<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">NUMERICAL METHODS WITH APPLICATIONS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE EC1</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Allied</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td>23BMAA1</td></tr>
<tr><td>Semester</td><td>I</td><td colspan="4"></td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">1</td><td colspan="2"></td><td>2</td><td>3</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• To expose the students to various tools in solving numerical problems.<br>• To prepare the students for competitive Examinations like CSIR ,NET etc.</td></tr>
<tr><td colspan="2">Unit I</td><td colspan="6">Solution of Algebraic and Transcendental equations- introduction, Bisection method- Iteration method –Method of False Position Method –Newtob Raphson Method.</td></tr>
<tr><td colspan="2">Unit II</td><td colspan="6">Interpolation : Finite differences –Forward differences –Backward differences –Central differences-Sympolic relations –Newton formula for interpolation-Interpolation with unevenly spaced points – Lagrange ‘s interpolation formula.</td></tr>
<tr><td colspan="2">Unit III</td><td colspan="6">Numerical differentiation and integration-Introduction Numerical Differentiation –Cubic spline Method –Maximum and Minimum values of a tabulated function –Numerical integration –Trapezoidal rule and simpson’s rule1/3 and 3/8 rules.</td></tr>
<tr><td colspan="2">Unit IV</td><td colspan="6">Matrices and Linear system of equations –Guassian Elimination method –Modification of the Guass Method to compute the inverse –Iterative Method –Jacobi and Guass Seidal Method.</td></tr>
<tr><td colspan="2">Unit V</td><td colspan="6">Numerical Solution of Ordinary differential equation –Solution by taylor Series –Picard’s Method of Successive Approximations –Runge-kutta Methods.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, problem solving, analytical ability, professional competency, professional communication and transferable skill.</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">1.Sastry S.S (2012) Introductory methods of Numerical Analysis.New Delhi : PHI Learning Pvt.Ltd</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="6">1.Kandasamy .P., Thilagavathi.K., & Gunavathy.k (2008) Numerical Methods .S.Chand Publications<br>2Arumugam.S., Thangapandi Isaac.A & Somasundaram .A(2013) Nmerical Analysis with Programming C, Palayamkottai: New Gamma Publishing House</td></tr>
</table>

**Course Learning Outcome (for Mapping with POs and PSOs)**

Students will be able to

**CLO 1:** Classify and Solve Bisection Method and False Position Method

**CLO 2:** Find the Finite difference, Forward and Backward Differences

**CLO 3:** Find Numerical Differentiation and Integration,Maximum and Minimum Values

**CLO 4:** Find Guassian Elimination Method, Guass Seidal Method

**CLO 5:** Find Picard's Method, Runge-Kutta Method

| | POs | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 |
| CLO1 | 3 | 1 | 3 | - | 1 | - | 3 | 2 | 1 |
| CLO2 | 2 | 1 | 3 | 1 | 1 | 1 | 3 | 2 | 1 |
| CLO3 | 3 | 1 | 3 | 1 | - | 2 | 3 | 2 | 1 |
| CLO4 | 3 | 1 | 3 | 1 | 2 | - | 3 | 2 | 1 |
| CLO5 | 3 | 1 | 3 | - | - | - | 3 | 2 | 1 |

- Offered by B.Sc., Mathematics to B.Sc., Mathematics student.

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">NUMERICAL METHODS WITH APPLICATIONS PRACTICAL</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE EC1</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Allied</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">23BMAAP1</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>1</td><td colspan="2"></td><td>1</td><td colspan="2">2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• To expose the students to various tools in solving numerical problems.<br>• To prepare the students for competitive Examinations like CSIR ,NET etc.</td></tr>
<tr><td colspan="2"></td><td colspan="6">1. Solve Bisection Method and False Position Method with examples<br><br>2. Find the Forward and Backward Differences with examples<br><br>3. Find Numerical Differentiation and Integration with examples<br><br>4. Find Guassian Elimination Method, Guass Seidal Method with examples<br><br>5. Find R.K Method and Euler Method with Examples</td></tr>
</table>

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">ANCILLARY MATHEMATICS - I</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">Allied Course – EC1</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23BMAA2</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">2</td><td colspan="2">1</td><td colspan="2">--</td><td>3</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• To learn the basic concepts and problem solving in differential equations<br>• To explore trigonometry as a tool in solving problems..</td></tr>
<tr><td colspan="2">Unit I</td><td colspan="8">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.</td></tr>
<tr><td colspan="2">Unit II</td><td colspan="8">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 eax cosax sinax..</td></tr>
<tr><td colspan="2">Unit III</td><td colspan="8">Differential Calculus – Successive Differentiation – n th derivative of standard functions (Derivation not needed) problems – Leibnitz formula for the nth derivative of a product (proof not needed) simple problems only – Curvature and Radius of Curvature in Cartesian coordinates only – problems. .</td></tr>
<tr><td colspan="2">Unit IV</td><td colspan="8">Integral Calculus – Integration by Parts – Bernoulli’s formula – Definite integrals – Properties – problems. , cosnθ, sinnθ and tannθ, cosnθ</td></tr>
<tr><td colspan="2">Unit V</td><td colspan="8">(n being aθ, cosnθ, sinnθ and tannθ, cosnθ Trigonometry : Expression for sinn (only problems in allθ in powers of θ, tanθ, cosθ+ve integer) Expansion of sin the above)</td></tr>
</table>

| | |
|---|---|
| **Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)** | Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour) |
| **Skills acquired from this course** | Knowledge, problem solving, analytical ability, professional competency, professional communication and transferable skill. |
| **Recommended Text** | 1. Arumugam, S., & Thangapandi Isaac, A. (2002). Ancillary Mathematics Paper I (Revised). Palayamkottai: New Gamma Publishing House<br>2. Arumugam, S., & ThangapandiIssac, A. (2003). Modern Algebra. Chennai: Scitech Publications.<br>3. Narayanan, S., & ManickavachagomPillay, T. K. (2006). Calculus. (Volume I). S.Viswanathan (Printers & Publishers) Pvt. Ltd<br>4. . Narayanan, S., & ManickavachagomPillay, T. K. (2014). Calculus. (Volume II). S.Viswanathan (Printers & Publishers) Pvt. Ltd<br>5. . Narayanan, S., & ManickavachagomPillay, T. K. (2015). Differential Equations and its Applications. S.Viswanathan (Publishers & Printers)Pvt. Ltd. |
| **Website and e-Learning Source** | https://nptel.ac.in |

**Course Learning Outcome (for Mapping with POs and PSOs)**

Students will be able to

**CLO 1:** Classify and Solve reciprocal equations

**CLO 2:** Find the sum of binomial, exponential and logarithmic series

**CLO 3:** Find Eigen values, eigen vectors, Clairaut's form and diagonalize a given matrix

**CLO 4:** Expand the powers and multiples of trigonometric functions in terms of sine and cosine

| | SEMESTER I | | | |
|---|---|---|---|---|
| **COURSE CODE** | ALLIED COURSE I | T/P | C | H/W |
| **23BMAAP2** | **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 $\cos\theta$.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Title of the Course** | | **ASTRONOMY** | | | | | |
| **Paper Number** | | **Elective II** | | | | | |
| **Category** | Elective | **Year** | I | **Credits** | 3 | **Course Code** | **23BMAA3** |
| | | **Semester** | II | | | | |

| **Instructional Hours per week** | **Lecture** | **Tutorial** | **Lab Practice** | **Total** |
|---|---|---|---|---|
| | 3 | 1 | -- | 3 |

| | |
|---|---|
| **Pre-requisite** | 12th Standard Mathematics |
| **Objectives of the Course** | • To provide Knowledge about the universe ,scientific thinking to problems in astronomy , the observational foundations of astronomy's greatest discoveries and the nature of galaxy. |
| **UNIT-I:** | Celestial sphere and diurnal motion –celestial coordinates – sidereal time |
| **UNIT-II:** | Morning and evening stars =circumpolar stars –Zones of earth-Perpetual day -Twilight. |
| **UNIT-III:** | Refraction –Laws of Refraction –Tangent formula – orizontal refraction –Geocentric parallax-horizontal parallaxs |
| **UNIT-IV:** | Kepler's Law- anomalies-Kepler's equation-calendar. |
| **UNIT-V:** | Moon-Sidereal and synodic months –elongation –phase of moon –Eclipses- umbraand penumbra-Lunar and solar eclipses-Maximum and minimum number of eclipses in a year |
| **Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)** | Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour) |
| **Skills acquired from this course** | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | S.kumaravel and susheelakumaravel, Astronomy ,Prentice Hall(2000) |

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">ASTRONOMY PRACTICAL</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">ELECTIVE PRACTICAL</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ELECTIVE</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code<br>23BMAAP3</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">1</td><td colspan="2"></td><td colspan="2">1</td><td>2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2"></td><td colspan="8">•</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="8">1.If the hour angles of a slar of declination delta be H when its azimuth is Δ and H when its azimuth is 180+A show that the latitude φ of the place of observation can be pound from the equation cos H-H'/2 = tan δ cos H-H' /2<br>2.A circumpolar star (a, δ) crosses the some vertical cirlcle at altitudes α1 and α2 and the meridian between the zenith and pole .Show that the latitude of the place is given by<br>Sin α1+ α2 /2 sin δ = sin φcosα1- α2 /2<br>3.if r'' be the horizontal refraction , show that the point on the horizon where the sun rises is shifted by r''sinφ(sec(φ - δ)sec(φ+ δ))$^{1/2}$ where δ is the declination of the sun and φ, the latitude oof the place<br>4. Show that the angle between the direction of motion of a planet and the radius vector joining it to the sun is given by tan$^{-1}$ (1-e$^2$)$^{1/2}$/ e sin u where u is eccentric anomaly<br>5.if the interior ecliptic limits be +β and if the moon revolves n times as fast as the sun, and its nodes regress θ for everybrevolutionthe moon makes round the earth, show that the minimum number of solar eclipsesx occurring at or near a node is 2(n-l)β / nθ+2Π</td></tr>
</table>

<table>
<tr><td>Title of the Course</td><td colspan="5">ANCILLARY MATHEMATICS II</td></tr>
<tr><td>Paper Number</td><td colspan="5">ALLIED</td></tr>
<tr><td rowspan="2">Category</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code<br>23BMAA4</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td>Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">3</td><td>1</td><td>-</td><td>3</td></tr>
<tr><td>Objectives of the Course</td><td colspan="5">• To learn vector differentiation and vector integration and solve differential equations</td></tr>
<tr><td>UNIT-I:</td><td colspan="5">Vector Calculus –Vector differentiation-gradient-Divergence-curl-Properties-Result</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-$x^m$ m be 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 function 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- Centrql difference – Interpolation formulae-Lagrange’s interpolation formulae</td></tr>
<tr><td>UNIT-V:</td><td colspan="5">Correlation –Rank correlqtion –Regression Lines and Regression coefficietns.</td></tr>
<tr><td></td><td colspan="5"></td></tr>
<tr><td>Skills acquired from this course</td><td colspan="5">Studnets relating the concepts of compound interest and simple interest</td></tr>
<tr><td>Recommended Text</td><td colspan="5">1.Dr S.arumugam and A.Thangapandi Isaac(2006) Analytical Geometry 2D and Vector Calculus,Palayamkottai, New Gamma Publishing House<br>2. Dr S.arumugam and A.Thangapandi Isaac(2006),Statisticss,Palayamkottai, New Gamma Publishing House.<br>3. Dr S.arumugam and A.Thangapandi Isaac(2006) Numerical Analysis with Programming in c,Palayamkottai, New Gamma Publishing House<br>4.S.Narayanan and T.Manickamvasagampillai ,(2014), Calculus (Vol III) ,Vishwanathan printers and publishers<br>S.Narayanan and T.Manickamvasagampillai ,(2014), Differentail Equation and its application ,Vishwanathan printers and publishers</td></tr>
<tr><td>Website and e-Learning Source</td><td colspan="5">https://nptel.ac.in</td></tr>
</table>

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">ANCILLARY MATHEMATICS II PRACTICAL</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE PRACTICAL</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ELECTIVE</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code 23BMAAP4</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td>1</td><td colspan="2"></td><td>1</td><td>2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="5">12th Standard Mathematics</td></tr>
<tr><td colspan="2"></td><td colspan="5">•</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="5">1.To find the Fourier coefficients of periodic functions of period 2 pi<br>2.. Solving problems using Newton’s Interpolation formula<br>3.Solving Problem using Lagrange’sinterpolation formula<br>4.Solvinng problem Rank Correlation<br>5.Solving problem regression line and regression coefficients<br>4. Solving probemscorrelation coefficients</td></tr>
</table>

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">MATHEMATICAL STATISTICS-I</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE M5</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>II</td><td colspan="2">Credits</td><td>3</td><td rowspan="2">Course Code 23BMAA5</td></tr>
<tr><td>Semester</td><td>III</td><td colspan="3"></td></tr>
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<tr><td colspan="2">2</td><td colspan="2">1</td><td>--</td><td>3</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• To provide an understanding of the fundamental concepts of probability theory<br>• To develop skills in applying probability theory and statitstical inference to sole real world</td></tr>
<tr><td colspan="2">UNIT-I:</td><td colspan="6">Definition of sample space –Events –Definition of probability –addition and Multiplication laws of probability –Independence of events –Conditional probability –Baye’s theorem –simple problems.</td></tr>
<tr><td colspan="2">UNIT-II:</td><td colspan="6">Distribution Function-Mathematical Expectation –Conditional Expectation and conditional Variance-Moment Generating Function –Probability Generating Function –Cumulants –Characteristic function-Simple problems</td></tr>
<tr><td colspan="2">UNIT III</td><td colspan="6">Discrete Distribution Binomial ,Poisson Continuos Distribution and Normal</td></tr>
<tr><td colspan="2">UNIT IV</td><td colspan="6">Sampling Distribution & Test of Significance Sampling –Tests of Significance –Null Hypothesis –Tests of significance for Large Samples</td></tr>
<tr><td colspan="2">UNIT V</td><td colspan="6">Test of Significance for Small Samples : Using the Chi-Square distribution- Students t-distributio-F-distribution</td></tr>
<tr><td colspan="2">Course Outcome</td><td colspan="6">On Completion of this course, students will able to Define Sammple space .events, and probability and apply the addition and multiplication Laws of probability to calculate probabilities of events</td></tr>
<tr><td colspan="2">Recommended Book</td><td colspan="6">S.C Gupta &V.K.Kapoor, Fundamental Mathematical Statistics , Sultan & sons</td></tr>
<tr><td colspan="2"></td><td colspan="6"></td></tr>
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<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">MATHEMATICAL STATISTICS-I PRACTICAL</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code<br>23BMAAP5</td></tr>
<tr><td>Semester</td><td>III</td></tr>
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<tr><td>-</td><td>-</td><td colspan="2">--</td><td>2</td></tr>
<tr><td colspan="2"></td><td colspan="5"></td></tr>
<tr><td colspan="2"></td><td colspan="5">•</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="5">1.Find the Skewness and kurtosisof a given data set distribution<br>2.Applying Baye’s theorem to solve simple problems<br>3.Find the binomial distribution with n=20 ,p=0.4<br>4.Using the normal distribution to calculate confidence intervals fir the mean when the standard deviation is known<br>5.Perform Z testfor difference in mean<br>6.Conducting a hypothesis test for the difference between two variance using the F-distribution<br>7.Perform t-test for equality of mean<br>8.Conducting a hypothesis testfor a sample mean with a known population variance<br><br>.</td></tr>
<tr><td colspan="2">Course Outcome</td><td colspan="5"></td></tr>
</table>

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">OPERATION RESEARCH 1 (ANCILLARYMATHEMAICS III</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8"></td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23BMAA6</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td colspan="2">1</td><td colspan="2">--</td><td colspan="2">4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">Identify and characterize sets and functions and Understand, test and analyze the convergence and divergence of sequences, series</td></tr>
<tr><td colspan="2">Unit 1:</td><td colspan="8">Introduction –origin and development of OR-Nature and features of OR-Scientific method in OR-Modelling in OR-Advantage and Limitation of Model-General Solution methods of OR Models-Applications of OR-LPP-Mathematical formulation of the problem-Illustration on Mathematic formulation of LPP-Graphical Solution Method-General LPP-Canonical and Standard forms of LPP</td></tr>
<tr><td colspan="2">Unit II</td><td colspan="8">Use of Artificial Variables (Big M Method-Two Phase Method)Duality in Linear Programming-General primal and dual Pair –Formulating a dual Problem-Primal –Dual Pair in a Matrix form –Duality theorems-Complementary slackness theorem-Duality and simplex method –Dual simplex method</td></tr>
<tr><td colspan="2">Unit III</td><td colspan="8">Introduction – L.P formulation of T.P-Existence solution in T.P- The transportation table-Loops in T.P-Solution of a Transportation problem-Finding an initial basic-feasible solution (NWCM-LCM-VAM0-Degeneracy in TP-Transportation Algorithm (MODI Method)-Unbalanced T.P-Maximization T.P</td></tr>
<tr><td colspan="2">Unit IV</td><td colspan="8">Assignment problem-Introduction-Mathematical formulation of the problem –Test for optimality by using Hungarian Method-Maximization case in Assignment Problem</td></tr>
<tr><td colspan="2">Unit V</td><td colspan="8">Sequencing problem-Introduction –Problem of Sequencing –Basic terms used in sequencing –n jobs to be operated on two machines –problems –n jobs to be operated on K machines –problems –Two jobs operated on K machines (Graphical Method)-Problems</td></tr>
<tr><td colspan="2"></td><td colspan="8"></td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">1, Operation Research (14th Edition)by Kantiswarub, P.K.Gupta and Man Mohan Sultan Chand & sons , New Delhi ,2008</td></tr>
<tr><td colspan="2">Website and e-Learning Source</td><td colspan="8">https://nptel.ac.in</td></tr>
</table>

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">ANCILLARY MATHEMATICS III PRACTICAL</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE PRACTICAL</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ELECTIVE</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code<br>23BMAAP6</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
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<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2"></td><td colspan="6">•</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">1.Solving Problem using Big –M method<br>2 Solvinng problem using Two Phase Methodntrol<br>3.Solvingn Transportation Problem,<br>4. Solving Assignment probems<br>5. Solving Mathemtical formulation problem<br>6.Solving problems using Graphical Method</td></tr>
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<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">TRANSFORMATION TECHNIQUES</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE M7</td></tr>
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<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">Identify and characterize sets and functions and Understand, test and analyze the convergence and divergence of sequences, series</td></tr>
<tr><td colspan="2">Course Out line</td><td colspan="6">Unit 1: Laplace Transform-Definition-Laplace Transform of Standard function –Laplace Transform of Periodic functions.<br>Unit II Inverse Laplace Transform –Standard formulae-Solving Ordinarry Differential Equation with constant Coefficients –variable coefficients of periodic functions of period 2 pi<br>Unit III Fouriers series –Definition –To find the Fourier coefficients of periodic functions of period 2 pi<br><br>Unit Iv Fourier transforms –Complex form of Fourier integral formula –Fourier integral theorem –Fourier sine and cosine<br>Unit V Z transforms – Definition –Properties - z Transforms of some basic functions and problems –Inverse Z transforms –Method to fid the inverse Z Transfroms</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">1, Narayanan .S &ManicavachagamPillai .T.K Calculus (Vol III) S.Viswanathan (Printers and Publishers ) PVT Ltd<br>1. Veerarajan .T (2004) Engineering Mathematics , New Delhi Tata MacGraw Hill Publishing Limited.</td></tr>
<tr><td colspan="2">Website and e-Learning Source</td><td colspan="6">https://nptel.ac.in</td></tr>
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<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">TRANSFORM TECHNIQUE PRACTICAL</td></tr>
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<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2"></td><td colspan="6">•</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">1.Laplace transform s of student functions qnd periodic functions<br>2.Solving ordinary differential Equations with constant coefficients ,Variable coefficients<br>3.Solving Simultaneous linear equations using laplace transform<br>4. –To find the Fourier coefficients of periodic functions of period 2 pi<br>5. Solving problems of Complex form of Fourier integral formula<br>6. Solving z Transforms of some basic functions and problems</td></tr>
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<tr><td colspan="2">Title of the Course</td><td colspan="6">OPERATION RESEARCH II (ANCILLARY MATHEMATICS IV)</td></tr>
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<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code 23BMAA8</td></tr>
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<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• Replace Problem<br>• Inventory Control<br>• Queuing System</td></tr>
<tr><td colspan="2">UNIT-I:</td><td colspan="6">Replace Problem and System Reliability-Introduction – Replacement of Equipment/ Assert that Deteriorates gradually—replacement of Equipment that fails suddenly.</td></tr>
<tr><td colspan="2">UNIT-II:</td><td colspan="6">Inventory control-Types of inventories-Reason for carrying inventories-Costs Associated with inventories-Factors affecting Inventory Control-The Concept of EOQ-<br>Deterministic Inventory Problems with no shortages with shortages problem of EOQ with price Breaks.</td></tr>
<tr><td colspan="2">Unit III:</td><td colspan="6">Queuing theory-Introduction-Queuing System –Elements of Queuing System-Operating characteristics of a Queuing system-Deterministic Queuing system-Probability Distributions of Queuing system Classification of queuing Models –Definition of transient and steady states-Poisson Queuing System- (M/M/1)::(∞/FIFO). (M/M/I)::(∞/SIRO),(M/M/I)☹N/FIFO) Generlized model Birth-Death process</td></tr>
<tr><td colspan="2">Unit IV</td><td colspan="6">Network Scheduling by PERT/CPM-Network Basic Components –Drawing network-Critical path Analysis-PERT Analysis-Distinction between PERT and CPM</td></tr>
<tr><td colspan="2">Unit V</td><td colspan="6">Game theory –Two person zero –Sum Games-Basic terms-Maximum-Minimax Principle-Games without saddle points – Mixed strategies-Graphical solution of 2xn and mx2 games-Deterministic property- General solution of mxn rectangular games</td></tr>
<tr><td colspan="2">Recommended BookRecommended Text</td><td colspan="6">1, Operation Research (14th Edition)by Kantiswarub, P.K.Gupta and Man Mohan Sultan Chand & sons , New Delhi ,2008</td></tr>
<tr><td colspan="2">Website and e-Learning Source</td><td colspan="6">https://nptel.ac.in</td></tr>
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<tr><td colspan="2">Title of the Course</td><td colspan="6">ANCILLARY MATHEMATICS IV PRACTICAL</td></tr>
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<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2"></td><td colspan="6">•</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">1.Solving Replace Problem and System Reliability-<br>2 Solvinng problem Inventory control<br>3.Explain(M/M/1)::(∞/FIFO). (M/M/I)::(∞/SIRO),<br>4. Solving probemsNetwork Scheduling by PERT/CPM method.<br>5.Solving problems of Two person zero –Sum Games<br>6. Solving problems Graphical solution of 2xn and mx2 games</td></tr>
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<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">MATHEMATICAL STATISTICS-II</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">ALLIED</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td>Course Code</td><td></td></tr>
<tr><td>Semester</td><td>II</td><td>23BMAA9</td><td></td></tr>
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<tr><td colspan="2">Pre-requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">• To provide an understanding of the fundamental concepts of probability theory<br>• To develop skills in applying probability theory and statitstical inference to sole real world</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="7">UNIT-I: Definition of sample space –Events –Definition of probability –addition and Multiplication laws of probability – Independence of events –Conditional probability –Baye’s theorem – simple problems.</td></tr>
<tr><td colspan="2"></td><td colspan="7">UNIT-II: Distribution Function-Mathematical Expectation – Conditional Expectation and conditional Variance-Moment Generating Function –Probability Generating Function –Cumulants – Characteristic function-Simple problems<br><br>UNIT III Discrete Distribution Binomial ,Poisson Continuos Distribution and Normal<br><br>UNIT IV Sampling Distribution & Test of Significance Sampling – Tests of Significance –Null Hypothesis –Tests of significance for Large Samples<br><br>UNIT V Test of Significance for Small Samples : Using the Chi-Square distribution- Students t-distributio-F-distribution</td></tr>
<tr><td colspan="2">Course Outcome</td><td colspan="7">On Completion of this course, students will able to Define Sammple space .events, and probability and apply the addition and multiplication Laws of probability to calculate probabilities of events</td></tr>
<tr><td colspan="2">Recommended Book</td><td colspan="7">S.C Gupta &V.K.Kapoor, Fundamental Mathematical Statistics , Sultan & sons<br><br>S.Arumugam&Thangapandi Isaac, Statistics ,New Gamma Publsihing House,</td></tr>
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<tr><td colspan="2"></td><td colspan="6"></td></tr>
<tr><td colspan="2"></td><td colspan="6">•</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">1.Applying Baye’s theorem to solve simple problems<br>2.Find the binomial distribution with n=20 ,p=0.4<br>4.Using the normal distribution to calculate confidence intervals fir the mean when the standard deviation is known<br>5.Explain Poisson distribution with Exampl<br>6.Conducting a hypothesis test for the difference between two variance using the F-distribution<br>7.Perform t-test for equality of mean<br>8.Conducting a hypothesis testfor a sample mean with a known population variance<br>9.Explain F-distribution with example<br>.</td></tr>
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