim N(3, 0.5), Y_3 = \ln X_3 \sim N(2, 0.4), Y_4 = \ln X_4 \sim N(1, 0.01).$$

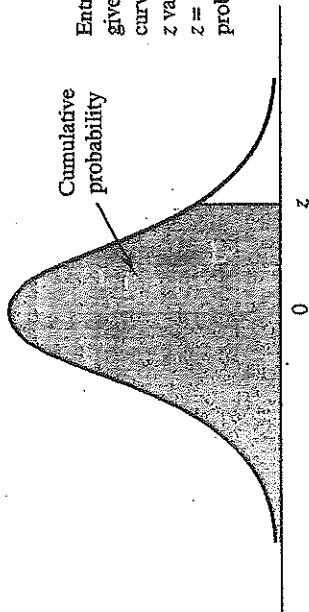
For $W = e^{1.5} [X_1^{2.5} X_2^{0.2} X_3^{0.7} X_4^{3.1}]$, find $P(20,000 \leq W \leq 600,000)$

B] Answer very briefly any **THREE**:

[3]

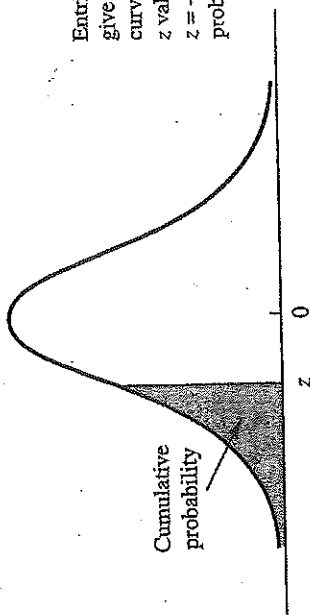
- (i) The salaries at a corporation are normally distributed with an average salary of Rs. 19,000 and a standard deviation of Rs. 4,000. What is the probability that an employee will have a salary between Rs. 12,520 and Rs. 13,480?
- (ii) The salaries at a corporation are normally distributed with an average salary of Rs. 19,000 and a standard deviation of Rs. 4,000. What is the probability that an employee will have a salary more than Rs. 11,880?
- (iii) The salaries at a corporation are normally distributed with an average salary of Rs. 19,000 and a standard deviation of Rs. 4,000. What is the probability that an employee will have a salary less than Rs. 28,440?
- (iv) State the Central Limit Theorem along with the necessary general conditions
- (v) 250 small parts are packaged in a crate. Part weights are independent random variables with a mean of 0.5 pound and a standard deviation of 0.10 pound. Twenty crates are loaded to a pallet. Find the mean and standard deviation of the total weight of the pallet.

TABLE 1 CUMULATIVE PROBABILITIES FOR THE STANDARD NORMAL DISTRIBUTION (Continued)



Entries in the table give the area under the curve to the left of the z value. For example, for $z = 1.25$, the cumulative probability is .8944.

TABLE 1 CUMULATIVE PROBABILITIES FOR THE STANDARD NORMAL DISTRIBUTION



Entries in the table give the area under the curve to the left of the z value. For example, for $z = -.85$, the cumulative probability is .1977.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
-2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
-2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
-2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
-2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
-2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
-2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
-2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
-2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
-2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
-2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
-1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
-1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
-1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
-1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
-1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
-1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
-1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
-1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
-1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
-1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
-0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
-0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
-0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
-0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
-0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
-0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
-0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
-0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
-0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
-0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990

M 898 - 1

M.Sc. (Sem.-1) Examination

STA 401

Matrix Algebra & Measure Theory

Time : 2-30 Hours]

March 2019

[Max. Marks : 70

Q-1(A) Write the following.

- (i) State important properties of determinant of a matrix. Prove any one of them. 07
- (ii) State and prove Laplace method of expansion for the determinant of a square matrix A of order n. 07

OR

- (i) If A: $m \times n$ and B: $n \times m$ are two rectangular matrices with $m < n$, then in usual notations obtain $|AB|$. 07
- (ii) In the elements of a row (or column) of a matrix $A = (a_{ij})$, a linear combination of the corresponding elements of remaining rows (or column) is added, the value of the determinant of resulting matrix remains unchanged. 07

Q-1(B) Answer the following questions. (Any four)

04

- (i) Define permutation of 'n' natural numbers.
- (ii) Obtain sign of permutation $P_1 = (2, 1, 5, 6, 4, 3)$.
- (iii) What is determinant of a matrix?
- (iv) If $A = \begin{bmatrix} 2 & 2 \\ 5 & 1 \end{bmatrix}$ then obtain A^{-1} and write $|A^{-1}|$.
- (v) "If $M=AA'$, then $|M| \geq 0$ if $m \leq n$ ", state whether this statement is true or false?

- (vi) Obtain rank of the matrix $\begin{pmatrix} 1 & 3 & 5 \\ 2 & 6 & 11 \\ 3 & 9 & 15 \end{pmatrix}$.

Q-2(A) Write the following.

- (i) Let L: $n \times n$ be a nonsingular matrix and M: $n \times r$ and N: $r \times n$ be two matrices such that $P = L + MN$ is a nonsingular matrix. Show that $P^{-1} = L^{-1} - L^{-1}M(I_r + NL^{-1}M)^{-1}NL^{-1}$. Hence obtain inverse of the matrix $P = (P_{ij})$ where $P_{ij} = 5$ for $i \neq j$, $P_{ii} = 7$; $i, j = 1, 2, \dots, n$. 07

(ii) If $P = \begin{bmatrix} A & B \\ C & D \end{bmatrix}$ is a nonsingular matrix such that A is a nonsingular matrix then
Obtain $|P|$ and P^{-1} . 07

OR

(i) For any matrix $A: m \times n$, if $\rho(A) = r$, then show that there exists two matrices $M: m \times r$ and $N: r \times n$ such that (i) $A = MN$ and (ii) $\rho(A) = \rho(M) = \rho(N) = r$. 07

(ii) State important properties of Idempotent matrix. For any square matrix H ; show that $\rho(H(I - H)) = \rho(H) + \rho(I - H) - n$. Further, show that H is an Idempotent matrix if and only if $\rho(H) + \rho(I - H) = n$. 07

Q-2(B) Answer the following questions. (Any four) 04

- (i) Define rank of a matrix in terms of minors of a matrix.
- (ii) Define Idempotent matrix. Give an example of an Idempotent matrix except identity matrix.
- (iii) Let $X: m \times n$ be a matrix with $m \leq n$. If all the m rows of X are linearly independent then, how many columns of X are linearly independent?
- (iv) For a rectangular matrix $A: m \times n$, when columns of A are linearly dependent?
- (v) Write the Statement of the Frobenius theorem on rank of a matrix.
- (vi) Write an example of skew-Hermitian matrix of order three.

Q- 3(A) Write the following.

- (i) Define system of homogeneous and non-homogeneous linear equations. When the system of linear equations $A\underline{x} = \underline{b}$ has a solution? Derive the condition for $A\underline{x} = \underline{0}$ to have a non-trivial solution. 07
- (ii) Define g- inverse of a matrix? Write the general form of g-inverse. How would you obtain g- inverse of any matrix $A: m \times n$? 07

OR

- (i) State and prove N-S conditions for the existence of g-inverse. Write important results regarding g-inverse. 07
- (ii) Define reflexive g-inverse of a matrix A . In usual notations show that $B = Q\Delta^{-1}P$ is a reflexive g-inverse of the matrix A . 07

Q-3(B) Answer the following questions. (Any three) 03

- (i) Solve the system of equations
- $$\begin{aligned} 2x_1 + 3x_2 &= 8 \\ 3x_1 - 3x_2 &= 2 \end{aligned}$$

M 809-3

- (ii) "A system of linear homogeneous equations $A\underline{x} = \underline{0}$ has a non-trivial solution iff A is a singular matrix", state whether this statement is true or false? Justify your answer.
- (iii) Why M-P g-inverse is unique?
- (iv) Why we define g- inverse?
- (v) Write an example of an idempotent matrix of order two. (except identity matrix)

Q- 4(A) Write the following.

- (i) Define field and sigma-field. Give an example of a class which is a field but not a sigma-field. 07
- (ii) Write important properties of measure. Prove any one of them. 07
OR
- (i) State and prove Continuity Theorem on measure μ . 07
- (ii) Define Outer measure μ^* . Given a measure μ how you will construct an Outer measure μ^* ? Explain with proper example. 07

Q-4 (B) Answer the following questions. (Any three) 03

- (i) Define a set function. Give an example of a set function.
- (ii) Define an Outer measurable set.
- (iii) Define ring. Give an example of a class ring.
- (iv) Define measure.
- (v) Define Monotone class.

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M 809-4

M.Sc. Sem-I, Examination, March-2019
STA401(Matrix Algebra)
(New Course)

Time: 2:30 Hours

Total Marks: 70

Q-1(A) Write the following.

- (i) State and prove Laplace method of expansion for the determinant of a square matrix A of order n. 07
- (ii) If the elements of a row (or column) of a matrix $A = (a_{ij})$ can be obtained as a linear combination of the corresponding elements of remaining rows (or column) of A : n x n then $|A| = 0$. 07

OR

- (i) If A: mxn and B: nxm are two rectangular matrices with $m < n$, then in usual notations obtain $|AB|$. 07
- (ii) If any two rows (columns) of a square matrix are interchanged then determinant of the resulting matrix have same value but sign is different. 07

Q-1(B) Answer the following questions. (Any four) 04

- (i) Define permutation of 'n' natural numbers.
- (ii) Obtain sign of permutation $P_1 = (5, 3, 1, 2, 4, 6)$.
- (iii) Write characteristic equation of a square matrix of order n.
- (iv) If $A = \begin{bmatrix} 3 & 2 \\ 5 & 5 \end{bmatrix}$ then obtain A^{-1} and write $|A^{-1}|$.
- (v) A square matrix of order five has how many principal minors of order three?

- (vi) Obtain rank of the matrix $\begin{pmatrix} 1 & 3 & 5 \\ 2 & 6 & 10 \\ 3 & 9 & 15 \end{pmatrix}$.

Q-2(A) Write the following.

- (i) Let L:nxn be a nonsingular matrix and M:nxr and N:rxn be two matrices such that $P = L + MN$ is a nonsingular matrix. Show that $P^{-1} = L^{-1} - L^{-1}M(I_r + NL^{-1}M)^{-1}NL^{-1}$. Hence obtain inverse of the matrix $P = (P_{ij})$ where $P_{ij} = \lambda$ for $i \neq j$, $P_{ii} = r$; $i, j = 1, 2, \dots, n$. 07

- (ii) If $P = \begin{bmatrix} A & B \\ C & D \end{bmatrix}$ is a nonsingular matrix such that D is a nonsingular matrix then
Obtain $|P|$ and P^{-1} . 07

OR

- (i) For any two matrices $A: m \times n$ and $B: n \times p$ show that 07
 $\rho(AB) = \rho(A^*AB) = \rho(ABB^*) = \rho(A^*ABB^*) = \rho(ABB^*A^*) = \rho(B^*A^*AB)$

- (ii) State and prove Frobenius Theorem on rank of a matrix. 07

Q-2(B) Answer the following questions. (Any four) 04

- (i) Define rank of a matrix in terms of minors of a matrix.
(ii) Give an example of an Idempotent matrix of order three. (except identity matrix).
(iii) Let $X: m \times n$ be a matrix with $m \leq n$. If all the m rows of X are linearly independent then, how many columns of X are linearly dependent?
(iv) If $A: m \times n$ be a rectangular matrix then, when rows of A are linearly dependent?
(v) Write any two properties of an idempotent matrix.
(vi) Give an example of skew symmetric matrix of order three. Write determinant of the matrix you have written.

Q- 3(A) Write the following.

- (i) Define system of homogeneous and non-homogeneous linear equations. When the system of linear equations $A\underline{x} = \underline{b}$ has a solution? Derive the condition for $A\underline{x} = \underline{0}$ to have a non-trivial solution. 07
(ii) Define g-inverse of a matrix in two ways and establish their equivalence. Show that g-inverse of a matrix is not unique. 07

OR

- (i) Define reflexive g-inverse of a matrix A . In usual notations show that $B = Q\Delta^{-1}P$ is a reflexive g-inverse of the matrix A . 07
(ii) State and prove N-S conditions for the existence of g-inverse. Write important results regarding g-inverse. 07

Q-3(B) Answer the following questions. (Any three) 03

- (i) Solve the system of equations $2x_1 + 3x_2 = 8$
 $4x_1 + 6x_2 = 16$
(ii) When a system of linear homogeneous equations $A\underline{x} = \underline{0}$ has a non-trivial solution?
(iii) Which g-inverse is unique? Why?
(iv) Write any two applications of g-inverse.

(v) Give an example of an idempotent matrix of order three. Write its characteristic roots.

Q- 4(A) Write the following.

(i) Show that every characteristic root of a real skew symmetric matrix is either zero or purely imaginary number. Hence or otherwise, show that any real skew symmetric matrix of order n is singular if and only if n is odd number. 07

(ii) Show that the number of nonzero characteristic roots of a square matrix A of order n is same as $\rho(A)$ if and only if $\rho(A) = \rho(A^2)$. 07

OR

(i) State different types of Quadratic forms. State and prove the N-S condition for a Quadratic form to be positive definite. 07

(ii) Show that if A and B are two symmetric matrices such that the roots of the equation $|A - \lambda B| = 0$ are all distinct, then there exists a matrix P such that $P^t A P$ and $P^t B P$ are both diagonal matrices. 07

Q-4 (B) Answer the following questions. (Any three) 03

(i) Define characteristic roots and characteristic vectors of a matrix.

(ii) Define Hermitian forms.

(iii) If $Q = \underline{x}' A \underline{x} = 15x^2 + y^2 + 12xy$, then write differentiation of Q with respect to vector \underline{x} .

(iv) Obtain characteristic roots and characteristic vectors of the matrix $A = \text{diag}(3, 7)$.

(v) If A and B are p.s.d. and p.d. matrices respectively then what are the greatest lower bound and the least upper bound of $\phi(\underline{x}) = (\underline{x}' A \underline{x}) / (\underline{x}' B \underline{x})$.

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M.Sc. (Sem.-1) Examination

BMT 401

Instrumentation and Methodology

Time : 2-30 Hours]

March 2019

[Max. Marks : 70

NB: All questions are compulsory. Illustrate your answers with neat diagrams wherever necessary.			
Q-1	(A)	Answer the following	
	(i)	Briefly describe glandular epithelium.	07
	(ii)	Give a brief description of connective tissues.	07
		OR	
	(i)	Give an account of construction of Bright Field Microscope.	07
	(ii)	Explain the principle and instrumentation of DIC microscope.	07
	(B)	MCQ / SQ (Any Four out of Six)	04
	(i)	What is dekenkerization?	
	(ii)	What is transitional epithelium? Give an example.	
	(iii)	What is tissue embedding?	
	(iv)	Discuss critical Illumination.	
	(v)	Explain role of vernier scale used for specimen Holder in Stage of Microscope.	
	(vi)	Define resolution in Microscope.	
Q-2	(A)	Answer the following	
	(i)	Chemical composition of mitochondrial inner membrane.	07
	(ii)	Write about plasma membrane fluidity and mobility.	07
		OR	
	(i)	What is GERL system? Write a short note on it.	07
	(ii)	Write about the factors affecting assembling and disassembling of microtubules.	07
	(B)	MCQ / SQ (Any Four out of Six)	04
	(i)	What is the importance of Cytochalasin-B in visualization of cytoskeleton?	
	(ii)	Give full form of CDK and SMC cell cycle regulation protein.	
	(iii)	What is Glycocalyx?	
	(iv)	Give functional significance of endocytosis.	
	(v)	Give two differences between arrangement of DNA in prokaryotic and eukaryotic cells.	
	(vi)	A typical mammalian cell contains how many stacks of cisternae?	
Q-3	(A)	Write the following	
	(i)	Discuss types of columns used in GC.	07
	(ii)	Explain thin layer chromatography.	07
		OR	
	(i)	Write a brief note on paper chromatography.	07
	(ii)	Discuss the principle and working of HPLC.	07
	(B)	MCQ / SQ (Any Three out of Five)	03
	(i)	What is capacity factor?	
	(ii)	Difference between adsorption and partition chromatography.	
	(iii)	Write down the Van Deemter equation.	
	(iv)	Define pH.	
	(v)	Define resolution in chromatography.	
Q-4	(A)	Write the following	
	(i)	Write a note on various types of centrifuges.	07
	(ii)	Write a note on myography.	07
		OR	
	(i)	Explain application of Sonography.	07
	(ii)	Write a note on uses of SDS-PAGE.	07
	(B)	MCQ / SQ (Any Three out of Five)	03
	(i)	What is g in centrifugation?	
	(ii)	What is the use of ammonium per sulphate in PAGE?	
	(iii)	How gradient is created in the centrifugation?	
	(iv)	What is Encephalography?	
	(v)	What is the principle of isoelectric focusing?	

2/33

0503M811

Candidate's Seat No : _____

M.Sc. (Sem.-1) Examination

BT 401

Cellular Microbiology

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

- Q : 1 (A) Describe in detail Gram positive and Gram negative bacterial cell wall. 14
OR
(A) 1. Explain the cytoplasmic membrane and its importance in bacteria. 07
2. Discuss the size, shape and arrangement of various prokaryotic cells. 07
(B) Give answers in brief (any four). 04
1. Bacterial endospore
2. Nucleoid
3. Why lipopolysaccharide is often called 'endotoxin'?
4. Which is the principle component of bacterial capsule?
5. Periplasmic space
6. Bacterial pili
- Q : 2 (A) Enlist the methods for isolation of bacteria and describe any four. 14
OR
(A) 1. Discuss the common ingredients of bacteriological media. 07
2. Describe the use of high temperature for bacterial control. 07
(B) Give answers in brief (any four). 04
1. Magnification
2. Dark field microscope
3. Selective medium
4. Numerical aperture
5. Range of visible spectrum of radiation
6. Pasteurization
- Q : 3 (A) Draw a typical eukaryotic cell and briefly describe types of eukaryotic cells. 14
OR
(A) 1. Discuss the modes of locomotion in eukaryotes. 07
2. Describe the structure and function of nucleus. 07
(B) Give answers in brief (any three). 03
1. Difference between primary and secondary lysosome
2. Chromatin fibres
3. Name two bacteria having monotrichous flagella
4. Function of Golgi bodies
5. Size of Eukaryotic ribosomes

(P. T. o)

Q : 4 (A) Discuss the important steps of isolation and identification of fungi from soil. 14

OR

(A) 1. Describe the general characteristics of protozoa. 07

2. Write a short note on 'fungal nutrition'. 07

(B) Give answers in brief (any three). 03

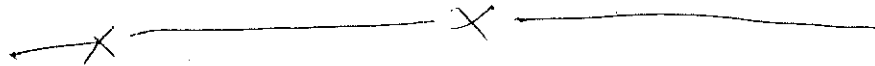
1. Clamp connection

2. Role of heterocyst in algae

3. Name two industrially important yeast

4. Saprophytes

5. Give the two examples of antibiotics produced by fungi



2/33

0503M812

Candidate's Seat No : _____

M.Sc. (Sem.-1) Examination

ELE 401 (Old-New)

Elements of Solid State Physics and Semiconductor Devices

Time : 2-30 Hours]

March 2019

[Max. Marks : 70

Instructions: [1] Symbols have their usual meanings

Q.1(a) i. Discuss nearly free electron model using allowed energy values are distributed essentially continuously from 0 to ∞ $\varepsilon_k = \frac{\hbar^2}{2m} [k_x^2 + k_y^2 + k_z^2]$ 07

ii. State the Bloch function and explain origin of the energy gap in detail. 07

OR

i. Discuss the solution of the central equation in detail. 07

ii. Write short note on Kronig-Penney model. 07

Q.1(b) Write short answer (Any Four) 04

1. Define 1st Brillouin zone.
2. How many independent orbitals associated in each energy bands?
3. Write the expectation values of the potential energy over which three charge distribution.
4. Differentiate between metal, semimetal, semiconductor and insulators.
5. What do you mean by reciprocal lattice?
6. Define Forbidden gap.

Q.2(a) i. Define superconductor and explain Meissner effect in detail. 07

ii. Write short note on thermodynamics of superconducting transition. 07

OR

i. Discuss coherence length in detail. 07

ii. Explain single particle tunneling and state the difference between type-I and type-II superconductors. 07

Q.2(b) Write short answer (Any Four) 04

1. Superconductivity occurs in metals with periodic system, alloys, intermetallic compounds and doped semiconductors. [TRUE/FALSE]
2. Who invented Meissner effect and when?
3. In all superconductors the entropy increases markedly on cooling below critical temperature T_c .
4. _____ method the heat capacity is measured as a function of temperature for the superconductor.
5. State the London equation.
6. What do you mean by DC Josephson effect?

Q.3(a) i. Discuss Gummel – Poon model in detail. 07

ii. Explain transit time effect in detail. 07

OR

i. Discuss Switching and Cut-off phenomenon in case of BJT. 07

ii. Discuss Kirk-Effect. 07

Dr. T. D.

M 8/2-2

- Q.3(b) Write Short Answers [Any Three] 03
1. In case of BJT emitter doping is _____ than base doping to ensure the high current gain.
 2. State the four biasing modes of BJT.
 3. What do you mean by saturation of BJT?
 4. Transit time of carriers is large in base of BJT, then efficiency of BJT is high or low. {Make Comment}
 5. In the CB-configuration the cut-off mode occurs when emitter current becomes infinity. [TRUE/FALSE]
- Q.4(a) i. Name the different types of p-n junction and explain rectifying contact in detail. 07
- ii. Discuss diffusion and ion implantation for the fabrication of p-n junction. 07
- OR
- i. Explain structure of MOSFET. 07
- ii. Discuss I-V characteristics of JFET. 07
- Q.4(b) Write Short Answer [Any Three] 03
1. What do you mean by RTP?
 2. Sketch the symbol of CMOS.
 3. How gate can be isolate in the MOSFET?
 4. In MESFET, The device is ohmic regime and then writes equation of transconductance.
 5. Write full form of MESFET.
-

Instructions:

All questions are compulsory.

Illustrate your answers with neat diagrams wherever necessary.

- 1 (A) Answer in Detail:**
- i) What is Lineweaver-Burk Plot? Discuss in details. [07]
- ii) Discuss Second Law of Thermodynamics and its applications. [07]
- OR
- i) Discuss Michaelis-Menten equation at very high and low substrate concentration. [07]
- ii) Define Free Energy and discuss its applications in Bioenergetics. [07]
- 1 (B) Answer in Short: (Any Three) [03]**
- i) Write limitations of Michaelis-Menten equation.
- ii) Define: Enthalpy
- iii) What is Cofactor?
- iv) What is Thermal Energy?
- v) Explain Km (Michaelis Constant).
- 2 (A) Answer in Detail:**
- i) Give a detailed account on Stereochemistry of Monosaccharides. Add biological significance of Monosachharides. [07]
- ii) Outline detailed Classification of Lipids. Add a note on their Physical properties. [07]
- OR
- i) Write a note on Classification of Polysaccharides. Elucidate their biological functions. [07]
- ii) Discuss various Sphingolipids with their significance in biological systems. [07]
- 2 (B) Answer in Short: (Any Four) [04]**
- i) Define: Epimer
- ii) Explain: Oligosaccharides
- iii) What are Enantiomers?
- iv) Give any two examples of Phospholipids.
- v) Draw the Structure of Cholesterol.
- vi) Name any two Sphingolipid Storage Diseases.
- 3 (A) Answer in Detail:**
- i) Describe Quaternary Level of Protein organization with special emphasis on Haemoglobin structure. [07]
- ii) Give a detailed account on various Components of Nucleic Acids. Add biological significance of nucleotides. [07]
- OR
- i) Outline Classification of Amino Acids proposed by West and Todd in detail. Add a brief note on Lehninger's classification of amino acids. [07]
- ii) Discuss various points of differences amongst properties of A-DNA, B-DNA and Z-DNA. [07]

- 3 (B) Answer in Short: (Any Three) [03]**
- i) Explain: Isoelectric pH
 - ii) Define: Amphoterism
 - iii) Enlist various Chemical Denaturing Agents for proteins.
 - iv) Explain: DNA Hyperchromism
 - v) Mention any two Chemical properties of DNA and RNA.

- 4 (A) Answer in Detail:**
- i) Discuss Alcoholic and Lactate fermentation of Glucose. [07]
 - ii) Describe sequential steps of Uric Acid Degradation with appropriate biochemical reactions. [07]

OR

- i) Explain the regulation of β -Oxidation of Fatty acids. [07]
 - ii) Discuss Urea Cycle in detail. Mention its relation with TCA Cycle. [07]
- 4 (B) Answer in Short: (Any Four) [04]**
- i) Why fatty acid activation occurs before β -Oxidation?
 - ii) What is Cori Cycle?
 - iii) Write name of regulatory enzymes of Gluconeogenesis.
 - iv) Give the examples of Branched Chain Amino Acids (BCAA).
 - v) Name key enzymes involved in regulation of Pyrimidine Biosynthesis.
 - vi) Distinguish between Uricotelic and Ureotelic organisms.

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M.Sc. (Sem.-1) Examination

402

Physics Paper

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

Instruction : (1) Attempt all questions
(2) Symbols used have their usual meanings

- Question 1 (A) Write the following
- (i) When is Hamilton-Jacobi theory more useful? Discuss the harmonic oscillator problem using Hamilton-Jacobi method. 07
- (ii) Discuss how the problem of motion of a body in a central force field is separable in polar coordinates but not in cartesian coordinates. 07
- OR**
- (i) Prove that the Poisson brackets of two constants of motion is itself a constant of motion even when the constants depend upon time explicitly. 07
- (ii) What are the action and angle variables? Sketch how such variables can be used to obtain the frequencies of a periodic motion. 07
- Question 1 (B) Answer in brief (Any Four out of Six) 04
- (i) In which field, the Lagrangian theory is found more suitable? Why?
- (ii) Define: canonical transformation.
- (iii) Find out the value of $[q_j, q_k]$.
- (iv) What will be the unit of new Hamiltonian K in SI unit system?
- (v) Show that $Q = \log\left(\frac{1}{q} \sin p\right)$ and $P = q \cot p$ are canonical.
- (vi) If $G(q, p)$ is a constant of motion, then $[H, G] =$ _____.
- Question 2 (A) Write the following
- (i) Obtain Lagrangian equation of motion of fixed vibrating string of length L at both ends and also discuss how frequencies of different mode of oscillations can be found. 07
- (ii) Deduce the eigen value equation for small oscillations. Obtain eigen values and eigen vectors from it. 07
- OR**
- (i) For triatomic molecule, find out three frequencies of oscillations and eigen vectors. 07
- (ii) What are normal coordinates? Obtain kinetic energy and potential energy in terms of normal coordinates and find out Lagrangian equation of motion. 07
- Question 2 (B) Answer in brief (Any Four out of Six) 04
- (i) Give dimensions of the action and angle variables.
- (ii) What is an equilibrium system in case of coupled oscillator?
- (iii) What is a degeneracy?
- (iv) What are coupled oscillators?

- (v) What do you mean by stable equilibrium?
 (vi) What do you understand by normal modes in relation to coupled oscillators?
- Question 3 (A) Answer the following
- (i) Prove that Brownian motion is random and irreversible. 07
 (ii) Explain Nyquist theorem. 07
- OR**
- (i) Using suitable example, explain Wiener-Khinchin theorem. 07
 (ii) Define shot noise and derive an expression for shot noise current. 07
- Question 3 (B) Answer in brief (Any Three out of Five) 03
- (i) Give the unit of \sqrt{Dt} (D = diffusivity and t = time)
 (ii) Define power spectrum of time dependent fluctuations.
 (iii) Define Johnson noise.
 (iv) State any two applications of Wiener-Khinchin theorem.
 (v) Under which conditions the Brownian motion is reversible?
- Question 4 (A) Answer the following
- (i) With suitable example, discuss the 1st order phase transition. 07
 (ii) Discuss the Bragg-William approximation for magnetic phase transition in solids. 07
- OR**
- (i) With suitable example, discuss the 2nd order phase transition. 07
 (ii) Explain critical indices and their importance in phase transition. 07
- Question 4 (B) Answer in brief (Any Three out of Five) 03
- (i) Plot a graph of molar volume versus temperature in first order phase transition
 (ii) Plot a graph of specific heat versus temperature in second order phase transition
 (iii) Differentiate between first order and second order phase transition.
 (iv) Define statistical equilibrium.
 (v) Write Griffith's inequality of critical exponents.
-

M.Sc. (Sem.-1) Examination

402

Botany Paper-II

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

Q-1 A. Describe characteristics of Anthocerotales, Funariales, Polytrichales and Sphagnales. 14

OR

Q-1 A (i) Describe biomapping and biomonitoring using bryophytes. 07

Q-1 A (ii) Describe Economic and Ecological significance of bryophytes. 07

Q-1 B Short Questions. (Answer in one or two lines) (Any Four) 04

1. What is homologous theory about evolution of bryophytes?
2. Which are the main group of bryophytes?
3. What are the main characteristics of bryophytes?
4. Name any two parasitic bryophytes.
5. Give occurrence of bryophytes.
6. Give occurrence of Sphagnum. Give names of its different species.

Q-2A Describe the evolution of stele. 14

OR

Q-2A (i) Describe the origin and development of Heterospory. 07

Q-2A (ii) Describe Telome theory. 07

Q-2B Short Questions. (Answer in one or two lines) (Any Four) 04

1. What type of life cycle is followed by pteridophytes?
2. What is the prothallus of pteridophytes?
3. Write down three general characters of pteridophytes.
4. Give occurrence of pteridophytes.
5. Write down two general characters of Lycophyta.
6. Write down ecological importance of pteridophytes.

Q-3A Describe Classification by Coulter and Chamberlain. 14

OR

Q-3A (i) Describe male gametophyte of gymnosperms. 07

Q-3A (ii) Describe paleobotanical techniques. 07

Q-3B Short questions. (Answer in one or two lines) (Any Three) 03

1. What are the economic uses of gymnosperms?
2. Which type of life cycle is found in gymnosperms?
3. What is pteridospermales?
4. Where are the gymnosperms found?
5. What are the main characteristics of gymnosperms?

Q-4A Describe the evidences and theories of organic evolution. 14

OR

Q-4A (i) Describe molecular tools in phylogeny. 07

Q-4A (ii) Describe the evolution of secondary metabolism. 07

Q-4B Short questions. (Answer in one or two lines) (Any Three) 03

1. What is parallel evolution?
2. What is adaptive radiation?
3. Who wrote "Origin of Species"
4. Study of fossils is known as?
5. Explain genetic drift.

M.Sc. (Sem.-1) Examination

402

Microbiology

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

Instruction : Figures to right indicates full marks.

- 1 (a) Describe biosynthesis of fatty acids in E-Coli. 14
- OR**
- (a) (i) Write a detail note on glycoconjugates. 7
(ii) Give brief account of metabolism of c_1 compounds. 7
- (b) Answer in one or two line only (any four) : 4
- (i) define carbohydrates (iv) feeder pathways
(ii) What is proteoglycans? (v) methanotrophs
(iii) define glucogenogenesis (vi) palmitic acid.
- 2 (a) Describe biosynthesis and regulation of pyrimidine nucleotides. 14
- OR**
- (a) (i) Explain biosynthesis of histidine 7
(ii) Discuss ammonia assimilation in nitrogen metabolism. 7
- (b) Answer in brief (any four) : 4
- (i) PRPP (iv) diazotrophs
(ii) carbamoyl - (P) (v) Essential amino acids
(iii) heterocysts (vi) Nod factors and Nod regulators.
- 3 (a) Describe methods of enzymes purification. 14
- OR**
- (a) (i) Describe equilibrium and steady state assumption and derive the M M equation for steady state assumption 7
(ii) Explain various catalytic mechanisms for enzyme action. 7
- (b) Answer in one or two lines only (any three) : 3
- (i) peptide bond (iv) dialysis
(ii) protein denaturation (v) isoelectric focusing.
(iii) chaperonins
- 4 (a) Describe in detail the enzyme inhibition and its significance. 14
- OR**
- (a) (i) Enlist the methods of enzyme immobilization and describe any one method in detail. 7
(ii) What are allosteric enzymes? Describe their role in regulation of metabolic pathways. 7
- (b) Answer in brief (any three) : 3
- (i) What is uncompetitive inhibition? (iv) covalent bonding
(ii) enzyme carriers (v) catalytic antibodies.
(iii) ribozymes

1.(A)(i) Define the length $|G|$ of an open subset G [7]
of $[a, b]$. Define the length $|F|$ of a closed
subset F of $[a, b]$.

(ii) If $E \subset [a, b]$ and the outer measure $\bar{m} E = 0$, [7]
prove that E is measurable and the
measure $m E = 0$.

OR

(i) True or False? If F is a closed subset of [7]
 $[a, b]$ and $|F| = 0$, then $F = \phi$. (Give details).

(ii) If I_1 and I_2 are open subintervals of $[a, b]$, [7]
prove that $|I_1 \cup I_2| \leq |I_1| + |I_2|$.

(B) Do any four. [4]

(i) Let S be the subset of $[1, 7]$ given by
 $(2, 3) \cup (4, 5]$. Find the outer measure
of S . (Do not prove).

(ii) Let S be the subset of $[0, 20]$ given by
 $S = (3, 18]$. Find the inner measure of S ,
(Do not prove).

(iii) Find the length of the open set $\bigcup_{n=1}^{\infty} \left(\frac{1}{2^{2n+1}}, \frac{1}{2^{2n}} \right)$.

(iv) True or False? Every open subset of $[a, b]$
is measurable. (Do not prove).

(v) True or False? Every countable subset
of $[a, b]$ is measurable. (Do not prove).

(vi) Give an example of a set $E \subset [1, 2]$
such that $m E = \frac{1}{2}$.

2. (A)(i) Suppose E_1 and E_2 are measurable subsets of $[0, 1]$. Suppose $mE_1 > \frac{3}{4}$ and $mE_2 > \frac{3}{4}$. Show that $m(E_1 \cap E_2) > \frac{1}{2}$. [7]

(ii) Let $f(x) = \begin{cases} 0 & , 0 < x \leq \frac{1}{2} \\ 1 & , \frac{1}{2} < x \leq 1 \end{cases}$, [7]

Prove that f is measurable on $[0, 1]$.

OR

(i) If E_1 and E_2 are measurable subsets of $[0, 1]$ and if $mE_1 = 1$, prove that $m(E_1 \cap E_2) = mE_2$. [7]

(ii) Suppose that the function f on $[a, b]$ is measurable. Show that for every $s \in \mathbb{R}$, the set $\{x \mid f(x) \leq s\}$ is a measurable set. [7]

(B) Do any four. [4]

(i) True or False? The union of uncountably many open subsets of $[a, b]$ must be measurable. (Do not prove).

(ii) Give an example of an uncountable subset E of $[0, 1]$ such that E is measurable. (Do not prove).

(iii) Consider the subset $E_1 = (\frac{1}{2}, \frac{7}{8}]$ and $E_2 = (\frac{1}{4}, \frac{3}{4})$ of $[0, 1]$. Find the measure of the symmetric difference of E_1 and E_2 .

(iv) Let $S = \{x \in [0, 1] \mid x^3 > \frac{1}{8}\}$. Find mS .

(v) Let f be measurable on $[0, 2]$ and $g(x) = f(x) - 3$. Is g measurable?

(vi) Draw the graph of $\min(x, x^3)$, $x \in [0, 2]$.

3. (A) (i) Show that if f is a bounded measurable function on $[a, b]$, then f is Lebesgue integrable. [7]
- (ii) Suppose f is a non-negative bounded measurable function on $[a, b]$ and $\int_a^b f(x) dx = 0$. Show that $f(x) < \frac{1}{3}$ for almost all $x \in [a, b]$.

OR

- (i) Let f be defined on $[0, 2]$ by $f(x) = x$. [7]
 Let E_1 be the inverse image under f of $[0, \frac{1}{3}]$.
 Let E_2 be the inverse image under f of $[\frac{1}{3}, 1]$.
 Let E_3 be the inverse image under f of $[1, \frac{3}{2}]$.
 Let E_4 be the inverse image under f of $[\frac{3}{2}, 2]$.
 Show that $P = \{E_1, E_2, E_3, E_4\}$ is a measurable partition of $[0, 2]$. Calculate $U[f; P]$ and $L[f; P]$.
- (ii) Suppose that E_1 and E_2 are measurable subsets of $[a, b]$. Suppose $m(E_1 \cap E_2) = 0$. Suppose f is bounded measurable on $[a, b]$. Prove that
- $$\int_{E_1} f + \int_{E_2} f = \int_{E_1 \cup E_2} f$$

(B) Do any three. [3]

(i) Let $E \subset [0, 1]$ with $mE = \frac{1}{4}$. Find $\int_E 1$.(ii) Let $f(x) = x^2$, $x \in [0, 1]$. Let $E = (\frac{1}{2}, \frac{2}{3})$. Find $\int_E f$.(iii) Suppose E_1 and E_2 are measurable subsets of $[a, b]$, and f is a bounded function in $L[a, b]$.If $\int_{E_1} f = 2$, $\int_{E_2} f = 3$, $\int_{E_1 \cup E_2} f = 4$, find $\int_{E_1 \cap E_2} f$.(iv) Let $f(x) = \begin{cases} 1, & \text{if } x \text{ is rational} \\ 0, & \text{if } x \text{ is irrational} \end{cases}, x \in [0, 1]$.Find $\int_0^1 f$. (Do not prove).(v) Evaluate $\int_0^\pi \cos x dx$.

4. (A) (i) Let $f(x) = \frac{1}{x^{\frac{1}{2}}}$, $(0 < x \leq 1)$. [7]

Prove that $f \in L[0, 1]$.

Find the value of $\int_0^1 f$.

(ii) Suppose f is a non-negative valued measurable [7]
function on $[a, b]$, and $f(x) \leq g(x)$, $a \leq x \leq b$.
Suppose $g \in L[a, b]$. Prove that $f \in L[a, b]$.

OR

(i) State the Lebesgue Dominated Convergence [7]
Theorem. (Do not prove).

(ii) Let $f(x) = 3$, $x \in [0, 2]$. Find $\delta > 0$ [7]
so that $\int_E f < \frac{1}{2}$, whenever E is a
measurable subset of $[0, 2]$ with $mE < \delta$.

(B) Do any three. [3]

(i) If $f(x) = \frac{1}{x}$, $(0 < x \leq 1)$, find $\int_0^1 f$.

(ii) If $f(x) = \cos x$, $(0 \leq x \leq 2\pi)$, draw the
graph of f^+ .

(iii) True or False? If $f \in L[a, b]$, then
 $f^2 \in L[a, b]$. (Do not prove).

(iv) State (without proof) Fatou's Lemma.

(v) Let $f(x) = 2 \sin x$. Draw the graph
of the function $\int f$, $x \in [0, \pi]$.

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M.Sc. (Sem.-1) Examination

402

Statistics Paper-II (C/N)

Time : 2-30 Hours]

March 2019

[Max. Marks : 70

Q-1(A) Write the following.

(i) Show that probability measure p is monotonic and subtractive. 07(ii) Let $\{A_n\}$ be a monotonic sequence of events in sigma-field G , then show that

$$P\left(\lim_{n \rightarrow \infty} A_n\right) = \lim_{n \rightarrow \infty} P(A_n).$$

OR

(i) Let $\{A_n\}$ be a sequence of events in a probability space (X, G, p) , then show that

$$P\left(\bigcap_{i=1}^n A_i\right) \geq \sum_{i=1}^n P(A_i) - (n-1)..$$

(ii) Define distribution function of a random variable. State and prove its properties. 07

Q-1(B) Answer the following questions. (Any four) 04

- (i) Explain the difference between Mutually Exclusive events and Equally likely events.
(ii) State Bayes' theorem.
(iii) Explain the difference between pair wise independence and mutual independence.
(iv) If P_1 and P_2 are two probability measures, show that $P = \lambda P_1 + (1-\lambda)P_2$, $0 < \lambda < 1$ is also a probability measure.
(v) State whether the following function is a distribution function. If it is a distribution function states the type.

$$F(x) = \begin{cases} 0 & \text{if } x < 0 \\ 4/9 & \text{if } 0 \leq x < 1 \\ 8/9 & \text{if } 1 \leq x < 2 \\ 1 & \text{if } x \geq 2 \end{cases}$$

(vi) Define probability space.

Q-2(A) Write the following.

(i) State Markov Inequality. Use it to obtain Chebyshev's Inequality. 07

(ii) State and prove Jensen's Inequality. 07

OR

(i) State and prove Holder's Inequality. 07

(ii) For a sequence of absolute moments $\{\beta_k\}$ of a random variable X defined over a probability space

$$(X, G, p), \text{ show that } \beta_k^{1/k} \leq \beta_{k+1}^{1/(k+1)}, \text{ for } k = 1, 2, \dots$$

Q-2(B) Answer the following questions. (Any four) 04

- (i) Define conditional expectation.
- (ii) State Decomposition Theorem on distribution function.
- (iii) Let X be random variable and $Y = a + bX$ where a and b are constants. If $V(Y) = V(X)$ then what should the values of a and b ?
- (iv) If F is a distribution function of a continuous random variable X and if $a < b$, $P(X = a)$ and $P(X = b)$ are not zero, then $P(a < X \leq b)$?
- (v) For n events A_1, A_2, \dots, A_n in a probability space (X, G, p) , how many relations in probability must be satisfied for mutual Independence?
- (vi) Let X and Y have joint probability density

$$f(x, y) = \begin{cases} 2 & \text{for } 0 < x < 1, 0 < y < x \\ 0 & \text{other wise} \end{cases}$$

Are X and Y are independent random variables?

Q-3(A) Write the following.

- (i) Discuss various properties of a characteristic function. 07
- (ii) State and prove Borel Cantelli Lemmas. 07

OR

- (i) Define "convergence in probability" and "convergence in quadratic mean". Discuss their inter relationships. 07
- (ii) State and prove Kolmogorov's Inequality. 07

Q-3(B) Answer the following questions. (Any three) 03

- (i) Define almost sure convergence.
- (ii) State Inversion Theorem on characteristic function.
- (iii) State "Weak Compactness Theorem".
- (iv) State the difference between Weak Law of large numbers & Strong Law of large numbers.
- (v) State Cauchy Schwartz Inequality.

Q-4(A) Write the following.

- (i) Let $\{X_k\}$, $k = 1, 2, \dots, n$ be a sequence of iid random variables defined on probability space

(X, G, p) with $E(X_k) = \mu$, for $k = 1, 2, \dots, n$. Then show that $\bar{X}_n \xrightarrow{P} \mu$ where $\bar{X}_n = \frac{1}{n} \sum_{k=1}^n X_k$.

- 07
- (ii) Discuss Central Limit Theorem due to Lindeberg and Levy. 07

OR

- (i) Discuss 'Pure Birth Process'. 07
- (ii) Discuss 'Immigration - Emigration Process' as a particular case of Birth and death Process. 07

Q-4(B) Answer the following questions. (Any three) 03

- (i) State Kolmogorov's strong Law of Large Numbers.
- (ii) State postulates of Poisson Process.
- (iii) State Chebyshev's Weak Law of Large Numbers.
- (iv) Explain the term 'Transition Probability Matrix' with suitable example.
- (v) State Liapounov's form of Central Limit Theorem.

M 822-3

M.Sc. Sem-II, Examination, March-2019
STA402 (Probability Theory)
(New Course)

Time: 2:30 Hours

Total Marks: 70

Q-1(A) Write the following.

- (i) Explain the difference between with suitable example:
(a) Limit Superior and Limit Inferior
(b) Field and Sigma-field
(c) Mutually Exclusive events and Equally likely events. 07
- (ii) Show that probability measure p is monotonic and subtractive. 07

OR

- (i) Let $\{A_n\}$ be a sequence of events in a probability space (X, G, p) , then show that
$$P\left(\lim_{n \rightarrow \infty} \text{Inf} A_n\right) \leq \lim_{n \rightarrow \infty} \text{Inf} P(A_n). \quad 07$$
- (ii) Let $\{A_n\}$ be a sequence of events in a probability space (X, G, p) , then show that
$$P\left(\bigcup_{i=1}^n A_i\right) \leq \sum_{i=1}^n P(A_i). \quad 07$$

Q-1(B) Answer the following questions. (Any four) 04

- (i) If $P(A) = 1/3$, $P(B) = 1/4$ and $P(A \cap B) = 1/6$, then find $P(A' \cup B)$ and $P(A \cup B')$.
- (ii) Explain the difference between pair wise independence and mutual independence.
- (iii) Let n balls be put at random into n cells then, what is the probability that each cell will be occupied?
- (iv) State Bayes' theorem.
- (v) Define Set function.
- (vi) If P_1 and P_2 are two probability measures, show that $P = \lambda P_1 + (1-\lambda)P_2$, $0 < \lambda < 1$ is also a probability measure.

Q-2 (A) Write the following.

- (i) State Chebyshev's Inequality. If X is a random variable such that $E(X) = 3$ and $E(X^2) = 13$, use Chebyshev's Inequality to determine the lower bound for $P(-2 < X < 8)$. 07
- (ii) State and prove Holder's Inequality. 07

OR

- (i) Let X be a non-negative random variable defined on probability space (X, G, p) such that $E(X)$ exists. Then for any positive number a , show that $P(X \geq a) \leq E(X) / a$. 07
- (ii) Let X be a random variable defined on probability space (X, G, p) such that $E(X)$ exists and is finite. If $g(X)$ is a borel measurable function then show that $E[g(X)] \leq g[E(X)]$. 07

Q-2(B) Answer the following questions. (Any four) 04

- (i) Define the distribution function of a random variable and state its properties.
- (ii) Define conditional expectation.
- (iii) If F is a distribution function of a continuous random variable X and if $a < b$, $P(X = a)$ and $P(X = b)$ are not zero, then find $P(a < X \leq b)$.

P. T. U.

M 822 - 4

- (iv) Let X be a random variable then for $f(x) = k e^{-2x}$, $x \geq 0$, $f(x) = 0$, e.w. to be a density function, what should be value of k ?
- (v) Let the joint density function of a two dimensional random variable (X, Y) be, $f(x, y) = 2$, for $0 < x < 1$ and $0 < y < x$; $f(x, y) = 0$, e.w., then state whether X and Y are independent?
- (vi) A coin is tossed until a head occurs. What is the expectation of the number of tosses required?

Q-3 (A) Write the following.

- (i) State Chebyshev's Inequality. If X is a random variable such that $E(X) = 3$ and $E(X^2) = 13$, use Chebyshev's Inequality to determine the lower bound for $P(-2 < X < 8)$. 07
- (ii) Let $\{E_n\}$ be a sequence of events in a probability space (X, G, p) , and if

$$\sum_{n=1}^{\infty} P(E_n) < \infty, \text{ then show that } P\left(\limsup_{n \rightarrow \infty} A_n\right) = 0. \quad 07$$

OR

- (i) For a sequence of absolute moments $\{\beta_k\}$ of a random variable X defined over a probability space (X, G, p) , show that $\beta_k^{1/k} \leq \beta_{k+1}^{1/(k+1)}$, for $k = 1, 2, \dots$ 07
- (ii) Define convergence in probability and convergence almost surely. Show that convergence almost surely implies convergence in probability. 07

Q-3(B) Answer the following questions. (Any three) 03

- (i) State Kolmogorov's Inequality.
- (ii) State the properties of characteristic function.
- (iii) Cauchy Schwartz Inequality can be derived from which Inequality? How?
- (iv) Explain "Convergence in Distribution"?
- (v) State Bernoulli's Weak Law of large numbers.

Q-4 (A) Write the following.

- (i) Let $\{X_k\}$, $k = 1, 2, \dots, n$ be a sequence of independent random variables in a probability space (X, G, p) with $E(X_k) = \mu_k$, $\text{Var}(X_k) = \sigma_k^2$, for $k = 1, 2, \dots, n$. If $\lim_{n \rightarrow \infty} \frac{1}{n^2} \sum_{k=1}^n \text{Var}(X_k) = 0$

$$\text{then show that } \bar{X}_n \rightarrow \bar{\mu}_n \text{ where } \bar{X}_n = \frac{1}{n} \sum_{k=1}^n X_k \text{ and } \bar{\mu}_n = \frac{1}{n} \sum_{k=1}^n \mu_k. \quad 07$$

- (ii) State and prove Lindberg Levy's form of Central limit theorem. 07

OR

- (i) Discuss Poisson Process. 07
- (ii) Describe Birth and Death process in details. 07

Q-4(B) Answer the following questions. (Any three) 04

- (i) Explain the difference between Markov chain and Markov process.
- (ii) State postulates of Pure Birth Process.
- (iii) State Kolmogorov's strong Law of Large Numbers.
- (iv) What you mean by "Transition Probability Matrix"?
- (v) State Liapounov's form of Central Limit Theorem.

M.Sc. (Sem.-1) Examination

402

Bio-Medical Technology Paper-II

March 2019

[Max. Marks : 70]

Time : 2-30 Hours]

NB: All questions are compulsory. Illustrate your answers with neat diagrams wherever necessary.		
Q-1	(A)	Answer the following
	(i)	Write a note on Lactose intolerance. 07
	(ii)	Explain in detail: Types of Diabetes mellitus. Add a brief note on each type. 07
		OR
	(i)	Discuss Glycogen storage disorders types I and II. 07
	(ii)	Describe the symptoms and complications of DM type 2. 07
	(B)	MCQ / SQ (Any Four out of Six) 04
	(i)	Define: ketosis.
	(ii)	Explain: impaired glucose tolerance.
	(iii)	Give the normal values of FBS and OGTT.
	(iv)	Explain the enzymatic defect in Pompe's disease.
	(v)	Briefly describe: Fructose Intolerance.
	(vi)	Distinguish between milk allergy and milk intolerance.
Q-2	(A)	Answer the following
	(i)	Describe the biochemical analysis of urine in renal disease. 07
	(ii)	Explain: Creatinine clearance tests. 07
		OR
	(i)	Write a note on: physical examination of urine. 07
	(ii)	Discuss Urea clearance test and explain its clinical significance. 07
	(B)	MCQ / SQ (Any Four out of Six)
	(i)	Explain: Casts in urine.
	(ii)	Why is it important to estimate insulin from urine?
	(iii)	Explain: Galactosemia.
	(iv)	Why is microscopic examination of urine necessary?
	(v)	Mention the varied types of crystals identified from urine.
	(vi)	Define: GFR.
Q-3	(A)	Write the following
	(i)	Write a short note on Phenylketonurea. 07
	(ii)	Explain tests used for determination of HDL and LDL. 07
		OR
	(i)	Describe lipid profile. 07
	(ii)	Write a note on Tay-Sachs disorder. 07
	(B)	MCQ / SQ (Any Three out of Five) 03
	(i)	Which enzyme plays an important role in MSUD?
	(ii)	Give normal range of cholesterol.
	(iii)	Enlist two functions of lipoprotein.
	(iv)	Name the tests used for Hartnup disease.
	(v)	What is inheritance pattern of Niemann Pick disease?
Q-4	(A)	Write the following
	(i)	Give a detailed account of bilirubin metabolism. 07
	(ii)	Write a note on Flocculation test. 07
		OR
	(i)	Give an account on plasma bicarbonate. 07
	(ii)	Write an account on types and diagnosis of jaundice. 07
	(B)	MCQ / SQ (Any Three out of Five) 03
	(i)	What is phototherapy?
	(ii)	Add a note on chloride shift.
	(iii)	Give a brief idea on colloidal solution.
	(iv)	Define "homeostasis in the body".
	(v)	What is the difference between adsorption and absorption?

M.Sc. (Sem.-1) Examination

402 0/100

Electronics Paper-II

Time : 2-30 Hours]

March 2019

[Max. Marks : 70

- 1 (A) Write the following
- (i) For lossless transmission lines obtain expression for the reflection coefficient. Hence obtain the reflection coefficient for, (1) Matched load, (2) Short circuit, and (3) Open circuit. 07
- (ii) Discuss the propagation coefficient of transmission line, and current and voltage phasor diagrams. 07

OR

- (i) What is Smith chart? Obtain the equations of constant resistance and reactance circles of Smith chart. 07
- (ii) Write the Helmholtz equation for TE modes in rectangular waveguides, and its solution. Hence solve the Maxwell's curl equations in frequency domain and obtain their solutions E_x , E_y , E_z , H_x , H_y , and H_z . 07
- (B) Answer the following (Any Four out of Six): 04
- 1 What are the minimum and maximum values of VSWR?
 - 2 Define neper. How it is related to decibel?
 - 3 What do you mean by the balanced mode two-wire line?
 - 4 The dominant mode in a particular waveguide is the mode having frequency.
 - 5 The intrinsic impedance in an unbounded dielectric is $\eta = \dots\dots$
 - 6 The two types of power losses in a rectangular waveguide are: Losses in and Losses in.....

- 2 (A) Write the following
- (i) Derive an equation for the phase difference caused due to path difference between direct and ground reflected waves in Tropospheric Propagation (flat earth assumption). 07
- (ii) What is meant by radio horizon? Obtain expression for maximum range for tropospheric transmission. Discuss super and subrefractions. 07

OR

- (i) Derive expression for MUF using Secant Law. Discuss the ray paths in atmosphere under various conditions of angle of incidence and frequencies. 07
- (ii) Derive power ratio equation in decibels for free space propagation. 07
- (B) Answer the following (Any Four out of Six) 04
- 1 Microwave radio systems operating at frequencies above 1 GHz propagate mainly in or mode.
 - 2 What is the skip distance?
 - 3 At plasma angular frequency the relative permittivity of the ionized medium becomes
 - 4 Calculate the maximum range (in miles) for tropospheric transmission

M 824-2

for which the antenna heights are 100 ft and 60 ft.

5 Define: gyro-frequency.

6 A satellite is at height of 36,000 km above the earth. The frequency used is 4000 MHz. Calculate the free-space transmission loss in decibels.

3 (A) Write the following:

(i) What is HERTZIAN DIPOLE? Obtain expressions for its Radiation Resistance and Power Radiated. 07

(ii) What are antenna arrays? What are their advantages and disadvantages? Name their applications. 07

OR

(i) What is HALF WAVE DIPOLE? Obtain expressions for its Radiation Resistance and Power Radiated. 07

(ii) Give characteristics of Resonant & non-resonant antennas. 07

(B) Answer the following (Any Three out of Five) 03

1 Define ANTENNA

2 Give radiation pattern of half wave dipole antenna,

3 Draw diagram of YAGI ANTENNA

4 Define directivity of antenna.

5 Give name of any one isotropic antenna.

4 (A) Write the following:

(i) Define information capacity? What is BITS and BITS RATE? Express the relationship Between baud (B) and minimum bandwidth. 07

(ii) What is QAM? Explain the working of 8-QAM system. 07

OR

(i) What is eye diagram? What information does it give about the digital communication system? Explain in detail. 07

(ii) Discuss in detail the DPSK system. 07

(B) Answer the following (Any Three out of Five) 03

1 Give constellation diagram of 16 QAM system.

2 What is BER?

3 What is BAUD?

4 What is difference between 8 QAM & 16 QAM?

5 Why is the recovered data delayed in clock recovery?

x ——— 1 ——— x

Instructions:

1. All symbols carry their usual meanings.
2. Scientific calculators are allowed

Q.1Ai). Discuss in detail "Retarded Potentials". [7]

- ii). Find radiation resistance of an oscillating **magnetic dipole**. Express the answer in terms of λ and a , and compare it with the radiation resistance of the electric dipole $R(\text{ele}) = 790 \left(\frac{d}{\lambda}\right)^2 \Omega$, where d is distance between two ends of the dipole and a is radius of loop of wire. [7]

OR

Q.1Ai). Derive expressions for electric field and magnetic field of the **magnetic dipole** radiation? [7]

- ii). Prove that radiation resistance of a wire joining the two ends of a **electric dipole** is $R(\text{ele}) = 790 \left(\frac{d}{\lambda}\right)^2 \Omega$. (where d is distance between two ends of the dipole). [7]

Q.1B). Answer **any four** from the following (**one** mark each) [4]

- i). What is *advance time* in retarded potential theory?
- ii). Select correct expression given below related to the **Total Power** $\langle P \rangle$ radiated by **electric dipole** obtained by integrating intensity **S** over sphere of radius r . But the quantity is independent of the radius of sphere r , as one would expect from conservation of energy.

$$(a) \langle P \rangle = \frac{1}{4\pi\mu_0} \frac{p_0^2 \omega^4}{3c^3}$$

$$(b) \langle P \rangle = \frac{1}{4\pi\epsilon_0} \frac{p_0^2 \omega^4}{3c^3} \frac{1}{r}$$

$$(c) \langle P \rangle = \frac{1}{4\pi\epsilon_0} \frac{p_0^2 \omega^4}{3c^3}$$

$$(d) \langle P \rangle = \frac{1}{4\pi\mu_0} \frac{p_0^2 \omega^4}{3c^3} \frac{1}{r}$$

- iii). What is radiation zone?

- iv). Write **Poisson's** equation.
 v). What is ratio of *total radiated power* (p_{mag} / p_{ele}) both terms relative to electric and magnetic dipole power radiation? (Assume both configurations with comparable dimensions, obviously the p_{ele} is enormously greater than p_{mag} .)

$$(a) \frac{P_{mag}}{P_{ele}} = \left(\frac{m_0}{p_0 c}\right)^4 \quad (b) \frac{P_{mag}}{P_{ele}} = \left(\frac{m_0}{p_0 c}\right)^3$$

$$(c) \frac{P_{mag}}{P_{ele}} = \left(\frac{m_0}{p_0 c}\right)^{1/2} \quad (d) \frac{P_{mag}}{P_{ele}} = \left(\frac{m_0}{p_0 c}\right)^2$$

- vi). In the static case of radiation from arbitrary distribution of charges & currents,

$$V(r, t) = \frac{1}{4\pi \epsilon_0} \left[\frac{Q}{r} + \frac{\hat{r} \cdot p(t_0)}{r^2} + \frac{\hat{r} \cdot \dot{p}(t_0)}{rc} \right]$$

The first two terms indicate _____ contributions to the multi-pole expression for V , the third term will not be present at far zone.

- (a) the monopole & dipole (b) the charge & current
 (c). both vector quantity (d) None of the above

- Q.2Ai).** Explain theory of **Lienard-Wiechert potentials** with appropriate example. [7]

- ii). Show that the **electric field** of a point charge in motion can be expressed as,

$$E = \frac{q}{4\pi \epsilon_0} \frac{1}{(R \cdot u)} \frac{\partial}{\partial t_r} \left(\frac{R u}{R \cdot u} \right) \quad \text{[NOTE: derivatives of } \left(\frac{\partial}{\partial t_r} \right) \text{ is on } r, \text{ where } r \text{ and } t \text{ are treated as constant].}$$
[7]

OR

- Q.2Ai).** Write in detail "The theory of power radiated by a point charge". [7]

- ii). Consider a particle of charge q moves in a circle of radius R at constant angular velocity ω (assume the circle lies in the xy plane at time $t=0$, the charge is at $(R,0)$ on the $+x$ axis). Find out the Lienard-Wiechert potentials for a point on the Z -axis? [7]

- Q.2B).** Answer any three from the following (one mark each): [3]

- i). The *current density* of a rigid object having which one value for the radiation from a point charge?
 (a) ρv (b) $\rho \mu$ (c) $\rho \epsilon$ (d) μv .
- ii). What is Radiation reaction?
- iii). What is Field reaction?

- iv). Write Lienard's generalization of Larmor formula for power radiated by a point charge.
- v). When caboose train looks a little longer, it is due to
- | | |
|-----------------------------|--------------------------|
| (a) steady state | (b) leaving you |
| (c) approaching towards you | (d) always looking same. |

Q.3Ai). Describe basic data types in C language. Mention their ranges. How range of these basic data types can be extended.

Distance between two points (x_1, y_1) and (x_2, y_2) is governed by the formula

$$D^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$$

Write a program to read coordinates of two points and calculate and print the distance between them. [7]

- ii). Write a program to read a positive number, generate a new number by reversing all digits, and print the original number and new number. The program also should find out and print average of all individual digits in the number. [7]

OR

Q.3Ai). Draw block diagram of a **for loop**. Write a program to calculate and print factorials of 5, 6, and 7 using while loop, do while loop and for loop respectively. [7]

- ii). Write a program to evaluate e^x using the following series expansion with an accuracy of 0.0001. [7]

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots \dots \dots 0 < x < 1$$

Q.3B). Answer any four from the following [4]

- i). Mention any one use of escape sequences.
- ii). The _____ operator returns the number of bytes occupied by the operand.
- iii). Write C statement for the following

$$side = \sqrt{b^2 + c^2 - 2bc \cos(A)}$$

- iv). Point out errors in the following statements

```
if(x=<y)
    printf('Jump');
```

- v). What will be value of x when the following statement is executed

```
int x = 10, y = 15;
x = (x < y) ? (x + y) : (x - y);
```

- vi). The _____ statement when executed causes immediate exit from switch.

M831-4

Q.4Ai). Write a program to read two 4x4 matrices, add the matrices and then print the resultant matrix. The program also should find out average of all individual elements in the resultant matrix. [7]

ii). What is a string constant? How is it different from a character constant? Write a program to read two strings and then attach the first one on the second one without using string handling functions. Program should print both strings. [7]

OR

Q.4Ai). Write a program to read 50 values and store it in an array and then find out and print the mean of the series and also lowest value in the series. [7]

ii). Palindrome is a word which spell same forward and backward. Write a program to read a string and check whether the string is a palindrome or not. [7]

Q.4B). Answer any three from the following (one mark each) [3]

i). How much memory is required to store the following array variable x.
float x[25];

ii). Declare a variable which can store a string of 20 characters.

iii). Write statements to copy contents of array x[25] to another array y[25]

iv) How the function strcmpi() is different from function strcmp().

v). Mention two functions which can be used to read strings through keyboard.

0703M831(5)

Candidate's Seat No : _____

M.Sc. (Sem.-1) Examination

403

Physics Paper-III (New)

March 2019

[Max. Marks : 70

Time : 2-30 Hours]

Instructions:

1. All symbols carry their usual meanings.
2. Scientific calculators are allowed

Q.1Ai). Explain the reflection from the *surface of metal* and obtain the equation

$R = 1 - 2\sqrt{\frac{2\omega\epsilon_1}{\sigma}}$. Use propagation vector K_T for conducting medium as

$$K_T^2 = \epsilon_2 \mu_2 \omega^2 \left[1 + \frac{i\sigma}{\omega\epsilon_2} \right] = (\alpha + i\beta)^2. \quad [7]$$

- ii). The index of refraction of air and diamond are **1** and **2.42** respectively. Draw a graph of amplitudes of reflected and transmitted waves versus the angle of incidence at air/diamond interface. (Assume $\mu_1 = \mu_2 = \mu_0$). Calculate (a) the amplitudes at normal incidence (b) Brewster's angle and (c) **cross-over angle** at which reflected and transmitted amplitudes are equal. [7]

OR

Q.1Ai). Discuss in detail, "reflection and transmission at normal incidence" [7]

- ii). Silver is an excellent conductor, but it's very expensive. Suppose you are designing a microwave experiment to operate at a frequency of **10 GHz**. How thick would you make the silver coatings? [Take : $\rho_{\text{silver}} = 1.59 \times 10^{-8} \Omega\text{m}$, $\epsilon = 8.85 \times 10^{-12} \text{ Fared/m}$, $\omega = 2\pi \times 10^{10} \text{ s}^{-1}$ and $\mu = 4\pi \times 10^{-7} \text{ Henry/m}$]. [7]

Q.1B). Answer **any four** from the following (one mark each) [4]

- i) If $n_1 = 1.08$ and $n_2 = 1.50$, then what will be *reflection coefficient and transmission coefficient values*? (Assume $\mu_1 = \mu_2 = \mu_0$)
- ii) Write **Fresnel's equations**.
- iii) What is the **Energy Density** equation for the wave propagating through linear media?
- iv) Distinguish between *dispersion* and *dispersive*?
- v) What is "skin depth/ penetrating distance"?
- vi). What is Snell's law?

- Q.2Ai).** Obtain guide wavelength (λ_g) equation for propagation of waves through two conducting parallel plates. [7]
- ii). Consider a rectangular waveguide with dimension 2.28×1.01 cm. If the driving frequency is 1.70×10^{10} Hz, which TE modes will propagate in this waveguide? What range of frequency has to be used to excite only one TE mode? What are the corresponding wavelengths in open space? [7]

OR

- Q.2Ai).** Discuss the **Resonant cavities** when a perfect conductor is placed at half infinite space in the direction of propagating wave. Explain Q-factor. [7]
- ii). Find the modes of 3cm wavelength radar waves that would be propagated in a waveguide of rectangular cross section with $a = 1$ cm, $b = 2$ cm. Find also the group velocity of the waves. [7]

- Q.2B).** Answer any **THREE** from the following (one mark each) [3]
- i). Explain the principal or dominant TE mode?
- ii). Prove product of v_p and v_g is equal to square of speed of light C.
- iii) In the case of Dielectric wave guide,

$$\tan(k,d) = k(\gamma + \delta) / (k^2 - \gamma \delta).$$
- iv). Which condition is responsible for loss of total internal reflection at the lower boundary and the mode will no longer be guided?
 (a) $\gamma=1$ (b) $\delta=1$ (c) $k^2=1$ (d) $\gamma=0$
- v) Find the shortest length of a simplest cavity resonator to be made from a rectangular waveguide with $a = 10.16$ mm and $b = 22.86$ mm which will resonate at 10GHz. [Take : $C = 3 \times 10^8$ m/s, m & $n = 1$]
- vi). Why Cavities are often used for frequency measurement?

- Q.3Ai).** Describe basic data types in C language. Mention their ranges. How range of these basic data types can be extended.

Distance between two points (x_1, y_1) and (x_2, y_2) is governed by the formula

$$D^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$$

Write a program to read coordinates of two points and calculate and print the distance between them. [7]

- ii). Write a program to read a positive number, generate a new number by reversing all digits, and print the original number and new number. The program also should find out and print average of all individual digits in the number. [7]

OR

- Q.3Ai).** Draw block diagram of a **for loop**. Write a program to calculate and print factorials of 5, 6, and 7 using while loop, do while loop and for loop respectively. [7]

- ii). Write a program to evaluate e^x using the following series expansion with an accuracy of 0.0001. [7]

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 ii). The _____ operator returns the number of bytes occupied by the operand.
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- iv). Point out errors in the following statements

```
if(x<y)
    printf('Jump');
```

- v). What will be value of x when the following statement is executed

```
int x = 10, y = 15;
x = (x<y) ? (x+y) : (x-y);
```

- vi). The _____ statement when executed causes immediate exit from switch.

- Q.4Ai). Write a program to read two 4x4 matrices, add the matrices and then print the resultant matrix. The program also should find out average of all individual elements in the resultant matrix. [7]

- ii). What is a string constant? How is it different from a character constant? Write a program to read two strings and then attach the first one on the second one without using string handling functions. Program should print both strings. [7]

OR

- Q.4Ai). Write a program to read 50 values and store it in an array and then find out and print the mean of the series and also lowest value in the series. [7]

- ii). Palindrome is a word which spell same forward and backward. Write a program to read a string and check whether is it a palindrome or not. [7]

- Q.4B). Answer any three from the following (one mark each) [3]

- i). How much memory is required to store the following array variable x.
`float x[25];`
 ii). Declare a variable which can store a string of 20 characters.
 iii). Write statements to copy contents of array x[25] to another array y[25]
 iv). How the function strcmpi() is different from function strcmp().
 v). Mention two functions which can be used to read strings through keyboard.

2/63

0703M832

Candidate's Seat No : _____

M.Sc. (Sem.-1) Examination

403

Chemistry Paper-III

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

Instructions: 1) All questions carry equal marks.

2) Necessary constants:

$$N = 6.022 \times 10^{23} \text{ mole}^{-1}$$

$$k = 1.38 \times 10^{-23} \text{ JK}^{-1}$$

$$h = 6.626 \times 10^{-27} \text{ ergs.sec.} = 6.626 \times 10^{-34} \text{ j.sec.}$$

$$R = 8.314 \times 10^7 \text{ ergs K}^{-1} \text{ M}^{-1}$$

$$= 8.314 \text{ J K}^{-1} \text{ M}^{-1} = 1.987 \text{ cal. K}^{-1} \text{ M}^{-1}$$

$$1\text{eV} = 1.602 \times 10^{-19} \text{ J}$$

Que.-1 (A) Discuss the Nernst heat theorem and derive the equation giving relations between heat capacity, free energy and enthalpy. On basis of the Nernst heat theorem explain in brief about the third law of thermodynamics. Explain how absolute entropy of a solid can be determined using this law. 14

OR

Que.-1 (A-i) Explain the term partial molar properties. On the basis of this derive Gibb's-Duhem equation. 07

Que.-1 (A-ii) Derive an equation for the approximate calculation of fugacity of a gas. The activity of 3.0 moles of a substance changes from 0.06 to 0.45. What would be the change in its free energy at 27 °C. 07

Que.-1 (B) Answer in One or Two lines (Any Four) 04

(i) What is the physical significance of the term fugacity?

(ii) What is meant by chemical potential?

(iii) Define the term activity of a substance.

(iv) How the values of ΔG and ΔH changes with change in temperature?

(v) What is the value of entropy of a substance at absolute zero temperature?

(vi) Define the term molar heat capacity.

Que.-2 (A) Explain the Lindemann theory of unimolecular reactions. What are the limitations of this theory. Explain the kinetics and mechanisms of branched chain reaction. Give the reasons of explosions in branched chain reactions. 14

OR

Que.-2 (A-i) Derive the Michaelis Menten equation of enzyme catalyzed reactions. 07

Que.-2 (A-ii) Explain the kinetics and mechanisms of reaction between hydrogen and bromine. 07

P.T.O.

- Que.-2 (B) Answer in One or Two lines (Any Four) 04**
- (i) What is meant by reaction velocity?
 - (ii) Name the factors on which the rate of a chemical reaction will depend according to the theory of absolute reaction rate.
 - (iii) What is the effect of catalyst on free energy and equilibrium constant?
 - (iv) What is meant by catalytic poisoning?
 - (v) Why activation energy of a reaction cannot be zero?
 - (vi) Define complex reactions.
- Que.-3 (A) Explain in detail about the defects in solids. Derive an equation to calculate number of Schottky and Frenkel defects in crystals. 14**
- OR**
- Que.-3 (A-i) Explain about Low temperature and high temperature superconductivity. 07**
- Que.-3 (A-ii) Classify crystalline solids according to the bonds that hold their atoms, ions or molecules. Explain the bond theory of metals. 07**
- Que.-3 (B) Answer in One or Two lines (Any Three) 03**
- (i) What is meant by long range order?
 - (ii) Which type of state of a material is considered as true solids?
 - (iii) Which types of substances show isotropic and anisotropic properties?
 - (iv) Which types of binding forces are involved in molecular crystals?
 - (v) What are point defects?
- Que.-4 (A) Explain in brief about physical and chemical adsorption. Derive BET equation for multilayer adsorption. How surface area of a finely divided solid can be determined? 14**
- OR**
- Que.-4 (A-i) Define the term surface tension. Derive Gibb's adsorption isotherm equation. 07**
- Que.-4 (A-ii) What are micelles? Explain critical micelle concentration. 07**
- Que.-4 (B) Answer in One or Two lines (Any Three) 03**
- (i) Give any two assumptions of BET theory.
 - (ii) Why a finely divided substance is more effective as an adsorbent?
 - (iii) Which types of forces are involved in physisorption?
 - (iv) What is adsorption isotherm?
 - (v) What are detergents?
-

M.Sc. (Sem.-1) Examination

403

Microbiology

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

Instruction : Figures to right indicates full marks.

- 1 (a) Describe mode of gene-exchange in bacteria by citing the example of transformation. 14
- OR**
- (a) (i) What are plasmids? Discuss their types and compatibility observed in bacteria. 7
(ii) Write a note on gene structure analysis by the use of transduction. 7
- (b) Answer in one or two line only (any four) : 4
- (i) Competence (iv) F prime
(ii) Generalized transduction (v) Transfection
(iii) Hfr (vi) Conjugal plasmids.
- 2 (a) What is tetrad analysis? Give its importance. 14
- OR**
- (a) (i) Describe molecular aspects of T_4 development. 7
(ii) Describe intracellular development of T_7 phage in E. Coil. 7
- (b) Answer in brief (any four) : 4
- (i) Trichogynes (iv) Role of coat protein of MS 2 phage
(ii) Mitotic non disjunction (v) Enlist types of promoters of T_7 phage
(iii) Parasexual cycle (vi) Sigma and anti sigma factors of T_4 phase.
- 3 (a) Describe molecular mechanism of DNA replication in bacteria. 14
- OR**
- (a) (i) Describe organization of eukaryotic chromosome. 7
(ii) Explain the mechanism of mutation by base analogs and alkylating agents. 7
- (b) Answer in brief (any three) : 3
- (i) Define chromatosome (iv) Photo-reactivation
(ii) Histone- H_1 and its importance (v) Physical mutagen
(iii) Ori - C
- 4 (a) Describe the importance of statistical methods used to interpret biological data by giving suitable examples. 14
- OR**
- (a) (i) Compute the median and standard deviation for the observations : 7
28, 18, 10, 40, 16, 32, 24, 30 (ANS : SD = 6.83, Median = 26)
- (ii) Find the coefficient of correlation r from the bivariate data given below and state your interpretation of r : 7
- | | | | | | | | | |
|---|----|----|----|----|----|----|----|----|
| X | 27 | 23 | 24 | 28 | 21 | 29 | 22 | 25 |
| Y | 29 | 25 | 26 | 30 | 23 | 31 | 24 | 27 |
- (ANS : $r = 1$)
- (b) Answer in brief (any three) : 3
- (i) Type of correlations (iii) Sample distribution
(ii) Differentiate qualitative data and quantitative data (iv) Meaning of statistical inference
(v) Limitation of ordinal scale

M.Sc. (Sem.-1) Examination
403

Mathematics
March 2019

Time : 2-30 Hours]

[Max. Marks : 70

Q.1 (a)

14

- (i) Establish $\arg(z_1) + \arg(z_2) = \arg(z_1 z_2)$. and show that it may not be true in case of principal argument by giving some example?
- (ii) Show that if $\lim_{z \rightarrow z_0} f(z)$ exists, then it is unique and evaluate the limit of the

$$\text{function } \lim_{z \rightarrow \infty} \frac{4z^2}{(z-1)^2} ?$$

OR

- (b) (i) If a function $f(z)$ is continuous and nonzero at a point z_0 , then $f(z) \neq 0$ 14

throughout some neighborhood of that point.

- (ii) Show that $f(z) = 1/z^2$
- (a) not uniformly continuous in the region $|z| \leq 1$.
- (b) uniformly continuous in the region $2 \leq |z| \leq 3$.

(c) Attempt any **FOUR**

4

- (i) Express $f(z) = \frac{z-1}{1+2z}$ in $u(x, y) + iv(x, y)$ form and state the natural domain of the function $f(z)$.

(ii) State the definition of open set.

(iii) What the region of the function $\operatorname{Re} z \neq 0$?

(iv) Show that $\operatorname{Re}(iz) = -\operatorname{Im}(z)$.

(v) Where the function $\operatorname{Ln}(z)$ is not continuous on the complex plane?

- (vi) Let $z_1, z_2 \neq 0$ and if $|z_1| = |z_2| = 1$, then show that $\frac{z_1 + z_2}{z_1 - z_2}$ is pure imaginary.
is uniformly continuous in the region $|z| \leq 1$?

Q.2 (a)

14

- (i) Find the constant a, b, c such that the function $f(z) = -x^2 + xy + y^2 + i(ax^2 + bxy + cy^2)$ is analytic. Express $f(z)$ in terms of z .
- (ii) Show that the following functions are differentiable everywhere in the complex plane
- (a) $f(x + iy) = x^3 - 3xy^2 + i(3x^2y - y^3)$
- (b) $f(x + iy) = e^{-y} \cos x + ie^{-y} \sin x$

OR

- (b) (i) Derive the formula of derivative of the multiplication of two functions i.e. 14

$$\frac{d}{dz}[f(z)g(z)] = f'(z)g(z) + f(z)g'(z)$$

- (ii) If a function $f(z) = u(x, y) + iv(x, y)$ is analytic in a domain D , then its component functions u and v are harmonic in D but not vice versa.

- (c) Attempt any Four

04

- (i) If $f(z)$ and $|f(z)|$ are both analytic in a given domain D , then $f(z)$ must be constant throughout D . (True/False)
- (ii) Let $f(z) = z^2/z$, if $z \neq 0$ and $f(0) = 0$. Then this function is not differentiable at 0. (True/False)
- (iii) If $u(x, y)$ and $v(x, y)$ are any two harmonic function in D then $(u_y - v_x) + i(u_x + v_y)$ is analytic in a domain D . (True/False)
- (iv) Differentiability not implies analyticity why?
- (v) A conjugate harmonic of $u(x, y) = e^x \sin(y)$ is.....
- (vi) The equation $|z - 1| = |z + i|$ represents.....

Q.3 (a)

13

- (i) Show that complex sine and cosine functions are unbounded.
- (ii) Let f be a continuous function defined on a domain D and there exist a function F defined on D such that $F' = f$. Let $z_1, z_2 \in D$. Then for any contour C lying in

D starting from z_1 and ending at z_2 the value of the integral $\int_C f(z) dz$ is independent of the contour.

OR

(b) (i) Evaluate the integral $I = \int_C z^n dz$, $n = 0, \pm 1, \pm 2, \dots$ where $C : |z| = r$ is traversed in anticlockwise direction. 13

(ii) Find an upper bound for the absolute value of the integral $I = \int_C (e^{z^2}) dz$, where C is the broken lines from $z=0$ to $z=1$ and then from $z=1$ to $z=1+i$.

(c) Attempt any **THREE** 03

(i) Let D be a doubly connected region bounded by two simple closed curve C and C_1 such that C_1 contained in C, then $\int_C f(z) dz = \dots\dots\dots$

(ii) A contour is said to be closed if it does not.....itself and the starting point of the first arcwith the end point of the last arc.

(iii) Compute the length of the curve $z(t) = (1-i)t^2$, $-1 \leq t \leq 1$.

(iv) Let C be the square with vertices at $2 \pm 2i, -2 \pm 2i$, $\int_C \frac{dz}{z-2} = \dots\dots\dots$

Q.4 (a) 13

(i) State and prove Cauchy integral formula for derivative.

(ii) Evaluate the integral $I = \oint_C \frac{3z^4 + 5z^2 + 2}{(z+1)^4} dz$, where C is simple closed contour containing the point $z=-1$ inside it

OR

(b) (i) State and prove Morera's theorem. 13

(ii) Verify that the maximum and minimum modulus theorems hold for following functions

a. $f(z) = 3z^2 + 2$ where C is the circle $|z| = \frac{1}{2}$.

M 834-4

b. $f(z) = e^{2z}$ where C is the circle $|z|=1$

(c) Attempt any **THREE**

03

(i) State Minimum modulus theorem.

(ii) A contour is a continuous chain of a finite number of regular arcs. **(True/False)**

(iii) Evaluate the integral $I = \oint_C \frac{z^2 + 1}{z^2(z-2)} dz$, $C: |z|=1$.

(iv) For the indefinite integral of a function $f(z)$ to exist in a simply connected domain D , it is not necessary that $f(z)$ be analytic in D . **(True/False)**

— ✗ —

Time : 2-30 Hours]

1.(A) Answer the following:

- (i) Define sufficient, minimal sufficient and complete sufficient statistics. Which one of these three estimators do you prefer? Why? 7
- (ii) Let X_1, X_2, \dots, X_n be a random sample from $N(\mu, \sigma^2)$ normal distribution. Obtain minimal sufficient statistic for $\{\mu, \sigma^2\}$. 7

OR

- (i) State and prove Basu's theorem. Let X_1, X_2, \dots, X_n be a random sample from exponential distribution with pdf $f(x, \theta) = \frac{1}{\theta} \exp\left\{-\left(\frac{x-\theta}{\theta}\right)\right\}, x > \theta$. Show that $X_{(1)}$ and $\sum_{i=1}^n (X_i - X_{(1)})$ are independent. 7
- (ii) Let X_1, X_2, \dots, X_n be a random sample from exponential distribution with mean $\theta > 0$. Obtain fisher information contained in sample and in statistic sample total. Can you conclude that sample total is sufficient for θ . 7

(B) Answer any four: 4

- (i) Define fisher information contained in statistic.
- (ii) State Lehmann-Scheffe theorem on minimal sufficient statistic.
- (iii) Define minimal sufficient statistic.
- (iv) Define ancillary statistic.
- (v) Let X_1, X_2, \dots, X_n be a random sample from $U(0, \theta), \theta > 0$ distribution. State $\text{Cov}(X_{(n)}, X_{(n)} / X_{(n-1)})$.
- (vi) Give an example of complete family of distributions.

2. (A) Answer the following:

- (i) Let Y_1 and Y_2 be two unbiased estimators of θ such that $V(Y_1) = 2V(Y_2)$. Obtain constants a and b such that $aY_1 + bY_2$ becomes MVUE of θ . 7
- (ii) Let $X_{(1)}, X_{(2)}$ and $X_{(3)}$ be the ordered statistics from a random sample of size 3 from uniform $U(0, \theta), \theta > 0$ distribution. Define $T_1 = cX_{(1)}$ and $T_2 = kX_{(3)}/5$. Determine constants c and k such that T_1 and T_2 becomes unbiased for θ . Which of the two estimators do you prefer? Why? 7

OR

- (i) Obtain Cramer - Rao inequality for unbiased estimator of $g(\theta)$. 7
- (ii) Let X be a random variable with pmf $P(x = -1, \theta) = \theta, P(x, \theta) = (1-\theta)^2 \theta^x, x = 0, 1, 2, \dots, 0 < \theta < 1$. Let $g(\theta) = P(X=0)$. Obtain UMVUE for $g(\theta)$. 7

(B) Answer any four: 4

- (i) Say True or False: Bhattacharya bound is a generalization of C-R inequality.
- (ii) Let T and U are two unbiased estimators for the same parametric function. If U is MVUE then state $\text{Cov}(T, U)$.
- (iii) Let X_1, X_2, \dots, X_n be a random sample from $U(0, \theta), \theta > 0$ distribution. State UMVUE of $1/\theta$.

- (iv) Define MVBUE.
- (v) Say True or False: If T_i is UMVUE for $g_i(\theta)$, $i = 1, 2, \dots, n$ then $\sum_{i=1}^n a_i T_i$ is UMVUE for $\sum_{i=1}^n g_i(\theta)$, provided $\sum_{i=1}^n a_i = 1$.
- (vi) State Rao-Blackwell theorem on UMVUE.
3. (A) Answer the following:
- (i) Prove that MLE's are asymptotically normal. 7
- (ii) Discuss the method of minimum chi square estimation. 7
- OR
- (i) What is confidence interval estimation? Discuss any method to construct confidence interval with example. 7
- (ii) Let X_1, X_2, \dots, X_n be a random sample from exponential distribution with mean $\theta > 0$. Obtain $(1-\alpha)100\%$ asymptotic confidence interval for mean of the distribution. 7
- (B) Attempt any three: 3
- (i) Give an example of unbiased MLE.
- (ii) Give an example of unique MLE.
- (iii) Let X_1, X_2, \dots, X_n be a random sample from $U(0, \theta)$, $\theta > 0$ uniform distribution. State MLE of $\log \theta$.
- (iv) Let $X \sim F(x, \theta)$, then state the distribution of $-\log F(x, \theta)$.
- (v) State invariance property of MLE.
4. (A) Answer the following:
- (i) Define Bayes estimator. Obtain general form of the Bayes estimator of a parametric function θ under a squared error loss function. 7
- (ii) Let X_1, X_2, \dots, X_n be a random sample from $N(\theta, 9)$ normal distribution. Obtain Bayes estimator $d = 2c\bar{X}$, where \bar{X} is a sample mean and $c > 0$ is a constant for θ , using squared error loss function when prior distribution of θ is also a normal $N(0, 4)$. 7
- OR
- (i) Obtain general form of the Bayes estimator of a parametric function $g(\theta)$ under a weighted squared error loss function. 7
- (ii) Let X_1, X_2, \dots, X_n be a random sample from Bernoulli distribution with mean $\theta > 0$. Suppose prior distribution of θ uniform(0,1). Obtain Bayes estimator of θ^2 , and associated Bayes risk. 7
- (B) Attempt any three. 3
- (i) Define Bayes risk.
- (ii) Define posterior distribution.
- (iii) Define squared error loss function.
- (iv) State one proper prior distribution for the parameter of Poisson distribution.
- (v) State an extensive form used to get Bayes estimator of θ .

1.(A) Answer the following:

- (i) Define sufficient, minimal sufficient and complete sufficient statistics. Which one of these three estimators do you prefer? Why? 7
- (ii) Let X_1, X_2, \dots, X_n be a random sample from $N(\mu, \sigma^2)$ normal distribution. Obtain minimal sufficient statistic for $\{\mu, \sigma^2\}$. 7

OR

- (i) State and prove Basu's theorem. Let X_1, X_2, \dots, X_n be a random sample from exponential distribution with pdf $f(x, \theta) = \frac{1}{\theta} \exp\left\{-\left(\frac{x-\theta}{\theta}\right)\right\}, x > \theta$. Show that $X_{(1)}$ and $\sum_{i=1}^n (X_i - X_{(1)})$ are independent. 7
- (ii) Let X_1, X_2, \dots, X_n be a random sample from exponential distribution with mean $\theta > 0$. Obtain fisher information contained in sample and in statistic sample total. Can you conclude that sample total is sufficient for θ . 7

(B) Answer any four: 4

- (i) Define fisher information contained in statistic.
- (ii) State Lehmann-Scheffe theorem on minimal sufficient statistic.
- (iii) Define minimal sufficient statistic.
- (iv) Define ancillary statistic.
- (v) Let X_1, X_2, \dots, X_n be a random sample from $U(0, \theta), \theta > 0$ distribution. State $\text{Cov}(X_{(n)}, X_{(n)} / X_{(n-1)})$.
- (vi) Give an example of complete family of distributions.

2. (A) Answer the following:

- (i) Let Y_1 and Y_2 be two unbiased estimators of θ such that $V(Y_1) = 2V(Y_2)$. Obtain constants a and b such that $aY_1 + bY_2$ becomes MVUE of θ . 7
- (ii) Let $X_{(1)}, X_{(2)}$ and $X_{(3)}$ be the ordered statistics from a random sample of size 3 from uniform $U(0, \theta), \theta > 0$ distribution. Define $T_1 = cX_{(1)}$ and $T_2 = kX_{(3)}/5$. Determine constants c and k such that T_1 and T_2 becomes unbiased for θ . Which of the two estimators do you prefer? Why? 7

OR

- (i) Obtain Cramer - Rao inequality for unbiased estimator of $g(\theta)$. 7
- (ii) Let X be a random variable with pmf $P(X = -1, \theta) = \theta, P(X, \theta) = (1-\theta)^2 \theta^x, x = 0, 1, 2, \dots, 0 < \theta < 1$. Let $g(\theta) = P(X=0)$. Obtain UMVUE for $g(\theta)$. 7

(B) Answer any four: 4

- (i) Say True or False: Bhattacharya bound is a generalization of C-R inequality.
- (ii) Let T and U are two unbiased estimators for the same parametric function. If U is MVUE then state $\text{Cov}(T, U)$.
- (iii) Let X_1, X_2, \dots, X_n be a random sample from $U(0, \theta), \theta > 0$ distribution. State UMVUE of $1/\theta$.

M 835-4

- (iv) Define MVBUE.
- (v) Say True or False: If T_i is UMVUE for $g_i(\theta)$, $i = 1, 2, \dots, n$ then $\sum_{i=1}^n a_i T_i$ is UMVUE for $\sum_{i=1}^n g_i(\theta)$, provided $\sum_{i=1}^n a_i = 1$.
- (vi) State Rao-Blackwell theorem on UMVUE.
3. (A) Answer the following:
- (i) Prove that MLE's are asymptotically normal. 7
- (ii) Prove that MLE's are consistent. 7
- OR
- (i) Discuss the method of minimum chi square estimation. 7
- (ii) Discuss the method of minimum modified chi square estimation. 7
- (B) Attempt any three: 3
- (i) Give an example of unbiased MLE.
- (ii) Give an example of unique MLE.
- (iii) Define MLE.
- (iv) Define likelihood function.
- (v) State invariance property of MLE.
4. (A) Answer the following:
- (i) What is confidence interval estimation? Discuss pivotal method to construct confidence interval with example. 7
- (ii) Let X_1, X_2, \dots, X_n be a random sample from exponential distribution with mean $\theta > 0$. Obtain $(1-\alpha)100\%$ asymptotic confidence interval for mean of the distribution. 7
- OR
- (i) Discuss any general method to construct confidence interval. 7
- (ii) Write not on the method of confidence interval estimation based on MLE. 7
- (B) Attempt any three. 3
- (i) State the general form of CI for mean.
- (ii) Define pivotal statistic.
- (iii) State pivotal statistic to construct CI for variance of normal distribution when mean is known.
- (iv) Define confidence coefficient.
- (v) State confidence interval for proportion.

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M.Sc. (Sem.-1) Examination

403

Bio-Medical Technology Paper-III

March 2019

[Max. Marks : 70]

Time : 2-30 Hours]

NB: All questions are compulsory. Illustrate your answers with neat diagrams wherever necessary.

Q-1	(A)	Answer the following	
	(i)	Discuss sources of infection.	07
	(ii)	Describe stool examination techniques.	07
		OR	
	(i)	Explain Pathogenicity with examples.	07
	(ii)	Give an account of blood diagnostic methods.	07
	(B)	MCQ / SQ (Any Four out of Six)	04
	(i)	Define host.	
	(ii)	Give names of two parasite adaptations with example.	
	(iii)	Explain prophylaxis.	
	(iv)	Explain mutualism and parasitism.	
	(v)	Name classes of host.	
	(vi)	Difference between vector transmission and direct transmission.	
Q-2	(A)	Answer the following	
	(i)	Give classification of Protozoan parasites with examples.	07
	(ii)	Describe the life cycle, pathogenicity and diagnosis of <i>Trichomonas vaginalis</i> .	07
		OR	
	(i)	Describe pathogenic effect of various protozoan parasites in humans.	07
	(ii)	Discuss the life cycle, pathogenicity and diagnosis of <i>Trypanosoma gambiense</i> .	07
	(B)	MCQ / SQ (Any Four out of Six)	04
	(i)	What is parasitology?	
	(ii)	Name the diagnostic method for <i>Giardia intestinalis</i> .	
	(iii)	Name the infective stage of <i>Leishmania donovani</i> .	
	(iv)	How will you treat amoebiasis?	
	(v)	Name the different forms of <i>Entamoeba histolytica</i>	
	(vi)	Name the different species of Plasmodia.	
Q-3	(A)	Write the following	
	(i)	Describe the life cycle of <i>Clonorchis sinensis</i> .	07
	(ii)	Discuss the laboratory diagnosis and prophylaxis of <i>Schistosoma mansoni</i> .	07
		OR	
	(i)	Describe the life cycle of <i>Taenia solium</i> .	07
	(ii)	Discuss the pathogenicity and prophylaxis of <i>Diphyllobothrium latum</i> .	07
	(B)	MCQ / SQ (Any Three out of Five)	03
	(i)	What is Fascioliasis?	
	(ii)	Give scientific name of lung fluke.	
	(iii)	Define the term: Strobila.	
	(iv)	Give examples of monoecious and diecious parasites.	
	(v)	What is hyatid cyst?	
Q-4	(A)	Write the following	
	(i)	Describe the life cycle of <i>Ascaris lumbricoides</i> .	07
	(ii)	Explain the role of vectors in parasitology.	07
		OR	
	(i)	Describe the life cycle of <i>Loa loa</i> .	07
	(ii)	Write a note on the pathogenicity and laboratory diagnosis of <i>Trichinella spiralis</i> .	07
	(B)	MCQ / SQ (Any Three out of Five)	03
	(i)	Give names of viviparous parasites.	
	(ii)	Name the parasite that causes river blindness.	
	(iii)	Which disease is transmitted by Tsetse fly?	
	(iv)	What is Microfilariae?	
	(v)	What is pathogenicity of <i>Strongyloides stercoralis</i> .	

M.Sc. (Sem.-1) Examination

403

Electronics Paper-III

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

- Instructions:** (1) Attempt All Questions.
 (2) All questions carry equal marks.
 (3) Symbols and terminology have their usual meanings.
 (4) Scientific calculator may be permitted.

- Question 1 (A) Write the following
- (i) What is a sample and hold circuit? Why is it needed? Discuss briefly. 07
- (ii) What is an instrumentation amplifier? Explain it briefly using transducer bridge briefly. Write three applications of it. 07
- OR
- (i) With necessary circuit diagram, explain the working of the ON/OFF temperature controller designed using LM339. 07
- (ii) Using necessary circuit and pin diagrams of LM380, discuss working of power amplifier briefly. State its applications also. 07
- Question 1 (B) MCQs (Any Four out of Six) 04
- (i) What do you mean by peak detector?
- (ii) Draw the circuit diagram of low voltage DC voltmeter.
- (iii) Define charge amplifier.
- (iv) What is rectifier? How many types of rectifier?
- (v) What determines the peak frequency f_p in the peaking amplifier?
- (vi) What is IC311 level detector?
- Question 2 (A) Write the following
- (i) What is the difference between the sawtooth wave and the triangular wave? Explain briefly sawtooth wave generator. 07
- (ii) Give pin diagram of IC9400. Discuss the use of it in Frequency to Voltage converter and state its design and calibration method. 07
- OR
- (i) Draw the circuit diagram of a triangular wave generator using OPAMP and explain its working. Derive the expression of its peak to peak amplitude of output voltage and frequency of oscillations. 07
- (ii) Draw the circuit diagram of Wien bridge oscillator using OPAMP and explain its working. Derive the expression for its frequency of oscillations. 07
- Question 2 (B) MCQs (Any Four out of Six) 04
- (i) Design a phase shift oscillator for $f_0 = 200\text{Hz}$. [Chose $C_1 = 0.1\mu\text{F}$].
- (ii) What is quadrature oscillator?
- (iii) Define: Video Controlled Oscillator (VCO).
- (iv) Give applications of voltage to frequency converter.

M837-2

- (v) Write two applications of VCO.
(vi) What is an oscillator?
- Question 3 (A) Write the following
(i) Draw circuit and explain operation of second order active Butterworth filter. Also give its frequency response.. 07
(ii) With circuit diagram explain one application of all pass filter. 07
OR
(i) With necessary circuit diagram, explain application of analog computation. 07
(ii) Design a second order bandpass filter using opamp for a gain of 25 and pass band from 5 KHz to 15 KHz. Draw its frequency response. 07
- Question 3 (B) MCQs (Any Three out of Five) 03
(i) Name two filters based on polynomials.
(ii) Draw the circuit of notch filter.
(iii) State the roll off in case of second order filter.
(iv) Give response of first order HPF.
(v) Active BPF has pass band between 2 KHz & 20 KHz. What is phase difference between input and output at 10 KHz?
(vi)
- Question 4 (A)
(i) Write a note on tone controls and their applications. 07
(ii) Give circuit diagram of IC3900 and explain its working. 07
OR
(i) Draw the circuit diagram of LM 733 and explain its application. 07
(ii) Draw the circuit diagram of RCA 3040 and explain its applications. 07
- Question 4 (B) MCQs (Any Three out of Five) 03
I. What is the meaning of BASS & TREBLE?
II. Give two disadvantages on Norton amplifier.
III. Give equation of Norton amplifier in inverting configuration.
IV. Write two advantages of FET input stage.
V. Give two advantages of Norton Amplifier.

0703M837(3)

Candidate's Seat No : _____

M.Sc. (Sem.-1) Examination

403

Electronics Paper-III (New)

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

- Instructions:** (1) Attempt All Questions.
(2) All questions carry equal marks.
(3) Symbols and terminology have their usual meanings.
(4) Scientific calculator may be permitted.

- Question 1 (A) Write the following
- (i) What is a comparator? Differentiate basic comparator and the Schmitt trigger. List the important characteristics of the comparator. 07
- (ii) What is a voltage limiter and why is it needed? Define a window detector. 07
- OR
- (i) With necessary circuit diagram, explain the working of the ON/OFF temperature controller designed using LM339. 07
- (ii) Using necessary circuit and pin diagrams of LM380, discuss working of power amplifier briefly. State its applications also. 07
- Question 1 (B) MCQs (Any Four out of Six) 04
- (i) State important characteristics of comparator.
- (ii) Draw the circuit of zero-crossing detector using OPAMP.
- (iii) State specifications of IC μ AF311.
- (iv) What is a window detector?
- (v) Write applications of IC μ A311 comparator.
- (vi) What is frequency of oscillator (f_0)?
- Question 2 (A) Write the following
- (i) What is the difference between the sawtooth wave and the triangular wave? Explain briefly sawtooth wave generator. 07
- (ii) Give pin diagram of IC9400. Discuss the use of it in Frequency to Voltage converter and state its design and calibration method. 07
- OR
- (i) Draw the circuit diagram of a triangular wave generator using OPAMP and explain its working. Derive the expression of its peak to peak amplitude of output voltage and frequency of oscillations. 07
- (ii) Draw the circuit diagram of Wien bridge oscillator using OPAMP and explain its working. Derive the expression for its frequency of oscillations. 07
- Question 2 (B) MCQs (Any Four out of Six) 04
- (i) Design a phase shift oscillator for $f_0 = 200\text{Hz}$. [Chose $C_1 = 0.1\mu\text{F}$].
- (ii) What is quadrature oscillator?
- (iii) Define: Video Controlled Oscillator (VCO).
- (iv) Give applications of voltage to frequency converter.

P.T.O.

- (v) Write two applications of VCO.
 - (vi) What is an oscillator?
- Question 3 (A) (i) Write a detailed note on MF-5. 07
- (ii) Draw circuit and explain working of narrow band reject filter. 07
- OR
- (i) Give detailed classification of filters and name their uses. 07
- (ii) Design a second order bandpass filter using opamp for a gain of 25 and pass band from 5 KHz to 15 KHz. Draw its frequency response. 07
- Question 3 (B) MCQs (Any Three out of Five) 03
- (i) State two applications of all pass filters.
- (ii) Draw the circuit of all pass active filter.
- (iii) State the roll off in case of first order filter.
- (iv) Give internal block diagram of FLT U2.
- (v) Active BPF has pass band between 2 KHz & 20 KHz. What is phase difference between input and output at 10 KHz?
- Question 4 (A)
- (i) Write a note on tone controls and their applications. 07
- (ii) Give circuit diagram of IC3900 and explain its working. 07
- OR
- (i) Draw the circuit diagram of LM 733 and explain its application. 07
- (ii) Draw the circuit diagram of RCA 3040 and explain its applications. 07
- Question 4 (B) MCQs (Any Three out of Five) 03
- I. What is the meaning of BASS & TREBLE?
- II. Give two disadvantages on Norton amplifier.
- III. Give equation of Norton amplifier in inverting configuration.
- IV. Write two advantages of FET input stage.
- V. Give two advantages of Norton Amplifier.

Instructions:

All questions are compulsory.

Illustrate your answers with neat diagrams wherever necessary.

- 1 (A) Answer in Detail:**
- Explain the Molecular recognition process in Eukaryotic Cell. [07]
 - Give detailed comparison regarding Ultra structural aspect of Prokaryotic and Eukaryotic Cell. [07]
- OR
- Explain the Molecular basis of Cell Physiology. [07]
 - Describe the Molecular Mechanism of Cell Division. [07]
- 1 (B) Answer in Short: (Any Three)** [03]
- Explain "Tetrahedral Structure of Water".
 - Discuss "*Omni e Cellula e Cellula*".
 - Mention the significance of diaster formation.
 - Explain: Diplotene
 - Mention the role of 'Tight Junction'.
- 2 (A) Answer in Detail:**
- Write an account on molecular anatomy of Plasma Membrane with special reference to Proteins and Lipids. [07]
 - Give an account on Cytoskeleton component predominantly made up with Tubulin Protein. [07]
- OR
- Describe the Passive Transport of micro-molecules through Plasma Membrane. [07]
 - Give an account on Intermediate Filament. [07]
- 2 (B) Answer in Short: (Any Four)** [04]
- Write equation of Fick's Law.
 - What is the importance of Glycocalyx in Plasma Membrane?
 - What is the difference between 'Unit Membrane Model' and 'Sandwich Model' of Plasma Membrane?
 - Which Cytoskeleton component visualization required high-voltage Electron Microscope?
 - What is the diameter of Microfilament?
 - Which Cytoskeleton component is very important for Cytokinesis?
- 3 (A) Answer in Detail:**
- Discuss in detail about F_0-F_1 Particle with diagram. [07]
 - Write a detailed note on: C_4 Pathway [07]
- OR
- Write detail account on Fractionation and Enzymatic Compartmentalization of Mitochondria. [07]
 - Give a detailed account on: Light Reaction [07]

3 (B) **Answer in Short: (Any Three)**

[03]

- i) Who coined the term 'Mitochondria'?
- ii) Write about chemical composition of Mitochondrial Membranes.
- iii) What are the structurally different types of Cristae observed in Mitochondria? Give any two examples.
- iv) What are Carotenoids?
- v) Define: Photosynthesis

4 (A) **Answer in Detail:**

- i) Explain in detail Composition of Ribosome.
- ii) Explain Peroxisomes in detail.

[07]

[07]

OR

- i) Write a note on Functions of Golgi Complex.
- ii) Give a detailed account on: Lysosomes

[07]

[07]

4 (B) **Answer in Short: (Any Four)**

[04]

- i) Define: Phagocytosis
- ii) Enlist name of Enzymes present in Acrosome.
- iii) Give full form of GlcNAc.
- iv) What is the result of ERS?
- v) What is the fate of Clathrin Coated Vesicles?
- vi) How Proteins are targeted to Lysosome?

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2/13

0703M839

Candidate's Seat No : _____

M.Sc. (Sem.-1) Examination
403

Polymer Science Paper-III

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

Q.1	(A)	Write the following.	
	i	How reinforcements are classified? Explain in brief about nature fiber used in polymer composite.	07
	ii	What are essential properties necessary for resin to use in composite? Explain epoxy resin used in polymer composites.	07
		OR	
	i	Discuss in detail the different types of matrices used in FRP. Explain the role of adhesion promoters in FRP.	07
	ii	Explain the role of Mold Release Agent in FRP. Discuss in detail the different types of reinforcements used in FRP.	07
Q.1	(B)	Any Four out of six (Answer in one or two lines only)	
	i	What is fiber optics made of?	01
	ii	Is low attenuation a sign of good quality in optical fiber?	01
	iii	Is fiber safe?	01
	iv	Parachutes are generally made from which fibers?	01
	v	The fiber which resemble wool are known as _____	01
	vi	What is the basic different between natural and synthetic fiber.	01
Q.2	(A)	Write the following.	
	i	Give graphical representation chart for Polymer-matrix composites process.	07
	ii	What is FRP? Explain any three method to prepare with desire application in detail	07
		OR	
	i	Explain the manufacturing process for carbon fibers with neat diagram	07
	ii	Give description of Kevlar & Aramid fiber properties used in different application.	07
Q.2	(B)	Any Four out of six (Answer in one or two lines only)	
	i	Which synthetic fibers has most excellent insulating properties	01
	ii	What is the difference between catalyst & initiator?	01
	iii	Why orientation is too important while preparing a product?	01
	iv	Can natural fibers be used for engg application?	01
	v	What do you mean by Nano fiber?	01
	vi	Name any two natural fiber having excellent tensile modulus	01
Q.3	(A)	Write the following.	
	i	What is the primary function of a fiber surface treatment? Discuss what surface treatment is given to glass fibers, aramid fibers and carbon fibers.	07
	ii	What is spinning? What the difference between wet spinning & dry spinning.	07
		OR	

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M839-2

	i	Brief the outline manufacturing process of Basalt & Boron fibers.	07
	ii	Describe any three thermoset resin chemistry with properties & application.	07
Q.3	(B)	Any Three out of five (Answer in one or two lines only)	
	i	What kind of fibers widely used in defense & aerospace application?	01
	ii	Name two suitable initiators used to prepare epoxy & polyester thermoset at room temperature.	01
	iii	What you mean by quartz fibers?	01
	iv	What product can be manufactured from Filament winding, pultrusion, vacuum bagging and sheet molding processes?	01
	v	Name best suitable fibers for thermal expansion/HDT properties.	01
Q.4	(A)	Write the following.	
	i	What is Resin Transfer molding? Explain what types of product is manufactured for desired application.	07
	ii	What are the different methods for surface preparation to improve bond strength in case of composites?	07
		OR	
	i	What are polymer nano composites? Classify polymer nano composites on the basic of number of dimensions.	07
	ii	Write down the selection criteria of thermoplastic & thermoset resins with appropriate fibers for marine, aerospace and defense application.	07
Q.4	(B)	Any Three out of five (Answer in one or two lines only)	
	i	What are starting monomers PEEK, Polyimide & aromatic polyamide?	01
	ii	What is the method to remove pot voids/air bubble in composites?	01
	iii	Do UHMWPE fiber can replace aramid fibers.	01
	iv	On what basis will you select fibers for any x,y,z properties.	01
	v	_____ fibers which is composed of the minerals plagioclase, pyroxene, and olivine.	01

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Time : 2-30 Hours]

- Q-1 (A)(i) State Bloch function and discuss Kronig-Penney model in detail. (7)
- (ii) Discuss origin of the energy gap and magnitude of the energy gap. (7)

OR

- Q-1 (A)(i) Explain crystal momentum of an electron and also discuss solution of central equation. (7)
- (ii) Discuss empty lattice approximation in detail for simple cubic lattice. (7)
- Q-1(B) Answer in brief **Any four** questions from the following: (Each question is of **one** mark). (4)

- (i) What do you mean by 1st Brillouin zone?
- (ii) In case of empty lattice approximation, how many number of low lying bands in FCC lattice?
- (iii) What do you mean by degeneracy?
- (iv) Each primitive cell contributes exactly one independent value of k to each energy bands. [TRUE/FALSE]
- (v) How many independent orbitals in each energy bands?
- (vi) A crystal can be an insulator only if the number of valance electrons in a primitive cell of crystal is a odd integer. [TRUE/FALSE]

- Q-2(A)(i) State the three different zone schemes with necessary figure and explain any one of them in detail. (7)
- (ii) Discuss the construction of Fermi surface in 2D. (7)

OR

- Q-2 (A)(i) Discuss quantization of orbits in a magnetic field. (7)
- (ii) Write short note on de-Haas-Van-Alphen effect. (7)
- Q-2 (B) Answer in brief **Any four** questions from the following: (Each question is of **one** mark). (4)

- (i) What do you mean by magnetic breakdown?
- (ii) A Fermi surface is the surface in k space of constant energy equal to ϵ_F . [TRUE/FALSE]

(iii) Define extremal orbit.

(iv) What do you mean by open orbit?

(v) Define Fermi surface.

(vi) In case of nearly free electrons, the crystal potential will not round out sharp corners in the Fermi surface. [TRUE/FALSE]

Q-3 (A)(i) Draw circuit diagram of a direct coupled Class A power amplifier and explain its working. Show that its maximum theoretical conversion efficiency is 25 %. (7)

(ii) Write short notes on: (a) Cross over distortion. (7)
(b) Class AB power amplifier.

OR

Q-3 (A)(i) Draw circuit diagram of Schmitt trigger using transistors and explain its working. (7)

(ii) What are multivibrators? What are its types? Explain clearly how they are different in their operation. (7)

An astable multivibrator is operated with supply voltage, $V_{CC} = 12 \text{ V}$. Determine the value of capacitors to use to provide a symmetrical oscillation of 50 kHz if $R_1 = R_2 = 4.7 \text{ k}\Omega$.

Q-3(B) Answer in brief Any Three questions from the following: (Each question is of one mark). (3)

(i) List the main properties of Class B power amplifier.

(ii) What is harmonic distortion.

(iii) What is the function of input transformer in a push-pull amplifier?

(iv) What is the maximum conversion efficiency of an idealized class B push pull power amplifier?

Q-4 (A)(i) Draw an analog computer circuit to solve the following equations: (7)

$$X - 4Y = 6.$$

$$3X - 2Y = 5.$$

Indicate where voltmeters should be connected to read the solutions.

(ii) Explain application of operational amplifier as Differential bridge amplifier. (7)

OR

- Q-4 (A)(i) Describe application of operational amplifier as: (7)
1. Integrator
 2. Differentiator
- (ii) Write a short note on: Frequency compensation in operational amplifier. (7)

Q-4 (B) Answer in brief **Any Three** questions from the following: (Each question is of **one** mark). (3)

- (i) What is virtual ground?
- (ii) Give circuit diagram of a voltage follower.
- (iii) Draw circuit diagram of current to voltage converter using op-amp?
- (iv) Explain the terms 'inverting terminal' and 'non-inverting terminal' as applied to an op-amp.

M.Sc. (Sem.-1) Examination

404

Chemistry Paper-4

Time : 2-30 Hours]

March 2019

[Max. Marks : 70

Que-1 [A] Explain qualitative and quantitative analysis in analytical science and write short note on confidence interval. [14]

OR

Que-1 [A] (I) Explain accuracy and precision and discuss in brief ways to express Accuracy-precision. [7]

Que-1 [A] (II) You are developing a new colorimetric method for determine the glucose. you have chosen the standard Folin-wu method with which to compare your results. Calculate the variance of your method differs significantly from that of the standard method. The tabulated F value is 4.95
Your method(mg/dl) : 127,125,123,130,131,126,129
Folin-wu method (mg/dl) : 130,128,131,129,127,125 [7]

Que-1 [B] Give short answers of any Four in following. [4]

- (1) What is standard deviation?
- (2) What do you understand by validation?
- (3) What is determinate error?
- (4) Give full form of QA and QC.
- (5) Indicate which zeros are significant in 0.060700 value.
- (6) Define Limit Of Detection.

Que-2 [A] Discuss the general steps involved in sample preparation and write short note Calibration curve. [14]

OR

Que-2 [A] (I) Write a brief note on the use of internal standards and standard addition technique with an illustration. [7]

Que-2 [A] (II) Describe the method of least square regression for finding the best straight line. [7]

Que-2 [B] Give short answers of any Four in following. [4]

- (1) How can you calibrate pipette?
- (2) Define : Normality
- (3) What is Sampling?
- (4) What does the value of correlation coefficient, $r=0$ suggest?
- (5) What is molality?
- (6) What are millimoles?

Que-3 [A] Explain: The photometric accuracy using Ringbom plot and discuss the various components of visible spectrophotometer. [14]

OR

Que-3 [A] (I) Derive Lambert-Beer's law and explain the logarithmic relation between Transmittance and Concentration. [7]

Que-3 [A] (II) Discuss Optical Rotatory Dispersion and Circular Dichroism. [7]

Que-3 [B] Give short answers of any Three in following. [3]

- (1) Give units for absorbance and molar absorptivity.
- (2) Explain monochromatic light.
- (3) Give significance of Ringbom plot.
- (4) Give one limitation of Beer-Lambert's law.
- (5) Write name of monochromator.

Que-4 [A] Explain various types of photometric titrations and analysis of a mixture with resolved and unresolved spectra. [14]

OR

Que-4 [A] (I) Discuss Job's method of continuous variation for determining the composition of a complex. [7]

Que-4 [A] (II) Explain the measurement of an equilibrium constant using Scatchard plot. [7]

Que-4 [B] Give short answers of any Three in following. [3]

- (1) Explain in brief 'Vibrational spectra'
- (2) Name any two detectors used in spectrophotometry.
- (3) State any two applications of spectrophotometry.
- (4) What is photometric titration?
- (5) Define: Wavelength.

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2/33

0803M861

Candidate's Seat No : _____

M.Sc. (Sem.-1) Examination
404

Botany Paper-4
March 2019

[Max. Marks : 70

Time : 2-30 Hours]

Note: Draw the diagram where ever required.

- Q. 1 A Explain: Origin, cultivation and uses of plants as fuel 14
OR
- Q. 1 Write Short Notes
- A I Oil Yielding Plants 07
- A II Fiber Yielding Plants 07
- Q. 1 B Short questions (Any 4 out of 6) 04
- I Name any two world centers of primary diversity of domesticated plants.
- II Give the scientific names and family of any two plants used for flavouring.
- III Give the full form of NAFED
- IV What is supply chain Management?
- V Explain Crop Residue Utilization.
- VI Define: Phyto resources.
- Q. 2 A Explain Traditional Plant use and Management for sustainable development. 14
OR
- Q. 2 Write Short Notes
- A I Traditional knowledge for drugs 07
- A II Gene and Seed bank 07
- Q. 2 B Short questions (Any 4 out of 6) 04
- I Give the full form of NIF and its functions.
- II Give the scientific names and families of any two medicinal plants.
- III What is *in-situ* conservation in ethnobotany?
- IV Explain the role of IUCN in one line.
- V What is a voucher specimen?
- VI What is TK?
- Q. 3 A Give the characteristics and biosynthetic pathways of secondary metabolites. 14
OR
- Q. 3 Write Short Notes
- A I Secondary metabolites 07
- A II Instruments required in phytochemical laboratory 07

M861-2

- Q. 3 B Short questions (Any 3 out of 5) 03
- I What is Quality Control?
 - II What are adulterants?
 - III Give the active principles of Ginger and Vinca.
 - IV What are phytochemicals?
 - V Name any two Research Institutes in the field of Phytochemistry in Gujarat.
- Q. 4 A Give the classification of Dye-Yielding Plants with examples. Explain any one process of making dye. 14
- OR
- Q. 4 Write Short Notes
- A I Non-Wood Forest Products. 07
 - A II Social Forestry 07
- Q. 4 B Short questions (Any 3 out of 5) 03
- I Name any two resin yielding plants with their scientific names, family and plant part used.
 - II What is carbon sequestration?
 - III What is the main role of Biosphere Reserve?
 - IV Name any two Sanctuaries of India.
 - V Name any two National Parks in India.

X ————— X

Time : 2-30 Hours]

Q – 1 (A) Describe nutrient transport mechanism found in prokaryotic cell with suitable examples. (14)

OR

Q – 1 (A)

- (1) Explain signal transduction with any one example. (7)
- (2) Describe mechanisms involved in drug resistance against beta lactam ring containing antibiotics. (7)

Q – 1 (B) Attempt **any four** of the followings in brief. (4)

- (1) What is bioluminescence?
- (2) Define – quorum sensing?
- (3) What do you mean by bacterial differentiation?
- (4) Define - drug resistance.
- (5) What do you mean by two-component system?
- (6) Write difference between endo- and exocytosis?

Q – 2 (A) Discuss the bacterial growth with reference to batch culture. (14)

OR

Q – 2 (A)

- (1) Discuss methods used to obtain synchronous growth. (7)
- (2) Discuss the influence of temperature on microbial growth. (7)

Q – 2 (B) Attempt **any four** of the followings in brief. (4)

- (1) What is VBNC?
- (2) Explain - Cryptic growth.
- (3) What is A_w ?
- (4) Define – generation time.
- (5) Petroff-Hausser Counter.
- (6) What do you mean by diauxic growth?

Q – 3 (A) What is antigen presentation? Explain the pathways of the same. (14)

OR

Q – 3 (A)

- (1) Write in detail on the structure of class – II MHC. (7)
- (2) Write in details of groups of cytokines with their functions. (7)

Q – 3 (B) Attempt **any three** of the followings in brief. (3)

- (1) Draw a figure of human chromosome -6 containing genes for MHCs.
- (2) Write in brief on cytochines.
- (3) Write any two differences between class – I and class – II MHCs.
- (4) Draw a labelled figure of MHC-I.
- (5) Write on the role of invariant chain (Ii) during antigen presentation

Q – 4 (A) What is monoclonal antibodies? Explain the technology to produce the same. (14)

OR

Q – 4 (A)

- (1) What is immunological tolerance? Describe theories for the same. (7)
- (2) Define AIDS and describe the structure of its causative agent in detail. (7)

Q – 4 (B) Attempt **any three** of the followings in brief. (3)

- (1) Define Anergy.
- (2) What is horror autotoxicus?
- (3) Write in brief on low level autoimmunity.
- (4) Define Tolerance.
- (5) What is HLA typing?

α ——— χ ——— χ

2/53
2153

0803M863

Candidate's Seat No : _____

M.Sc. (Sem.-1) Examination

404

Mathematics Paper-4

March 2019

[Max. Marks : 70]

Time : 2-30 Hours]

Q. 1(A) Answer the following questions.

[14]

(1) Solve the equation $y'' - 5y' + 6y = 0$.

(2) Solve the equation $(1 - x^2)y'' - 2xy' + p(p + 1)y = 0$ near $x = 0$.

OR

(1) Solve the equation $y'' + 4y = 0$.

(2) Solve the equation $(1 + x^2)y'' + 2xy' - 2y = 0$ near $x = 0$.

(B) Attempt any Four.

[04]

(1) Define the radius of the convergence of the series $\sum_{n=0}^{\infty} a_n x^n$.

(2) When we say that the function f is analytic at the point x_0 ?

(3) Give a powers series of the kind $\sum_{n=0}^{\infty} a_n x^n$ whose radius of convergence is $\frac{1}{3}$.

(4) Find the general solution of the equation $y'' = 0$.

(5) Prove or disprove: The set of functions $\{x, e^x\}$ is linearly independent over \mathbb{R} .

(6) True or false: If f is analytic at x_0 , f is infinitely differentiable at x_0 .

Q. 2(A) Answer the following questions.

[14]

(1) Define regular singular points by two illustrations.

(2) Solve the equation $2x^2y'' + x(2x + 1)y' - y = 0$ near $x = 0$.

OR

(1) Define irregular singular points by two illustrations.

(2) Show that the equation $x^2y'' - 3xy' + (4x + 4)y = 0$ has only one Frobenius series solution. Find it.

(B) Attempt any Four.

[04]

(1) What is the difference between the power series and the Frobenius series?

(2) State (only) Gauss' Hypergeometric equation. Why this equation is called 'Hyper Geometric'?

(3) Define the hypergeometric function $F(a, b, c, x)$.

(4) Show that $(1 + x)^p = F(-p, b, b, -x)$.

(5) When do we say that $x = \infty$ is an ordinary point of the equation $y'' + P(x)y' + Q(x)y = 0$?

(6) Define the exponents of the equation $y'' + P(x)y' + Q(x)y = 0$ at the regular singular point $x = 0$.

P. T. O.

Q. 3(A) Answer the following questions.

[14]

- (1) State and prove the Rodrigue's formula for $P_n(x)$.
- (2) State and prove the mini-max property of Chebyshev polynomials.

OR

- (1) State and prove the orthogonality of polynomials $P_n(x)$ over $[-1, 1]$.
- (2) Define the Hermite polynomials. Find first four Hermite polynomials.

(B) Attempt any Three.

[03]

- (1) Prove that $P_n(-1) = (-1)^n$.
- (2) Show that $P_n(x)$ is an odd function if n is odd.
- (3) Can we have a Legendre polynomial $P_n(x)$ such that $P_n(k) = 0$ for all $k \in \mathbb{Z}$? Justify.
- (4) State (only) the Least square approximation result.
- (5) Find the first three terms of the Legendre series of the function $f(x) = e^x$.

Q. 4(A) Answer the following questions.

[14]

- (1) Define the Bessel function $J_p(x)$. Show that $J_{\frac{7}{2}}(x)$ is an elementary function.
- (2) State (without proof) Picard's theorem. By an example, show that the continuity of $\frac{\partial f}{\partial y}$ cannot be omitted from the statement.

OR

- (1) Find the values of $r!$ for $r = \frac{1}{2}, \frac{3}{2}, \frac{5}{2}$.
- (2) Solve the IVP: $y' = -y, y(0) = 3$ by successive approximation method.

(B) Attempt any Three.

[03]

- (1) Define the elementary function and special function.
- (2) Show that between any two positive zeros of $J_0(x)$ there is a zero of $J_1(x)$.
- (3) True or false: $f(x, y) = xy$ satisfies the Lipschitz condition in the variable y on the whole space \mathbb{R}^2 .
- (4) Show that $f(x) = x$ and $g(x) = \sin x$ are linearly independent on \mathbb{R} .
- (5) Find the differential equation satisfied by the one parameter family of curves $x^2 + y^2 = a^2$ (a is parameter).

6/33

6/33

0803M864

Candidate's Seat No : _____

M.Sc. (Sem.-1) Examination

404 New

Statistics Paper-4

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

Note: Attempt all questions.

Q.1(A)

- (i) Explain fixed relative standard error method for the determination of sample size. [07]
(ii) Explain the Lahiri's method of drawing a varying probability sample. [07]

OR

- (i) Explain the method of determination of sample size when $E(L)$ is specified. [07]
(ii) Explain cost aspect method for the determination of sample size. [07]
(B) Answer any four [04]
(i) What do you understand by confidence interval?
(ii) What do you mean by permissible error?
(iii) How many distinct samples of size 3 can be drawn without replacement from the population (1,2,3,4,5) of 5 units? Also, give samples.
(iv) Give one disadvantage of cumulative total method.
(v) Define PPS sampling.
(vi) Give one advantage of PPS sampling.

Q.2 (A)

- (i) Show that stratified ppswr sampling is always more efficient than unstratified pps sampling when the allocation is proportional to X_s . [07]
(ii) Show that linearity of regression is not a sufficient condition for pps sampling to be better than srs. [07]

OR

- (i) In sampling with unequal probabilities, wor, a sample of size 2 is drawn. The first unit is selected with pps and the second with pps of the remaining units. Show that Yates and Grundy's variance estimator is always positive for this sampling system. [07]
(ii) Discuss Des Raj's estimator. [07]

M 864-2

(B) Answer any four

[04]

(i) Give one disadvantage of PPS sampling.

(ii) What do you understand by an ordered estimator?

(iii) In Sen-Midzuno method of selecting a sample of size n units out of N units, we select first unit with pps and the remaining $(n-1)$ units from $(N-1)$ units of the population by

(a) stratified sampling

(b) simple random sampling, wor

(c) systematic sampling

(d) none of the above.

(iv) In Sen-Midzuno method π_{ij} is given by -----.

(v) In usual notations $\sum_{j(\neq i)=1}^N (\pi_{ij} - \pi_i \pi_j)$ is equal to

(a) $-\pi_i(1-\pi_i)$

(b) $\pi_i(1-\pi_i)$

(c) $-\pi_i(2-\pi_i)$

(d) none of the above.

(vi) In usual notations $\sum_{j(\neq i)=1}^N \pi_{ij}$ is equal to

(a) $(n-1)\pi_i$

(b) $(n+1)\pi_i$

(c) $(n+2)\pi_i$

(d) none of the above.

Q.3 (A)

(i) Suggest an unbiased estimator of population mean when a sample of n clusters of equal size is selected with srswr. Derive its variance and also obtain unbiased estimator of this variance. [07]

(ii) Suppose n fsu's are selected with PPSWR and from each selected fsu, m ssu's are selected with SRSWOR. Give an unbiased estimator of the population total Y and derive its sampling variance. Also, obtain an unbiased estimator of this variance. [07]

OR

(i) In usual notations show that $E = \frac{1}{1+(M-1)\rho_c}$ in cluster sampling. [07]

(ii) Suggest an unbiased estimator of population total in two-stage sampling. Obtain its variance using SRSWR at first stage and SRSWOR at second stage. Also, obtain an unbiased estimator of this variance. [07]

(B) Answer any three

[03]

- (i) Define cluster sampling.
- (ii) Give one advantage of cluster sampling.
- (iii) In usual notations ρ_c lies in the range $\{-1/(M-1)\}$ to 1.
(a) True (b) False
- (iv) Define two-stage sampling.
- (v) Give one disadvantage of two-stage sampling.

Q.4 (A)

- (i) Obtain the expressions for bias and variance of the ratio estimator in case of simple random sampling with replacement. [07]
- (ii) Discuss separate and combined regression estimators. [07]

OR

- (i) Obtain the expressions for bias and variance of the ratio estimator in case of systematic sampling. [07]
 - (ii) Discuss separate and combined ratio estimators. [07]
- (B) Answer any three [03]
- (i) Define ratio estimator.
 - (ii) Give a situation where ratio estimator could be used.
 - (iii) The ratio estimators are generally unbiased and consistent.
(a) True (b) False.
 - (iv) Define regression estimator.
 - (v) Give a situation where regression estimator could be used.

0803M864(4)

Candidate's Seat No : _____

M.Sc. (Sem.-1) Examination

404

Statistics Paper-4 (Old)

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

Note: Attempt all questions.

Q.1(A)

- (i) Explain fixed relative standard error method for the determination of sample size. [07]
- (ii) Explain the method of determination of sample size when Prob.($L \leq d$) is specified. [07]

OR

- (i) Explain Stein's method for the determination of sample size. [07]
- (ii) Explain cost aspect method for the determination of sample size. [07]

(B) Answer any four [04]

- (i) What do you mean by permissible error?
- (ii) What do you understand by confidence interval?
- (iii) How many distinct samples of size 2 can be drawn without replacement from the population (1,2,3,4,5,6) of 6 units?
- (iv) Define PPS sampling.
- (v) Give one advantage of PPS sampling.
- (vi) Give one disadvantage of cumulative total method.

Q.2 (A)

- (i) Explain the Lahiri's method of drawing a varying probability sample. [07]
- (ii) If in a sample of three units, drawn with ppswr, only two units are distinct, show that the estimators (i) $\frac{1}{3} \left(\frac{y_1}{p_1} + \frac{y_2}{p_2} + \frac{y_1 + y_2}{p_1 + p_2} \right)$ and (ii) $\frac{y_1}{1 - (1 - p_1)^3} + \frac{y_2}{1 - (1 - p_2)^3}$ are unbiased for the population total Y. If the size measure used for selection is approximately proportional to \bar{y} , state, giving reasons, which of the two estimators you would prefer. [07]

M864-5

OR

- (i) Show that stratified ppswr sampling is always more efficient than unstratified pps sampling when the allocation is proportional to X_s . [07]
- (ii) In sampling with unequal probabilities, wor, a sample of size 2 is drawn. The first unit is selected with pps and the second with pps of the remaining units. Show that Yates and Grundy's variance estimator is always positive for this sampling system. [07]

(B) Answer any four [04]

- (i) Give one disadvantage of PPS sampling.
- (ii) What do you understand by an unordered estimator?
- (iii) In Sen-Midzuno method of selecting a sample of size n units out of N units, we select first unit with pps and the remaining $(n-1)$ units from $(N-1)$ units of the population by
(a) stratified sampling (b) simple random sampling, wor
(c) systematic sampling (d) none of the above.
- (iv) In Sen-Midzuno method π_{ij} is given by -----.
- (v) Des Raj's estimator is an unordered estimator.
(a) True (b) False
- (vi) In usual notations $\sum_{j(\neq i)=1}^N \pi_{ij}$ is equal to
(a) $(n-1)\pi_i$ (b) $(n+1)\pi_i$ (c) $(n+2)\pi_i$ (d) none of the above.

Q.3 (A)

- (i) In usual notations show that $E = \frac{1}{1+(M-1)\rho_c}$ in cluster sampling. [07]
- (ii) Suggest an unbiased estimator of population total in two-stage sampling. Obtain its variance using SRSWOR at both the stages. Also, obtain an unbiased estimator of this variance. [07]

OR

- (i) Suggest an unbiased estimator of population mean when a sample of n clusters of unequal size is selected with srswor. Derive its variance as a function of intraclass correlation coefficient ρ_c and also obtain unbiased estimator of this variance. [07]
- (ii) Suggest an unbiased estimator of population total in two-stage sampling. Obtain its variance using SRSWR at both the stages. Also, obtain an unbiased estimator of this variance. [07]

(B) Answer any three

[03]

- (i) Define cluster sampling.
- (ii) Give one advantage of cluster sampling.
- (iii) Give a situation where cluster sampling could be used.
- (iv) Define two-stage sampling.
- (v) Give one disadvantage of two-stage sampling.

Q.4 (A)

- (i) Obtain the expressions for bias and variance of the ratio estimator in case of ppswr. [07]
- (ii) Discuss unbiased ratio type estimators. [07]

OR

- (i) Discuss almost unbiased ratio estimators. [07]
 - (ii) Discuss separate and combined regression estimators. [07]
- (B) Answer any three [03]

- (i) Give a situation where ratio estimator could be used.
- (ii) In usual notations, to the first order of approximation, the ratio estimator is unbiased.
 - (a) True (b) False
- (iii) The ratio estimators are generally unbiased and consistent.
 - (a) True (b) False
- (iv) Define regression estimator.
- (v) If the regression of y on x is perfectly linear then the variance of regression estimate is:
 - (a) zero (b) one (c) between zero and one (d) none of the above.

NB: All questions are compulsory. Illustrate your answers with neat diagrams wherever necessary.		
Q-1	(A)	Answer the following
	(i)	Describe structure and function of haemoglobin. 07
	(ii)	Explain types of granulocytes and their function. 07
		OR
	(i)	Write a note on ESR and PCV. 07
	(ii)	Explain structure and function of platelets. 07
	(B)	MCQ / SQ (Any Four out of Six) 04
	(i)	What is erythroblastosis foetalis.
	(ii)	Define fetal haemoglobin.
	(iii)	What is osmotic fragility?
	(iv)	Write full form of MCHC.
	(v)	What is hemostasis?
	(vi)	What is RDW?
Q-2	(A)	Answer the following
	(i)	Describe blood coagulation factors and intrinsic pathway. 07
	(ii)	Describe clot lysis and factors affecting it. 07
		OR
	(i)	Laboratory tests for coagulation. 07
	(ii)	Describe various diseases of WBC, platelets and RBC. 07
	(B)	MCQ / SQ (Any Four out of Six) 04
	(i)	What is hemolysis?
	(ii)	What are the various shapes of RBC? Mention any four.
	(iii)	Where does hemopoiesis occur?
	(iv)	Write the blood group antigens present on RBCs.
	(v)	Which clotting factor deficiency leads to hemophilia?
	(vi)	Explain mechanism of action of EDTA as an anticoagulant.
Q-3	(A)	Write the following
	(i)	Discuss the etiology and symptoms of Haemolytic Anaemia. 07
	(ii)	Describe giving details: Sickle cell Anaemia. 07
		OR
	(i)	Write a note on AML. 07
	(ii)	What is Hemophilia? Explain in detail. 07
	(B)	MCQ / SQ (Any Three out of Five) 03
	(i)	Give name of nutritional anaemia.
	(ii)	Any two lab tests for Hemolysis.
	(iii)	Mention lab tests for iron deficiency anemia.
	(iv)	What happens in case of severe vitamin B 12 deficiency?
	(v)	Briefly explain the cause for B-Thalassemia.
Q-4	(A)	Write the following
	(i)	Describe cross matching in blood bank. 07
	(ii)	Hb electrophoresis. 07
		OR
	(i)	Discuss in detail Blood donation criteria. 07
	(ii)	Various blood transmitted diseases. 07
	(B)	MCQ / SQ (Any Three out of Five) 03
	(i)	Name various blood components prepared in a blood bank.
	(ii)	What is Coomb's test?
	(iii)	Mention any 2 adverse effects of blood transfusion.
	(iv)	What is Bombay blood type?
	(v)	What is the storage temperature for platelets concentration in a blood bank?

Time : 2-30 Hours]

Q – 1 (A) Discuss various mechanisms of drug resistance with appropriate examples. (14)

OR

Q – 1 (A)

(1) What is signal transduction? Explain it with any one example. (7)

(2) Explain bacterial differentiations with reference to bacterial endospores. (7)

Q – 1 (B) Attempt **any four** of the followings in brief. (4)

(1) Explain – Active transport.

(2) Enlist target sites of action of antibiotics.

(3) Differentiate between endo- and exocytosis.

(4) Write on bioluminescence.

(5) What are membrane proteins?

(6) Write on two-component system.

Q – 2 (A) Discuss the bacterial growth with reference to continuous culture. (14)

OR

Q – 2 (A)

(1) Discuss the influence of oxygen on microbial growth. (7)

(2) Discuss indirect methods used for measurement of microbial growth (7)

Q – 2 (B) Attempt **any four** of the followings in brief. (4)

(1) What do you mean by diauxic growth?

(2) What is AW?

(3) Define – synchronous growth of bacteria.

(4) Write on VBNC.

(5) Enlist methods for measurement of bacterial growth.

(6) What is cardinal temperature?

Q – 3 (A) Write a detailed note on structure and functions of MHCs. (14)

OR

Q – 3 (A)

(1) Differentiate between MHC – I and MHC – II. (7)

(2) Write a note on cytokine bias in some human diseases. (7)

Q - 3 (B) Attempt any three of the followings in brief.

(3)

- (1) Write in brief on cytokines.
- (2) Role of invariant chain (Ii).
- (3) Enlist different groups of cytokines.
- (4) Write on the cell involved in exogenous pathway of antigen presentation.
- (5) What is endogenous antigen presentation?

Q - 4 (A) What is immunodeficiency? Describe AIDS in detail.

(14)

OR

Q - 4 (A)

- (1) Give an overview of some autoimmune diseases.
- (2) What are monoclonal antibodies? Explain its uses.

(7)

(7)

Q - 4 (B) Attempt any three of the followings in brief.

(3)

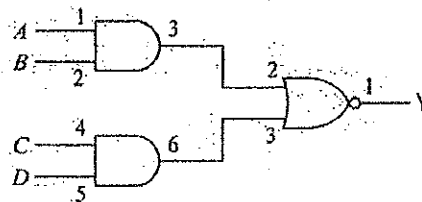
- (1) Define myeloma cell.
- (2) What is Hybridoma technology?
- (3) What is horror autotoxicus?
- (4) What is transplantation?
- (5) Which medium is generally used for Hybridoma technology?

x ————— x ————— T

- 1 (A) Write the following
- (i) Design and discuss BCD to Decimal code converter for decimal numbers D6 to D9 using universal gates. 07
- (ii) Explain the working of Mod-5 counter using JK flip-flops. Draw appropriate waveforms and truth table. 07

OR

- (i) Write the Verilog code for given circuit using Dataflow model and Behavioral model. 07



- (ii) Explain the working of Mod-6 counter drawing necessary circuit diagram, waveforms and truth table. 07
- (B) Answer the following (Any Four out of Six): 04
- 1 Draw the circuit diagram of a mod-3 counter.
 - 2 In the syntax $m'tn$ of input variables in Verilog HDL the variable ' m ' represents, ' t ' represents and ' n ' represents.....
 - 3 In Behavioral modeling the procedural statements following keyword is executed only if any variable within sensitivity list changes its value.
 - 4 The symbol for bit wise Ex-OR operation is
 - 5 technique is used to reduce indicator power requirements in displays.
 - 6 Relational VHDL operator for 'Not equal to' operation is

- 2 (A) Write the following
- (i) Discuss the design of 1 Hz generator using (a) IC-555, and (b) IC-5369. 07
- (ii) Discuss the design of frequency counter drawing necessary block diagram. 07

OR

- (i) Write the VHDL program for a 4 bit ripple carry adder using gate level and data flow model. 07
- (ii) Drawing necessary block diagram, discuss the design of time base circuit to obtain 1 MHz, 100 kHz, 10 kHz, 1 kHz, 100 Hz, 10Hz, 1 Hz, 0.1 Hz, 0.01 Hz. 07
- (B) Answer the following (Any Four out of Six) 04
- 1 Draw a circuit to generate 1 Hz clock using IC-4521.
 - 2 Draw a circuit to generate 1 Hz clock using IC-4060.
 - 3 Draw a circuit to generate 1 Hz clock from AC mains.
 - 4 If we divide the 60-Hz power source by 600, we get wave form at interval of seconds.
 - 5 Using data flow model the carry output of full adder $Sum = A \oplus B \oplus C$ is represented by assign statement
 - 6 Draw a basic block diagram of time period measurement set up.

- 3 (A) Write the following
- (i) A binary number is stored in memory location BINBYT. Convert the number into BCD, and store each BCD as unpacked BCD digits in the Output Buffer. Write a main program and two subroutines: One to supply the powers of ten, and the other to perform the conversion. 07
- (ii) A set of three packed BCD numbers are stored at XX60H. The seven-segment codes of the digits 0 to 9 for a common cathode LED are stored at XX70H, and the Output-Buffer is at XX90H. Write a program & two subroutines, called UNPAK and LEDCOD, to unpack the BCD numbers & select an seven-segment code for each digit. The codes should be stored in the Output-Buffer memory. 07

OR

- (i) A set of ten packed BCD numbers is stored in memory location starting at XX30H. 07
1. Write a program with a subroutine to add these numbers in BCD. If a carry is generated, save it in register B, & adjust it for BCD. The final sum will be less than 9999_{BCD} .
 2. Write a second subroutine to unpack the BCD sum stored in registers A & B, and store them in the output-buffer memory starting at XX40 H. The most significant digit (BCD_4) should be stored at XX40H, and the least significant digit (BCD_1) at XX43H.
- (ii) A multiplicand is in XX20H & multiplier in XX21H. Write program: 1. Transfer the Two numbers from memory locations to HL registers. 2. Store product at XX70H. Write subroutine (1) Multiply two unsigned numbers placed in H & L. (2) Return the result into the HL pair. 07
- (B) Answer the following (Any Three out of Five) 03
- 1 XCHG exchanges the contents of HL with _____.
 - 2 SPHL copies HL register into the _____.
 - 3 _____ instruction adds memory contents with carry.
 - 4 Instruction _____ adds immediate 8-bit data with carry.
 - 5 Full form of SIM instruction is _____.

- 4 (A) Write the following
- (i) List the major sections of the 8279 keyboard/display interface, & explain their functions. 07
- (ii) Draw the pin diagram of 8155 and explain control word of IC 8155. 07

OR

- (i) Explain BSR mode and I/O mode of 8255 with the help of control word. 07
- (ii) Draw the pin diagram and explain each block of 8259A in detail. 07
- (B) Answer the following (Any Three out of Five) 03
- 1 The IC 8155 has _____ bit port C.
 - 2 The IC 8279, has two major segments: Keyboard and _____.
 - 3 In IC 8255, if bit $D_7 =$ _____, port C operates in the I/O mode.
 - 4 The 8253 is programmable _____ timer.
 - 5 In 8259 IMR stands for _____.

M.Sc. (Sem.-1) Examination

404

Electronics Paper-4 (Old)

March 2019

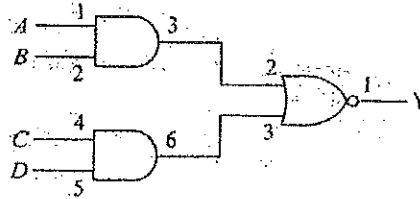
Time : 2-30 Hours]

[Max. Marks : 70

- 1 (A) Write the following
- (i) Explain the working of Mod-5 counter using JK flip-flops. Draw appropriate waveforms and truth table. 07
- (ii) Design and discuss BCD to Decimal code converter for decimal numbers D6 to D9 using universal gates. 07

OR

- (i) Write the Verilog code for given circuit using Dataflow model and Behavioral model. 07



- (ii) Explain the working of Mod-6 counter drawing necessary circuit diagram, waveforms and truth table. 07
- (B) Answer the following (Any Four out of Six): 04
- 1 Relational VHDL operator for 'Not equal to' operation is
 - 2 In the syntax $m'n$ of input variables in Verilog HDL the variable ' m ' represents, ' n ' represents and ' n ' represents.....
 - 3 In Behavioral modeling the procedural statements following keyword is executed only if any variable within sensitivity list changes its value.
 - 4 The symbol for bit wise Ex-OR operation is
 - 5 technique is used to reduce indicator power requirements in displays.
 - 6 Draw the circuit diagram of a mod-3 counter.
- 2 (A) Write the following
- (i) Discuss the design of frequency counter drawing necessary block diagram. 07
- (ii) Discuss the design of 1 Hz generator using (a) IC-555, and (b) IC-5369. 07
- OR
- (i) Write the VHDL program for a 4 bit ripple carry adder using gate level and data flow model. 07
- (ii) Drawing necessary block diagram, discuss the design of time base circuit to obtain 1 MHz, 100 kHz, 10 kHz, 1 kHz, 100 Hz, 10Hz, 1 Hz, 0.1 Hz, 0.01 Hz. 07
- (B) Answer the following (Any Four out of Six) 04
- 1 Draw a circuit to generate 1 Hz clock using IC-4521.
 - 2 Draw a circuit to generate 1 Hz clock using IC-4060.
 - 3 Draw a circuit to generate 1 Hz clock from AC mains.
 - 4 If we divide the 60-Hz power source by 600, we get wave form at interval of seconds.
 - 5 Using data flow model the carry output of full adder $\text{Sum} = A \oplus B \oplus C$ is represented by assign statement
 - 6 Draw a basic block diagram of time period measurement set up.

M867-4

- 3 (A) Write the following
- (i) Draw and explain with block diagram of the 8085 interrupts and their vectored memory locations. 07
 - (ii) Draw and explain the block diagram of Typical Modem device and discuss Modulation Techniques. 07
- OR**
- (i) With the help of block diagram of IC 8259 & explain each block in detail. 07
 - (ii) Explain the types of Communication Systems, Transmissions Standards and Serial Transmission Format. 07
- (B) Answer the following (Any Three out of Five) 03
- 1 _____ is bit 7 of SIM Instruction.
 - 2 _____ is bit 3 of RIM Instruction.
 - 3 In IC 8259 IRR stands for _____.
 - 4 EOI in IC 8259 stands for _____.
 - 5 Define : Full Duplex
- 4 (A) Write the following
- (i) Draw the pin configuration of IC 8251. With block diagram explain IC 8251 in detail. 07
 - (ii) With the help of block diagram explain IC 8253 in detail. Explain its control word format. 07
- OR**
- (i) With block diagram explain 8155 in detail and explain its timer loading format & modes. 07
 - (ii) Draw Pin diagram of 8253 & explain each pin. Give the list of different modes of operation. 07
- (B) Answer the following (Any Three out of Five) 03
- 1 IC 8251 has in total _____ pins.
 - 2 The IC 8155 has _____ bit port C.
 - 3 IC 8155 includes _____ bytes of R/W memory.
 - 4 The IC 8253 is programmable _____ timer.
 - 5 In IC 8253, to select BCD bit no D₀ should be _____.

✕ ————— ✕

M.Sc. (Sem.-1) Examination

404

Polymer Science Paper-4

Time : 2-30 Hours]

March 2019

[Max. Marks : 70

Sr.No.	Questions	Marks
Q.1(A)	(i) Define the Biopolymers and give their Classification? (ii) Explain the Hydroxylation (ring opening) process of vegetable oil with suitable reactions? or (i) Discuss about the Structural hierarchy and its importance for Polypeptides? (ii) Discuss about present scenario of industries based on Biopolymers in India and abroad?	7+7
Q.1(B)	Short Questions (any four out of six)(Answer in one or two line) (i) Give the name of Nitrogenous bases present in DNA (ii) Write Two difference between RNA and DNA (iii) Define Compostable polymers (iv) Write Two example of polymers derived from Oils and fats (v) Define the peptide bonding	4
Q2(A)	(i) Write the properties and dissolution of cellulose .How regenerated cellulose can be useful? (ii) Write the Properties and use of hemicelluloses and their derivatives in brief? or (i) Give the actual market importance and future chances of Chitin & Chitosan? (ii) Write the Chemical structure, Sources and extraction of chitin?	7+7
Q.2.(B)	Short Questions (any four out of six)(Answer in one or two line) (i) Structural Difference between Cellulose and hemicellulose (ii) Write the name of Monomers of cellulose (iii) Which type of Bonding is present in between two monomer of chitin (iv) Difference between chitin and chitosan (v) Give the Name of most abundant biopolymer found in nature.	4
Q.3.(A)	(i) Write the Production methods for Polylactides in detail ? (ii) Write Properties of PLA blends & their biomedical applications ? or (i) Explain the biosynthesis of Poly hydroxyalkanoates, and their application? (ii) Write the Properties & applications of polyhydroxyalkanoates blends ?	7+7
Q.3.(B)	Short Questions (any three out of five)(Answer in one or two line) (i) What is Tg value for PLA (ii) Write the Two biomedical application of PLA (iii) Example of biodegradable aliphatic polyester (iv) What are the Methanotrophic Bacteria	3

Q.4(A)	(i) Write short notes on Natural fibres as a filler in thermoplastics ? (ii) Explain the organic recycling compared to mechanical recycling? or (i) Explain the different processing methods (Extrusion and Injection moulding) for biopolymer? (ii) Discuss about the Biobased films for Food packaging applications?	7+7
Q.4(B)	Short Questions (any three out of five)(Answer in one or two line) (i) Give the two biomedical application of biopolymer (ii) Define Creep property for biopolymer (iii) Define dynamic mechanical properties for biopolymer (iv) Write the materials used in of edible films used for packaging (v) Why biopolymer is safe for environment (write two reason)?	3