ALLIED COURSES FOR OTHER DEPARTMENT STUDENTS

Course code:	Allied - IA	T/P	C	H/W
22BMAA1	ANCILLARY MATHEMATICS - I	T	3	3

Objectives	➢ To learn the basic concepts and problem solving in differential equations ➢ To explore trigonometry as a tool in solving problems.
Unit -I	Matrices – Characteristic Equation and Cayley - Hamilton Theorem (Proof not included) – Finding the inverse of a matrix using Cayley – Hamilton Theorem – Eigen values and Eigen vectors.
Unit-II	Equations of the first order but of Higher Degree – Equations solvable for dy/dx – Equations solvable y, x – Clairaut's form – Linear equations with constant coefficients – Finding the complementary function and particular integral of the type e^{ax} cosax sinax.
Unit- III	Differential Calculus – Successive Differentiation – n^{th} derivative of standard functions (Derivation not needed) problems – Leibnitz formula for the n^{th} derivative of a product (proof not needed) simple problems only – Curvature and Radius of Curvature in Cartesian coordinates only – problems.
Unit- IV	Integral Calculus – Integration by Parts – Bernoulli's formula – Definite integrals – Properties – problems.
Unit- V	Trigonometry : Expression for $\sin n\theta$, $\cos n\theta$ and $\tan n\theta$, $\sin^n\theta$, $\cos^n\theta$ (n being a +ve integer) Expansion of $\sin\theta$, $\cos\theta$, $\tan\theta$ in powers of θ (only problems in all the above)

Reference and Textbooks

Arumugam, S., & Thangapandi Isaac, A. (2002). *Ancillary Mathematics Paper I (Revised)*. Palayamkottai: New Gamma Publishing House

Arumugam, S., & ThangapandiIssac, A. (2003). *Modern Algebra*. Chennai: Scitech Publications.

Narayanan, S., & ManickavachagomPillay, T. K. (2006). *Calculus.* (Volume I). S.Viswanathan (Printers & Publishers) Pvt. Ltd.

Narayanan, S., & ManickavachagomPillay, T. K. (2014). *Calculus.* (Volume II). S.Viswanathan (Printers & Publishers) Pvt. Ltd.

Narayanan, S., & ManickavachagomPillay, T. K. (2015). *Differential Equations and its Applications*. S.Viswanathan (Publishers & Printers) Pvt. Ltd.

Outcomes	Students will be able to ➢ Develop the ability of solving the integrals ➢ Understand the applications of differentiation

Course Code 22BMAAP1	Allied - IA	T/P	C	H/W
	Practical	**P**	**2**	**2**
ANCILLARY MATHEMATICS - I				
Q1. Find the rank of a 3 into 3 matrix. Q2. Finding inverse of a given matrix using Cayley- Hamilton Theorem. Q3. Finding complementary functions and particular integral of given differential equations with right hand side consisting of exponential, trigonometry and algebraic function and its combinations. Q4. Finding nth derivative of a product of functions using Leibnitz formula. Q5. Finding Integration by parts two or more times using Bernoulli's formula. Q6. Express $\sin^m\theta\cos^n\theta$ in terms of either $\sin\theta$ or $\cos\theta$.				

Course Designed by

<table>
<tr><td rowspan="2">Course code: 22BMAA2</td><td colspan="2">Allied - IB</td><td>T/P</td><td>C</td><td>H/W</td></tr>
<tr><td colspan="2">ANCILLARY MATHEMATICS - II</td><td>T</td><td>3</td><td>3</td></tr>
<tr><td>Objectives</td><td colspan="5">➢ To learn vector differentiation and vector integration
➢ To solve differential equations.</td></tr>
<tr><td>Unit -I</td><td colspan="5">Vector Calculus – Vector Differentiation – Gradient – Divergence – Curl – Properties – Results.</td></tr>
<tr><td>Unit-II</td><td colspan="5">Linear equations with constant coefficients with Right hand side of the from e^{ax} v where v is any function of x – x^m (a power of x) m being a positive integer – Linear equations with variable coefficients (Homogeneous Differential Equations only).</td></tr>
<tr><td>Unit -III</td><td colspan="5">Fourier Series – Definition – Fourier Series Expansion of Periodic Functions with Period 2π – Even and Odd functions – Half range Fourier Series – Problems.</td></tr>
<tr><td>Unit- IV</td><td colspan="5">Interpolation – Newton's Interpolation formula – Central Difference Interpolation formulae – Lagrange's interpolation formulae.</td></tr>
<tr><td>Unit- V</td><td colspan="5">Correlation – Rank Correlation – Regression lines and Regression coefficients.</td></tr>
</table>

Reference and Textbooks

Arumugam. S., & Thangapandi Issac,A. (2006). *Analytical Geometry of Three Dimensions and Vector Calculus*. Palayamkottai: New Gamma Publishing House.

Arumugam, S., & Thangapandi Issac, A. (2007). *Statistics.* Palayamkottai: New Gamma Publishing House.

Arumugam, S., Thangapandi Issac, A., & Somasundaram, A. (2013). *Numerical Analysis with Programming in C*. Palayamkottai: New Gamma Publishing House.

Narayanan, S., & ManicavachagomPillay, T. K. (2014). *Calculus* (Vol. III). S.Viswanathan Printers & Publishers.

Narayanan, S., & ManicavachagomPillay, T. K. (2015). *Differential Equations and its Applications*. S.Viswanathan (Printers and Publishers) Pvt. Ltd.

<table>
<tr><td>Outcomes</td><td>Students will be able to
➢ Understand the need and importance of statistical analysis in their major subjects.
➢ Acquire the knowledge of fourier series.</td></tr>
</table>

Course Designed by

<table>
<tr><td rowspan="2">Course Code
22BMAAP2</td><td>Allied - IB</td><td>T/P</td><td>C</td><td>H/W</td></tr>
<tr><td>Practical</td><td>P</td><td>2</td><td>2</td></tr>
<tr><td colspan="5">ANCILLARY MATHEMATICS - II</td></tr>
<tr><td colspan="5">Q1. Finding Gradient of a given scalar Point function.
Q2. Finding Divergence of a given vector Point function.
Q3. Finding Curl of a given vector Point function.
Q4. Solving a given homogeneous differential equation.
Q5. Finding Fourier series expansions for a given periodic functions.
Q6. Finding Half range Fourier series expansions for a given periodic functions.
Q7. Finding interpolation using Newton’s interpolation formula for a given data.
Q8. Finding interpolation using Central difference interpolation formula for a given data.
Q9. Finding Rank correlation for a given data.
Q10. Finding regression co- efficient and Regression lines for a given data.</td></tr>
</table>

Course Designed by

<table>
<tr><td rowspan="2">Course code:
22BMAA3</td><td colspan="2">Allied - IIA</td><td>T/P</td><td>C</td><td>H/W</td></tr>
<tr><td colspan="2">ANCILLARY MATHEMATICS - III</td><td>T</td><td>3</td><td>3</td></tr>
<tr><td>Objectives</td><td colspan="5">➢ To learn the partial differential equations
➢ To enrich the knowledge in multiple integrals.</td></tr>
<tr><td>Unit -I</td><td colspan="5">Partial Differential Equations – Formation of Partial Differential Equations by eliminating arbitrary constants and arbitrary functions – Complete, Particular, Singular and General integral.</td></tr>
<tr><td>Unit-II</td><td colspan="5">Solving Lagrange’s linear equation Pp + Qq = R - Solution of equations of Standard types f(p, q) = 0, z = px + qy +f (p, q), f(z, p, q) = 0, $f_1(x, p) = f_2(y,q)$.</td></tr>
<tr><td>Unit III</td><td colspan="5">Laplace Transform – Definition – Laplace transform of some Standard Functions –Problems – Inverse Laplace Transform – Standard formulae – problems.</td></tr>
<tr><td>Unit IV</td><td colspan="5">Numerical Differentiation – Derivatives using Newton’s Forward Difference formula – Derivatives using Newton’s Backward Difference formula – Derivatives using Newton’s Central difference formula – Maxima and Minima of the interpolating polynomial.</td></tr>
<tr><td>Unit V</td><td colspan="5">Beta and Gamma functions – Relations between them – Evaluation of multiple integrals using Beta and Gamma functions.</td></tr>
<tr><td colspan="6">Reference and Textbooks
Arumugam, S., Thangapandi Issac, A., & Somasundara, A. (2013). Numerical Analysis with Programming in C. Palayamkottai: New Gamma Publishing House.
Arumugam, S., & Thangapandi Issac, A. (2014). Differential Equations and Applications. Palayamkottai: New Gamma Publishing House.
Narayanan, S., & ManicavachagomPillay, T. K. (2014). Calculus. (Vol. II). S.Viswanathan (Printers & Publishers) Pvt. Ltd.</td></tr>
<tr><td>Outcomes</td><td colspan="5">Students will be able to
➢ Understand a way to solve problems quickly and easily
➢ Acquire knowledge to transform ordinary differential equations in to algebraic equations.</td></tr>
</table>

Course Designed by

<table>
<tr><td rowspan="2">Course Code
22BMAAP3</td><td>Allied - IIA</td><td>T/P</td><td>C</td><td>H/W</td></tr>
<tr><td>Practical</td><td>P</td><td>2</td><td>2</td></tr>
<tr><td colspan="5">ANCILLARY MATHEMATICS - III</td></tr>
<tr><td colspan="5">Q1. Solving differential equations of the form Pp +Qq = R, using Lagrange's method.
Q2. Solving differential equations using Charpit's method.
Q3. Solving differential equations using Laplace transform.
Q4. Finding integration using Beta and Gamma functions.
Q5. Finding multiple integrals of a given function.</td></tr>
</table>

Course Designed by

<table>
<tr><td colspan="2" rowspan="2">Course code:
22BMAA4</td><td>Allied - IIB</td><td>T/P</td><td>C</td><td>H/W</td></tr>
<tr><td>OPTIMIZATION TECHNIQUES</td><td>T</td><td>3</td><td>3</td></tr>
<tr><td>Objectives</td><td colspan="5">➢ To introduce the fundamental concepts of LPP
➢ To Study the concept of Simplex method and Transportation problem.</td></tr>
<tr><td>Unit -I</td><td colspan="5">Origin and Development of O.R. – Definition of O.R. – Linear Programming – Mathematical formulation – Graphical method – Problems.</td></tr>
<tr><td>Unit-II</td><td colspan="5">Simplex method using Slack and Surplus variables.</td></tr>
<tr><td>Unit- III</td><td colspan="5">Transportation Problem – Definition – Finding initial basic feasible solution by North – West Corner rule – Least Cost method – Vogel's Approximation method.</td></tr>
<tr><td>Unit -IV</td><td colspan="5">Assignment problem – Definition – Finding optimal solution by using Hungarian method.</td></tr>
<tr><td>Unit -V</td><td colspan="5">Sequencing Problem – Processing n jobs through two machines – Processing n jobs through K machines – Problems.</td></tr>
<tr><td colspan="6">Textbook
Swarup, K., Gupta, P.K., & Mohan, M. (2008). Operations Research (14th Ed.). New Delhi: Sultan Chand & Sons Publishers.
Reference Book
Gupta, P. K., & Hira, D.S. (2004). Operations Research (2nd edition). New Delhi: S.Chand & Co.</td></tr>
<tr><td>Outcomes</td><td colspan="5">Students will be able to
➢ Develop the skills in decision making
➢ Equip the students in solving real time problems.</td></tr>
</table>

Course Code 22BMAAP4	Allied - IIB	T/P	C	H/W
	Practical	**P**	**2**	**2**
OPTIMIZATION TECHNIQUES				
Q1. Solving a given linear programming problem using graphical method. Q2. Solving a given linear programming problem using Simplex method. Q3. Finding OBFS for a given transportation problem. Q4. Finding OBFS for a given assignment problem. Q5. Finding the Sequence of jobs using the given data.				

Instructions for all four practical

Tutor's Guide

- All the Questions can be solved by applying the concepts through the pen and paper mode. (Solving through computer is not necessary for these papers, but if students are interested then they can do on their own).
- Practice at least three problems for all questions in the observation notebook.
- Write exactly one problem for all questions from the observation notebook with your own choice from the three.

Guide to write the record notebook

- For all Questions write the algorithm (if any) of the method used, graphs (if any) in the right hand side page of the record notebook; solution of particular problem in the left hand side page of the record notebook.
- Write the objective of the problem first, then write the basic concepts involved in that problem, then write the algorithm used, as said in the previous point, finally write the solution as result.

Course Designed by

ALLIED COURSES FOR MATHEMATICS DEPARTMENT STUDENTS

<table>
<tr><td rowspan="2">Course code:
22BMAA5</td><td>Allied - IA</td><td>T/P</td><td>C</td><td>H/W</td></tr>
<tr><td>STATISTICS – I</td><td>T</td><td>3</td><td>3</td></tr>
<tr><td>Objectives</td><td colspan="4">➢ To extend and formalize knowledge of the theory of probability.
➢ To introduce the notation of regression and time series analysis.</td></tr>
<tr><td>Unit -I</td><td colspan="4">Central Tendencies – Introduction – Arithmetic Mean – Partition Values – Mode – Geometric Mean and Harmonic Mean – Measures of Dispersion.</td></tr>
<tr><td>Unit-II</td><td colspan="4">Moments – Skewness and Kurtosis – Curve fitting – Principle of least squares.</td></tr>
<tr><td>Unit- III</td><td colspan="4">Correlation – Rank correlation Regression – Correlation Coefficient for a Bivariate Frequency Distribution.</td></tr>
<tr><td>Unit- IV</td><td colspan="4">Interpolation – Finite Differences – Newton's Formula – Lagrange's Formula – Attributes – Consistency of Data – Independence and Association of Data.</td></tr>
<tr><td>Unit- V</td><td colspan="4">Index Numbers – Consumer Price Index Numbers – Analysis of Time series – Time series – Components of a Time series – Measurement of Trends.</td></tr>
<tr><td colspan="5">Textbook
Arumugam, S., & ThangapandiIssac, A. (2015). Statistics. Palayamkottai: New Gamma Publishing House.

Reference Books
Gupta, S.C., & Kapoor, V. K. (2002). Fundamentals of Mathematical Statistics. New Delhi: Sultan Chand &Sons Pvt. Ltd.
Pillai, R.S.N., & Bagavathi. (2007). Statistics: Theory and Practice. New Delhi: S.Chand and Company Pvt. Ltd.</td></tr>
<tr><td>Outcomes</td><td colspan="4">Students will be able to
➢ Understand Moments, Skewness and Kurtosis.
➢ Calculate the correlation coefficient for the given data.
➢ Compute Rank correlation for the given data.</td></tr>
</table>

Course Designed by

Course Code: 22BMAAP5	Allied - IA	T/P	C	H/W
	Practical	P	2	2

STATISTICS – I

1. From the following table showing the wage distribution in a certain factory determine:
   i. The mean wages
   ii. The median wages
   iii. The modal wages
   iv. The wage limits for 50% of the earners
   v. The percentages of workers who earned between Rs. 75 and Rs. 125
   vi. The percentages of workers who earned more than Rs. 150 per week, and
   vii. The percentages of workers who earned less than Rs. 100 per week

Weekly Wages (Rs.)	20-40	40-60	60-80	80-100	100-120	120-140	140-160	160-180	180-200
No. of Employees	8	12	20	30	40	35	18	7	5

2. The following table gives the frequency distribution of marks in a class of 65 students

Marks	0-4	4-8	8-12	12-14	14-18	18-20	20-25	25 and over
No. of Students	10	12	18	7	5	3	4	6

   Calculate: (i) Upper and lower quartiles
   (ii) Number of students who secured marks more than 17
   (iii) Number of students who secured marks between 10 and 15

3. Find the second, third and fourth central moments of the frequency distribution given below. Hence find the measure of skewness (γ_1) and measure of kurtosis(γ_2).

Class limits	110.0-114.9	115.0-119.9	120.0-124.9	125.0-129.9	130.0-134.9	135.0-139.9	140.0-144.9
Frequency	5	15	20	35	10	10	5

4. In calculating the moments of a frequency distribution based on 100 observations, the following results are obtained:
   Mean = 9, Variance = 19, $\beta_1 = 0.7$ $\beta_2 = 4$
   But later on it was found that one observation 12 was read as 21. Obtain the correct values of first central moments, β_1 and β_2.

5. If X_1 and X_2 are independent normal variates and U and V are defined by $U = X_1 \cos \alpha + X_2 \sin \alpha$ and $V = X_2 \cos \alpha - X_1 \sin \alpha$, show that the correlation

coefficient ρ between U and V is given by $\rho^2 = 1 - \frac{4\sigma_1^2\sigma_2^2}{4\sigma_1^2\sigma_2^2+(\sigma_1^2-\sigma_2^2)\sin^2 2\alpha}$, where σ_1^2 and σ_2^2 are variances of X_1 and X_2 respectively.

6. If $U = aX + bY$ and $V = bX - aY$, show that U and V are uncorrelated if $\frac{ab}{a^2-b^2} = \frac{\rho\sigma_X\sigma_Y}{\sigma_X^2-\sigma_Y^2}$, where ρ is the correlation co-efficient of *X* and *Y*. Show further that in this case
$\sigma_U^2 + \sigma_V^2 = (a^2 + b^2)(\sigma_X^2 + \sigma_Y^2)$ and $\sigma_U\sigma_V = (a^2 + b^2)\sigma_X\sigma_Y\sqrt{1-\rho^2}$.

7. The coefficient of rank correlation between the marks obtained by 10 students in Mathematics and Statistics was found to be 0.5. It was discovered that the difference in ranks in two subjects obtained by one student was wrongly taken as 3 instead of 7. Find the correct coefficient of rank correlation.

8. If d_i be the difference in the ranks of the i^{th} individual in two different characteristics then show that the maximum value of $\sum_{i=1}^{n} d_i^2$ is $\frac{1}{3}(n^3 - n)$. Hence or otherwise, show that rank correlation coefficient lies between -1 and 1.

9. Twenty five pairs of values of variants X and Y led to the following results:
$N = 25,\ \sum X = 127,\ \sum Y = 100,\ \sum X^2 = 760,\ \sum Y^2 = 449$ and $\sum XY = 500$.
A subsequent scrutiny showed that two pairs of values were copied down as (8, 14) and (8, 6) instead of (8, 12) and (6, 8),
   i. Obtain the correct value of the correlation coefficient.
   ii. Hence or otherwise, find the correct question of the two lines of regression.
   iii. Find the angle between the regression lines.

10. In a university examination, which was indeed very tough, 50% at least failed in Statistics, 75% at least in Topology, 82% at least in Functional Analysis and 96% at least in Measure theory. How many at least failed in all the four?

11. Given that *(A)=(B)=(C)= ½ N=50* and *(AB)=30, (AC)=25*, find the limits within which *(BC)* will lie.

12. Prove that if *n* is an integer, then $(x\Delta)^{(n)}u_x = (x + n - 1)^{(n)}\Delta^{n}u_x$.

<table>
<tr><td rowspan="2">Course code:
22BMAA6</td><td>Allied - IB</td><td>T/P</td><td>C</td><td>H/W</td></tr>
<tr><td>STATISTICS – II</td><td>T</td><td>3</td><td>3</td></tr>
<tr><td>Objectives</td><td colspan="4">➢ To study the concepts of random variable and some special distributions.
➢ To inculcate the concepts of the sampling distribution and hypothesis testing.</td></tr>
<tr><td>Unit -I</td><td colspan="4">Probability – Conditional Probability – Random variables – Discrete Random Variable – Continuous Random Variable – Mathematical Expectations – Moment Generating Function – Characteristic function.</td></tr>
<tr><td>Unit-II</td><td colspan="4">Some Special Distributions – Binomial Distribution – Poisson Distribution – Normal Distribution – Gamma Distribution – Chi-Square Distribution – Student’s t-Distribution – Snedecor’s F- Distribution.</td></tr>
<tr><td>Unit- III</td><td colspan="4">Tests of Significance of large samples – Sampling – Sampling Distribution – Testing of Hypothesis – Procedure for Testing of Hypothesis for large samples – Tests of Significance for large samples.</td></tr>
<tr><td>Unit- IV</td><td colspan="4">Tests of Significance based on ‘t’ Distribution – Test of Significance based on F-Test – Test for Significance of an Observed sample correlation.</td></tr>
<tr><td>Unit -V</td><td colspan="4">Test based on Chi - Square Distribution – Chi - Square Test for Population variance – Chi - Square Test – To test the Goodness of fit – Test for Independence of Attributes – Analysis of Variance – One Criterion of Classification – Two Criteria of Classification.</td></tr>
<tr><td colspan="5">Textbook
Arumugam, S., & Thangapandi Isaac, A. (2015).Statistics. Palayamkottai: New Gamma Publishing House.
Reference Books
Gupta, S.C., & Kapoor, V.K. (2002). Fundamentals of Mathematical Statistics. New Delhi: Sultan Chand &Sons Pvt. Ltd.
Pillai, R.S.N., & Bagavathi. (2007). Statistics: Theory and Practice. New Delhi: S.Chand & Co. Pvt. Ltd.</td></tr>
<tr><td>Outcomes</td><td colspan="4">Students will be able to
➢ Compute expectations, moments and correlation coefficients.
➢ Acquire knowledge of discrete and continuous distributions and their properties</td></tr>
</table>

Course Code	Allied - IIB	T/P	C	H/W
22BMAAP6	Practical	P	2	2

STATISTICS – II

1. (a) A perfect cube is thrown a larger number of times in the sets of 8. The occurrence of a 2 or 4 is called a success. In what proportion of the sets would you expect 3 successes.
   (b) In eight throws of a die, 5 or 6 is considered a success. Find the mean number of successes and the standard deviation.
   (c) A man tosses a fair coin 10 times. Find the probability that he will have
      (i) heads on the first five tosses and tails on the next five tosses
      (ii) heads on tosses 1,3,5,7,9 and tails on tosses 2,4,6,8,10
      (iii) 5 heads and 5 tails
      (iv) at least 5 heads
      (v) not more than 5 heads.
2. If the probability of hitting a target is 1/5 and if 10 shots are fired, what is the conditional probability of the target being hit at least twice assuming that at least one hit is already scored?
3. (a) If the number of claims per policyholder is the sum of the number of claims under each of his two policies, state with reasons how the number of claims per policyholder, within that group and over that period is distributed, and
   (b) Calculate to the nearest whole number, the percentage of policyholders within that group and over that period who made more household claims than motor claims.
4. Suppose that a radio tube is inserted into a socket and tested. Assume that the probability that it tests positive equals P and the probability that it tests negative is (l-P). Assume furthermore that we are testing large supply of such tubes. The testing continues until the first positive tube appears. If X is the number of tests required to terminate the experiment, what is the probability distribution of X?
5. Suppose that the number of telephone calls that an operator receives from 9.00 to 9.05 hours in a day follows a Poison distribution with mean 3. Find the probability that
      (i) The operator will receive no calls in that time interval tomorrow,
      (ii) In the next three days the operator will receive a total of 1 call in that time interval.
6. In a box there are 4 granite stones, 5 sand stones and 6 bricks of identical size and shape. Out of them 3 are chosen at random. Find the chance that :
      (i) They all belong to different varieties.
      (ii) They all belong to the same variety.
      (ii) They are all granite stones.
7. (a) A bag contains 10 balls, two of which are red, three blue and five black. Three balls are drawn at random from the bag, that is every ball has an equal chance of being included in the three. What is the probability that
      (i) the three balls are of different colours,
      (ii) two balls are of the same colour, and
      (iii) the balls are all of the same colour?
   (b) A is one of six horses entered for a race and is to be ridden by one of the two jockeys B and C. It is 2 to 1 that B rides A, in which case all the horses are equally likely to win, with rider C, A's chance is trebled.
      (i) Find the probability that A wins.
      (ii) What are odds against A's winning?

8. (a) Three points are taken at random on the circumference of a circle. Find the chance that they lie on the same semi-circle.
   (b) A chord is drawn at random in a given circle. What is the probability that it is greater than the side of an equilateral triangle inscribed in that circle?
   (c) Show that the probability of choosing two points randomly from a line segment of length 2 inches and their being at a distance of at least 1 inch from each other is 1/4.
9. (a) A and B throw with one die for a stake of Rs. 44 which is to be won by the player who first throws a 6. If A has the first throw, what are their respective expectations?
   (b) A contractor has to choose between two jobs. The first promises a profit of Rs.1,20,000 with a probability of ¾ or a loss of Rs. 30,000 due to delays with a probability of ¼ ; the second promises a profit of Rs. 1,80,000 with a probability of ½ or a loss of Rs. 45,000 with a probability of ½. Which job should the contractor choose so as to maximise his expected profit?
   (c) A random variable X can assume any positive integral value n with a probability proportional to $1/3^n$. Find the expectation of X.
10. X is normally distributed with $\sigma = 5$ and it is desired to test H_0: $\mu = 105$ against H_1 : $\sigma = 110$. How large a sample should be taken if the probability of accepting H_0 when H_1 is true is 0.02 and if a critical region of size 0.05 is used?
11. Let p be the probability that a given die shows an even number. To test $H_0 : p = \frac{1}{2}$ against $H_1 : p = 1/3$; the following procedure is adopted. Toss the die twice and accept H_0 if both times it shows even number. Find the probabilities of type I and type II errors.
12. (a) Obtain the statistic for testing the hypothesis that the mean of a Poisson population is 2 against the alternative that it is 3, on the basis of n independent observations.
    (b) Suppose you are testing $H_0 : \lambda = 2$ against $H_1 : \lambda = 1$, where λ is the parameter of the Poisson distribution. Obtain the best critical region of the test.
13. (a) Discuss the concept of interval estimation and provide suitable Illustration.
    (b) Critically examine how interval estimation differs from point estimation. Give the 95% confidence interval for the mean of the normal distribution, when its variance is known.

Instructions for all four practical

Tutor's Guide

- All the Questions can be solved by applying the concepts through the pen and paper mode. (Solving through computer is not necessary for these papers, but if students are interested then they can do on their own).

Guide to write the record notebook

- For all Questions write the algorithm (if any) of the method used, graphs (if any) in the right hand side page of the record notebook; solution of particular problem in the left hand side page of the record notebook.
- Write the objective of the problem first, then write the basic concepts involved in that problem, then write the algorithm used, as said in the previous point, finally write the solution as result.