# Basaveshwar Engineering College (Autonomous), Bagalkot
## Department of Mathematics
## B.E. III Semester

Subject Title: **NUMERICAL TECHNIQUES & INTEGRAL TRANSFORMS**

| | |
|---|---|
| Subject code : UMA391C | Credits: 3 (3-0-0) |
| Total contact Hours : 40 | Duration of SEE: 03 Hrs. |
| CIE : 50 Marks | SEE: 50 Marks |

**Course Objectives:**

To apply the knowledge of Mathematics in various engineering fields, students are able

- *To be understand the numerical methods of solving algebraic, transcendental equations.*
- *To be acquired the knowledge about various methods of interpolation*
- *It is very much essential to understand the basic concepts of numerical differention, numerical integration and numerical solutions of ode.*
- *To be understand concepts of Fourier series, Fourier transforms, and z-transforms, because Fourier series is very powerful tool to solve ode and pde.*

**Course outcomes**:

On the successful completion of this course, students are able

*CO1: The ability to solve engineering problems using non-linear equations and interpolation techniques.*

*CO2: The ability to solve problems using numerical differention and numerical integration.*

*CO3: Be capable to perform numerical solutions of ordinary differential equations.*

*CO4: Fourier analysis provides a set of mathematical tools which enable the engineer to break down a wave into its various frequency components. It is then possible predict the effect of a particular waveform.*

*CO5: It is essential to understand the basic concepts of Fourier transforms and z –transforms, to solve ode, pde and difference equations.*

**Unit-I**

**Numerical Analysis-I:** **10 Hours**

*Introduction to root finding problems, Bisection Method, Newton-Raphson method. Finite differences, forward and backward difference operators (no derivations on relations between operators) Newton-Gregory forward and backward interpolation formulae. (Without proof), Lagrange's and Newton's divided difference interpolation formulae (without proof).*

**Unit-II**

**Numerical Analysis-II:** **10 Hours**

*Numerical differentiation using Newton's forward and backward formulae-problems.Trapezoidal rule, Simpson's one third rule, Simpson's three eighth rule and Weddle's rule (no derivation of any formulae)-problems. Euler's and Modified Euler's method, Runge-Kutta $4^{th}$ order method.*

**Unit-III**

**Fourier series:** **10 Hours**

*Periodic functions, Conditions for Fourier series expansions, Fourier series expansion of continuous and functions having finite number of discontinuities, even and odd functions. Half-range series, practical harmonic analysis.*

**Unit-IV**

**Fourier transforms and z-transforms:** **10 Hours**

*Infinite Fourier transforms and inverse Fourier transforms- simple properties, Fourier sine and Fourier cosine transforms, Inverse Fourier sine and cosine transforms. Z-transforms-definition, standard forms, linearity property, damping rule, shifting rule-problems.*

**Resources:**

1. Numerical Methods for Engineers by Steven C Chapra & Raymond P Canale.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
3. Advanced Engineering Mathematics By H. K. Das, S. Chand & company Ltd. Ram Nagar, New Delhi.
4. Advanced Engineering Mathematics by E Kreyszig ( John Wiley & Sons)

**Question paper pattern for SEE**:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

**Assignment Test for 5 Marks:** Ten objective type questions can be prepared from **entire** syllabus.

| **Course Outcomes** | **Programme Outcomes** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| CO1 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO2 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO3 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO4 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO5 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

# Basaveshwar Engineering College (Autonomous), Bagalkot
## Department of Mathematics
## B.E. III Semester

Subject Title: **NUMERICAL TECHNIQUES & FOURIER SERIES**

| | |
|---|---|
| Subject code : UMA392C | Credits: 3 (3-0-0) |
| Total contact Hours: 40 | Duration of SEE: 03 Hrs. |
| CIE : 50 Marks | SEE: 50 Marks |

**Course Objectives:**

To apply the knowledge of Mathematics in various engineering fields, students are able

- *To be understand the numerical methods of solving algebraic, transcendental equations.*
- *To be acquired the knowledge about various methods of interpolation*
- *It is very much essential to understand the basic concepts of numerical integration, numerical solutions of ode and pde*
- *To be understanding concepts of Fourier series and Fourier transforms, because Fourier series is very powerful tool to solve ode and pde.*

**Course outcomes**:

On the successful completion of this course, students are able

*CO1: The ability to solve engineering problems using non-linear equations and interpolation techniques.*

*CO2: The ability to solve problems using numerical differention*

*CO3: Be capable to perform numerical integration and solutions of ordinary differential equations.*

*CO4: Fourier analysis provides a set of mathematical tools which enable the engineer to break down a wave into its various frequency components. It is then possible predict the effect of a particular waveform.*

*CO5: It is essential to understand the basic concepts of Fourier transforms to solve ordinary differential equation and pde..*

### Unit-I

**Numerical Analysis-I:** **10 Hours**

*Introduction to root finding problems, Newton-Raphson method. Finite differences, forward and backward difference operators (no derivations on relations between operators) Newton-Gregory forward and backward interpolation formulae. (Without proof), Lagrange's and Newton's divided difference interpolation formulae (without proof) Numerical differentiation using Newton's forward and backward formulae-problems.*

### Unit-II

**Numerical analysis-II:** **10 Hours**

*Numerical Integration: Simpson's one third rule, Simpson's three eighth rule (no derivation of any formulae)-problems. Numerical solution of ODE and PDE: Euler's and Modified Euler's method, Runge-Kutta 4$^{th}$ order method, Numerical solutions of one-dimensional heat and wave equations by explicit method, Laplace equation by using five point formula.*

**Unit-III**

**Fourier series:** **10 Hours**

*Periodic functions, Conditions for Fourier series expansions, Fourier series expansion of continuous and functions having finite number of discontinuities, even and odd functions. Half-range series, practical harmonic analysis.*

**Unit-IV**

**Fourier transforms:** **10 Hours**

*Infinite Fourier transforms and inverse Fourier transforms- simple properties, Fourier sine and Fourier cosine transforms. Inverse Fourier sine and cosine transforms.*

**Resources:**

1. Numerical Methods for Engineers by Steven C Chapra & Raymond P Canale.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
3. Advanced Engineering Mathematics By H. K. Das, S. Chand & company Ltd. Ram Nagar, New Delhi.
4. Advanced Engineering Mathematics by E Kreyszig ( John Wiley & Sons)

**Question paper pattern for SEE**:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

**Assignment Test for 5 Marks:** Ten objective type questions can be prepared from entire Syllabus.

| Course Outcomes | Programme Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| CO1 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO2 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO3 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO4 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO5 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

# Basaveshwar Engineering College (Autonomous), Bagalkot
## Department of Mathematics
## B.E. IV Semester

Subject Title: **Statistics and Probability Distributions**

| | |
|---|---|
| Subject code : UMA491C | Credits: 3 (3-0-0) |
| Total contact Hours: 40 | Duration of SEE: 03 Hrs. |
| CIE : 50 Marks | SEE: 50 Marks |

**Course Objectives:**

To apply the knowledge of Mathematics in various Engineering fields, students are able

- To be acquired knowledge about predictions preferably on the basis of mathematical equations.
- To be understand the principal concepts about probability.

**Course outcomes**:

On completion of this course, students are able

CO1: To apply the least square sense method to construct the specific relation for the given group of data.

CO2: To understand the concept of probability

CO3: To apply the concept of probability to find the physical significance of various distribution phenomena.

CO4: To understand the concepts of probability distributions

CO5: To apply the concept of Markov Chain for commercial and industry purpose.

**Unit –I**

**Statistics:** **10 Hours**

*Curve fitting by the method of least squares:*

*Correlation, expression for the rank correlation coefficient and regression.*

**Unit –II**

**Probability:** **10 hours**

*Probability: addition rule, conditional probability, multiplication rule, Baye's rule. Discrete and continuous random variables-Probability density function, Cumulative distribution function, Problems on expectation and variance*

## Unit –III

**Probability distributions:** **10 Hours**

*Binomial distributions Poisson distributions and Normal distributions. Concept of joint probability, Joint probability distributions.*

## Unit –IV

**Markov chains:** **10 Hours**

*Markov chains: Introduction, Probability vectors, Stochastic Matrices, Fixed Points and Regular stochastic Matrices, Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states.*

**Resources:**

1. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
2. Theory and problems of probability by Seymour Lipschutz (Schaum's Series).
3. Advanced Engineering Mathematics by H. K. Dass
4. Advanced Engineering Mathematics by E Kreyszig ( John Wiley & Sons)
5. Probability and stochastic processes by Roy D. Yates and David J. Goodman, wiley India pvt.ltd 2nd edition 2012.
6. Advanced Engineering Mathematics by Peter V. O'Neil.

**Question paper pattern for SEE**:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

**Assignment Test for 5 Marks:** Ten objective type questions can be prepared from entire syllabus.

| Course Outcomes | Programme Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| CO1 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO2 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO3 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO4 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO5 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

# Basaveshwar Engineering College (Autonomous), Bagalkot
## Department of Mathematics
## B.E. IV Semester

Subject Title: **Complex Analysis and Statistics**

Subject code : UMA492C Credits: 3 (3-0-0)
Total contact Hours : 40 Duration of SEE: 03 Hrs.
CIE : 50 Marks SEE: 50 Marks

### Course Objectives:

**Course Objectives:**

To apply the knowledge of Mathematics in various Engineering fields, students are able

- To examine functions of a single complex variable z = x+iy and the calculus of these functions.
- To be acquired knowledge about predictions preferably on the basis of mathematical equations.
- To be understand the principal concepts about probability

### Course outcomes:

On completion of this course, students are able

CO1: To attempt solve real world problems using complex variable techniques.
CO2: To use the concept of complex integration technique's for solving engineering problems.
CO3: To understand the concepts of curve fitting and probability
CO4: To understand the concepts of probability distributions
CO5: To apply the concept of Markov Chain for commercial and industry purpose.

**Unit –I**

**Complex Variables: 10 Hours**

*Analytic function, Cauchy-Reimann equations in Cartesian and polar forms. Construction of analytic function (Cartesian and polar forms)*

**Unit-II**

**Complex Integration: 10 Hours**

*Line integral, Cauchy's theorem – corollaries (without Proof), Cauchy's integral formula. Taylor's and Laurent's series (statements only), singularities, poles, calculation of residues, Cauchy's residue theorem (without proof) – problems.*

**Unit –III**

## Statistics and Probability 10 Hours

***Statistics:*** *Curve fitting by the method of least squares:* $y = a + bx$, $y = ab^x$ *and* $y = a + bx + cx^2$ *Correlation and regression.*

***Probability****: addition rule, conditional probability, multiplication rule, Baye's rule. Random variables, Problems on expectation and variance.*

**Unit –IV**

## Probability distributions: 10 Hours

*Binomial distributions Poisson distributions and Normal distributions(No drivations). Concept of joint probability, Joint distributions - discrete random variables,* ***Markov chains:***

*Markov chains: Introduction, Probability vectors, Stochastic Matrices, Fixed Points and Regular stochastic Matrices, Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states.*

**Total: 40 Hours**

## Resources:

1. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
2. Theory and problems of probability by Seymour Lipschutz (Schaum's Series).
3. Advanced Engineering Mathematics by H. K. Dass
4. Advanced Engineering Mathematics by E Kreyszig ( John Wiley & Sons)
5. Probability and stochastic processes by Roy D. Yates and David J. Goodman, wiley India pvt.ltd 2nd edition 2012.
6. Advanced Engineering Mathematics by Peter V. O'Neil.

## Question paper pattern for SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

**Assignment Test for 5 Marks:** Ten objective type questions can be prepared from entire

Syllabus.

| Course Outcomes | Programme Outcomes | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| CO1 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO2 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO3 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO4 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO5 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

## BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT

## MODEL COURSE PLAN

| | | | | | |
|---|---|---|---|---|---|
| **Title of Course** | **:** | **Engineering Mathematics-I** | **Course Code** | **:** | **21UMA101C** |
| **Credits** | **:** | **03(L-T-P: 3-0-0)** | **Contact Hours/ Week** | **:** | **03** |
| **Total Hours** | **:** | **40** | **Branch** | **:** | **Common to All** |
| **CIE Marks** | **:** | **50** | **SEE Marks** | **:** | **50** |
| **Semester** | **:** | **I** | **Year** | **:** | **2021-2022** |

**Course Objectives:** This course will enable students to

| | |
|---|---|
| 1 | Enhance learning of Engineering Mathematics. |
| 2 | Develop, understanding, stimulate their interest, and increase their proficiency in Mathematics. |
| 3 | Visualizing and representations: learners can see abstract concepts; make connections between geometry and algebra. |
| 4 | Make our teaching modules more active and improve the learning outcomes of our students. |
| 5 | Learn Engineering Mathematics conceptually and relationally in order to be able to apply, when they have learned. |
| 6 | Create inquiry based learning and an opportunity to learn, practice. |

**Course Outcomes:**

| | **At the end of the course the student should be able to:** |
|---|---|
| 1 | Understand the concepts of polar curves and curvatures apply when needed. |
| 2 | Learn the notion of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions. |
| 3 | Apply the concepts of partial differentiation in computing Jacobians and extreme values. |
| 4 | Apply the concepts of multiple integrals and their usage in computing the area and volumes. |
| 5 | Learn how complex integrals can be reduced to expressions involving beta function and gamma function is useful for modelling situations involving continuous change, with important applications to calculus, differential equations, complex analysis and statistics. |
| 6 | Apply the knowledge of differentiation of vectors to solve the engineering problems. |

**Course Articulation Matrix: Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)**

| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **No** | **Programme Outcomes Course Outcomes** | | | | | | | | | | | | | | | |
| **The students will be able to:** | | | | | | | | | | | | | | | | |
| 1 | Understand the concepts of polar curves and curvatures apply when needed. | 3 | 2 | | | | | | | | | | | | | |
| 2 | Learn the notion of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions, Jacobians. | 3 | 2 | | | | | | | | | | | | | |
| 3 | Apply the concepts of partial differentiation in computing Jacobians and extreme values. | 3 | 2 | | | | | | | | | | | | | |
| 4 | Apply the concepts of multiple integrals and their usage in computing the area and | 3 | 2 | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | volumes. | | | | | | | | | | | | | | | |
| 5 | Learn how complex integrals can be reduced to expressions involving beta function and gamma function is useful for modelling situations involving continuous change, with important applications to calculus, differential equations, complex analysis and statistics. | 3 | 2 | | | | | | | | | | | | | |
| 6 | Apply the knowledge of differentiation of vectors to solve the engineering problems. | 3 | 2 | | | | | | | | | | | | | |

## Course Content

| | | | | | |
|---|---|---|---|---|---|
| **Title of Course** | **:** | **Engineering Mathematics-I** | **Course Code** | **:** | **21UMA101C** |
| **Credits** | **:** | **03(L-T-P:3-0-0)** | **Contact Hours/Week** | **:** | **03** |
| **Total Hours** | **:** | **40** | **Branch** | **:** | **Common to All** |
| **CIE Marks** | **:** | **50** | **SEE Marks** | **:** | **50** |
| **Semester** | **:** | **I** | **Year** | **:** | **2021-2022** |

| **Content** | |
|---|---|
| **Unit - I** | |
| **Differential Calculus-1:** Review of elementary calculus, Polar curves - angle between the radius vector and tangent, angle between two curves, pedal equation. Curvature and radius of curvature-Cartesian, parametric and polar forms (without proof) problems. | **10 Hrs** |
| **Unit – II** | |
| **Differential Calculus-2:** Introduction to function of several variables, Partial differentiation; Total derivatives-differentiation of composite functions, Jacobian. Maxima and minima for a function of two variables and its applications; -problems. | **10 Hrs** |
| **Unit – III** | |
| **Integral Calculus:** Multiple integrals: Evaluation of double and triple integrals. Evaluation of double integrals-change of order of integration and changing into polar, spherical and cylindrical co-ordinates. Applications to find area and volumes. | **10 Hrs** |
| **Unit – IV** | |
| **Beta and Gamma functions:** Definitions, relation between beta and gamma functions-problems. **Vector Differentiation:** Scalar and vector fields. Gradient, directional derivative; curl and divergence-physical interpretation; solenoidal and irrotational vector fields-problems | **10 Hrs** |

**Text Books:**

- Maurice D weir, Joel Hass and Frank R. Giordano, “Thomas calculus”, Pearson, eleventh edition, 2011.
- B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
- B.V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010

**Reference books**:

1. Erwin Kreyszing's Advanced Engineering Mathematics volume1 and volume1I,wiley India Pvt.Ltd.,2014.

| Course Outcomes | Programme Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| CO1 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO2 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO3 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO4 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO5 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO6 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

**Evaluation Scheme:**

| Assessment | Marks | Weightage |
|---|---|---|
| **CIE-I** | **40** | **20** |
| **CIE-II** | **40** | **20** |
| **Course Project** | **10** | **10** |
| **SEE** | **100** | **50** |
| **Total** | **190** | **100** |

**Question paper pattern for CIE-I**

1. Question paper consists Part-A and Part-B. Question number 1 is compulsory, it consists of short answer questions of 1 or 2 marks, covering Unit-I and Unit-II (no multiple choice questions and No true or false questions).
2. In Part-B, four questions are to be set as per the following table.

| CIE | Number of questions /Maximum marks | Sub divisions | Unit |
|---|---|---|---|
| I | One question of 15 marks | Sub divisions shall not be mixed within the unit | Unit-I |
| | OR | | |
| | One question of 15 marks | Sub divisions shall not be mixed within the unit | Unit-I |
| | One question of 15 marks | Sub divisions shall not be mixed within the unit | Unit-II |
| | OR | | |
| | One question of 15 marks | Sub divisions shall not be mixed within the unit | Unit-II |

**Question paper pattern for CIE-II**

1. Question paper consists Part-A and Part-B. Question number 1 is compulsory, it consists of short answer questions of 1 or 2 marks, covering Unit-III and Unit-IV (no multiple choice questions and No true or false questions).
2. In Part-B, four questions are to be set as per the following table.

| CIE | Number of questions /Maximum marks | Sub divisions | Unit |
|---|---|---|---|
| II | One question of 15 marks | Sub divisions shall not be mixed within the unit | Unit-III |
| | OR | | |
| | One question of 15 marks | Sub divisions shall not be mixed within the unit | Unit-III |
| | One question of 15 marks | Sub divisions shall not be mixed within the unit | Unit-IV |
| | OR | | |
| | One question of 15 marks | Sub divisions shall not be mixed within the unit | Unit-IV |

**Details of course project:**

- Each student should prepare different problems and submit to the course instructor
- Students will identify by the members of the team by picking (Roll number) chits
- Total twelve teams in a class
- Problems may be based on the previous lectures delivered by the teacher( knowledge based)
- Each member of the team will demonstrate the mathematical problems in front of the other students

**Question paper pattern for SEE:**

1. Question paper consists Part-A and Part-B. Question number 1 is compulsory, it consists of short answer questions of 1 or 2 marks, covering entire syllabus (no multiple choice questions and No true or false questions, 50% of questions must be L3 and L4 level).
2. In Part-B total of eight questions with two from each unit; with internal choice to be set uniformly covering the entire syllabus.
3. Each question carries 20 marks and should not have more than four subdivisions.
4. In Part-B, any FOUR full questions are to be answered choosing at least one from each unit.
5. Sketches, figures and tables if any should be clearly drawn, as the same is scanned for printing.
6. The question paper should contain all the data / figures / marks allocated, with clarity.

**BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT**

**BRIDGE COURSE MATHEMATICS-I**
**(Common to all branches)**
**(Effective from the academic year 2018-19)**

| | |
|---|---|
| **Subject Code : UMA330M** | **CIE Marks : 50** |
| **Contact Hours/Week : 3L** | **SEE Marks: 50** |
| **Total Hours:40** | **Exam Hours : 03** |
| **Semester : III** | **Credits: Mandatory** |

**Course Learning Objectives**: This course (**UMA330M**) will enable students to master the basic tools of calculus and vectors to become skilled for solving problems in science and engineering.

**Differential Calculus:** **15 Hours**
Review of elementary calculus, Polar curves - angle between the radius vector and tangent, angle between two curves, pedal equation. Taylor's and Maclaurin's series expansions for one variable (statements only)without proof. problems
**Partial differentiation :** Introduction to function of several variables, Partial derivatives; Euler's theorem - problems. Total derivatives-differentiation of composite functions. Jacobians-problems,

**Integral Calculus:** **15 Hours**
Evaluation of double and triple integrals. Area bounded by the curve.
**Beta and Gamma functions:** Definitions, Relation between beta and gamma functions-problems.

**Vector Calculus:** **10 Hours**
**Vector Differentiation:** Scalar and vector fields**.** Gradient, directional derivative; curl and divergence-physical interpretation; solenoidal and irrotational vector fields- problems

**Text Books:**

- B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, $43^{rd}$ Ed., 2015.
- E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, $10^{th}$ Ed.(Reprint), 2016.

**Reference books**:

1. Thomas' Calculus: Early Transcendentals, Single Variable (13th Edition)
2. Calculus: Early Transcendentals James Stewart
3. C.Ray Wylie, Louis C.Barrett : "Advanced Engineering Mathematics", $6^{th}$ Edition, McGraw-Hill Book Co., New York, 1995.
4. B.V. Ramana: "Higher Engineering Mathematics" $11^{th}$ Edition, Tata McGraw-Hill, 2010.
5. Veerarajan T.," Engineering Mathematics for First year", Tata McGraw-Hill, 2008.
6. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, $7^{th}$ Ed., 2010.

**Course Outcomes:** On completion of this course, students are able to:

CO1: Apply the knowledge of calculus to solve problems related to polar curves and its applications in determining the bentness of a curve.

CO2: Learn the notion of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions and Jacobians.

CO3: Apply the concept of multiple integrals and their usage in computing the area and volumes.

CO4 : Apply the knowledge of vector calculus to solve the engineering problems

**Question paper pattern for SEE**

1. Total of eight questions uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered

| Course Outcomes | Programme Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| CO1 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO2 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO3 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO4 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

**Evaluation Scheme:**

| Assessment | Marks | Weightage |
|---|---|---|
| CIE-I | 40 | 20 |
| CIE-II | 40 | 20 |
| Course Project | 10 | 10 |
| SEE | 100 | 50 |
| Total | 190 | 100 |
| | | |

**BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT**

**BRIDGE COURSE MATHEMATICS-II**
**(Common to all branches)**
**(Effective from the academic year 2018-19)**

**Subject Code : UMA430M** — **CIE Marks : 50**
**Contact Hours/Week : 03** — **SEE Marks: 50**
**Total Hours:40** — **Exam Hours : 03**
**Semester : IV** — **Credits: Mandatory**

**Course Learning Objectives**: The purpose of the course **UMA430M** is to facilitate the students with concrete foundation of differential equations and Laplace transform to acquire the knowledge of these mathematical tools.

**Ordinary differential equations of first order:** **15 Hours**
Variable seperable,Homogeneous.Exact form and reducible to exact differential equations. Linear and Bernoulli's equation.
**Differential Equations of higher order:**
Second and higher order linear ODE's with constant coefficients-Inverse differential operator, method of variation of parameters(second order); Cauchy's and Legendre homogeneous equations.

**Laplace Transform:** **15 Hours**
Introduction, Definition of Laplace Transform, Laplace Transform of Elementary functions, Properties: Shifting, differentiation, Integral and division by t. Periodic function, Heaviside's Unit step function
**Inverse Laplace transforms** –
Properties. Convolution theorem. Solutions of linear differential equations

**Partial Differential Equations(PDE's):** **10 Hours**
Introduction to PDE : Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Solution of Lagrange's linear PDE, method of separation of variables,

**Text Books:**

- B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
- E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed.(Reprint), 2016.

**Reference books**:

1. Thomas' Calculus: Early Transcendentals, Single Variable (13th Edition)

2. Calculus: Early Transcendentals James Stewart
3. C.Ray Wylie, Louis C.Barrett : "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill Book Co., New York, 1995.
4. B.V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
5. Veerarajan T.," Engineering Mathematics for First year", Tata McGraw-Hill, 2008.
6. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.

**Course Outcomes:** On completion of this course, students are able to:

CO1: Explain various physical models through first and higher order differential equations and solve such linear ordinary differential equations.

CO2: Apply the Laplace transform techniques to solve differential equations.

CO3: Understand a variety of partial differential equations and solution by exact methods.

CO4: solve PDE by direct integration and Solution of Lagrange's linear PDE, method of separation of variables

**Question paper pattern for SEE**

1. Total of eight questions uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered

| Course Outcomes | Programme Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| CO1 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO2 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO3 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO4 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

**Evaluation Scheme:**

| Assessment | Marks | Weightage |
|---|---|---|
| CIE-I | 40 | 20 |
| CIE-II | 40 | 20 |
| Course Project | 10 | 10 |
| SEE | 100 | 50 |
| Total | 190 | 100 |
| | | |

# Basaveshwar Engineering College (Autonomous), Bagalkot

## Model Course Plan

| | | | | | |
|---|---|---|---|---|---|
| **Title of Course** | **:** | **Engineering Mathematics-I** | **Course Code** | **:** | **21UMA101C** |
| **Credits** | **:** | **03(L-T-P: 3-0-0)** | **Contact Hours/ Week** | **:** | **03** |
| **Total Hours** | **:** | **40** | **Branch** | **:** | **Common to All** |
| **CIE Marks** | **:** | **50** | **SEE Marks** | **:** | **50** |
| **Semester** | **:** | **I** | **Year** | **:** | **2021-2022** |

**Course Objectives:** This course will enable students to

| | |
|---|---|
| 1 | Enhance learning of Engineering Mathematics. |
| 2 | Develop, understanding, stimulate their interest, and increase their proficiency in Mathematics. |
| 3 | Visualizing and representations: learners can see abstract concepts; make connections between geometry and algebra. |
| 4 | Make our teaching modules more active and improve the learning outcomes of our students. |
| 5 | Learn Engineering Mathematics conceptually and relationally in order to be able to apply, when they have learned. |
| 6 | Create inquiry based learning and an opportunity to learn, practice. |

**Course Outcomes:**

| | **At the end of the course the student should be able to:** |
|---|---|
| 1 | Understand the concepts of polar curves and curvatures apply when needed. |
| 2 | Learn the notion of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions. |
| 3 | Apply the concepts of partial differentiation in computing Jacobians and extreme values. |
| 4 | Apply the concepts of multiple integrals and their usage in computing the area and volumes. |
| 5 | Learn how complex integrals can be reduced to expressions involving beta function and gamma function is useful for modelling situations involving continuous change, with important applications to calculus, differential equations, complex analysis and statistics. |
| 6 | Apply the knowledge of differentiation of vectors to solve the engineering problems. |

**Course Articulation Matrix: Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)**

| No | Programme Outcomes<br>Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | The students will be able to: | | | | | | | | | | | | | | | |
| 1 | Understand the concepts of polar curves and curvatures apply when needed. | 3 | 2 | | | | | | | | | | | | | |
| 2 | Learn the notion of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions, Jacobians. | 3 | 2 | | | | | | | | | | | | | |
| 3 | Apply the concepts of partial differentiation in computing Jacobians and extreme values. | 3 | 2 | | | | | | | | | | | | | |
| 4 | Apply the concepts of multiple integrals and their usage in computing the area and volumes. | 3 | 2 | | | | | | | | | | | | | |
| 5 | Learn how complex integrals can be reduced to expressions involving beta function and gamma function is useful for modelling situations involving continuous change, with important applications to calculus, differential equations, complex analysis and statistics. | 3 | 2 | | | | | | | | | | | | | |
| 6 | Apply the knowledge of differentiation of vectors to solve the engineering problems. | 3 | 2 | | | | | | | | | | | | | |

**Competencies Addressed in the course and Corresponding Performance Indicators**
**Programme Outcome: Any of 1 to 12 PO's:**

| Competency | Indicators | |
|---|---|---|
| 1.1 Apply the knowledge of Mathematics to the solution of Engineering problems | 1.1.1 | Apply the knowledge of polar curves and curvatures. |
| | 1.1.2 | Apply the knowledge of partial differentiation and extreme values. |
| | 1.1.3 | Apply the concepts of multiple integrals to solve problems |
| | 1.1.4 | Apply beta and gamma functions to solve engineering problems |
| | 1.1.5 | Apply the knowledge of vector differentiation to solve engineering problems. |

Example: 1.2.3: Represents program outcome '1' , competency '2' , & performance indicator '3' .

**PO**1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO**2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO**3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO**4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO**5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO**6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO**7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO**8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO**9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO**10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO**11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12. Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## Course Content

| | | | | | |
|---|---|---|---|---|---|
| **Title of Course** | **:** | **Engineering Mathematics-I** | **Course Code** | **:** | **21UMA101C** |
| **Credits** | **:** | **03(L-T-P:3-0-0)** | **Contact Hours/ Week** | **:** | **03** |
| **Total Hours** | **:** | **40** | **Branch** | **:** | **Common to All** |
| **CIE Marks** | **:** | **50** | **SEE Marks** | **:** | **50** |
| **Semester** | **:** | **I** | **Year** | **:** | **2021-2022** |

| Content | |
|---|---|
| **Unit - I** | |
| **Differential Calculus-1:** Review of elementary calculus, Polar curves - angle between the radius vector and tangent, angle between two curves, pedal equation. Curvature and radius of curvature- Cartesian, parametric and polar forms (without proof) problems. | **10 Hrs** |
| **Unit – II** | |
| **Differential Calculus-2:** Introduction to function of several variables, Partial differentiation; Total derivatives-differentiation of composite functions, Jacobian. Maxima and minima for a function of two variables and its applications; -problems. | **10 Hrs** |
| **Unit – III** | |
| **Integral Calculus:** Multiple integrals: Evaluation of double and triple integrals. Evaluation of double integrals-change of order of integration and changing into polar, spherical and cylindrical co-ordinates. Applications to find area and volumes. | **10 Hrs** |
| **Unit – IV** | |
| **Beta and Gamma functions:** Definitions, relation between beta and gamma functions-problems. **Vector Differentiation:** Scalar and vector fields. Gradient, directional derivative; curl and divergence-physical interpretation; solenoidal and irrotational vector fields- problems | **10 Hrs** |

**Text Books:**

- Maurice D weir, Joel Hass and Frank R. Giordano, “Thomas calculus”, Pearson, eleventh edition, 2011.
- B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, $44^{th}$ Edition, 2017.
- B.V. Ramana: "Higher Engineering Mathematics" $11^{th}$ Edition, Tata McGraw-Hill, 2010

**Reference books**:

1. Erwin Kreyszing’s Advanced Engineering Mathematics volume1 and volume1I,wiley India Pvt.Ltd.,2014.

| Course Outcomes | Programme Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| CO1 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO2 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO3 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO4 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | | | | | | | | | | | |
| CO5 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO6 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

**Unit Learning Outcomes (ULO): Unit-I**

**Differential Calculus-1.** **L-10Hours, T-06 Hours**

| | Unit Learning Outcome (ULO) | CO | BLL | PI addressed |
|---|---|---|---|---|
| 1. | Able to recall the elementary calculus. | CO1 | L1 | 1.1.1 |
| 2. | Able to find the relation between Cartesian and polar coordinate systems. | CO1 | L1, L3 | 1.1.1 |
| 3. | Ability to find the angle between the radius vector and tangent to the given curve. | CO1 | L2 | 1.1.1 |
| 4. | Ability to show that the given curves are orthogonal. | CO1 | L2,L3 | 1.1.1 |
| 5 | Able to solve examples on pedal equation | CO1 | L2 | 1.1.1 |
| 6. | Able to find the radius of curvature at any point on the given curve. | CO1 | L1,L2 | 1.1.1 |

**Course Content: Unit-I**

**Differential Calculus-1.** **L - 10 Hours**

| Hours Required | Topic to be covered | Mode of Delivery |
|---|---|---|
| 01 | Review of elementary calculus. | Chalk and talk in classroom |
| 01 | Introduction to polar curves. | Chalk and talk in classroom |
| 01 | Relation between Cartesian and polar coordinate systems. | Chalk and talk in classroom |
| 01 | Angle between the radius vector and tangent. | Chalk and talk in classroom |
| 01 | Examples on angle between the radius vector and tangent. | Chalk and talk in classroom |
| 01 | Examples on angle between two curves. | Chalk and talk in classroom |
| 01 | Examples on pedal equation | Chalk and talk in classroom |
| 01 | Curvature and radius of curvature- Cartesian, parametric and polar forms (without proof). | Chalk and talk in classroom |
| 01 | Examples on Curvature and radius of curvature- Cartesian, parametric and polar forms | Chalk and talk in classroom |
| 01 | Solve variety of examples on curvature. | Chalk and talk in classroom |

Note: L – Lecture.

**Review Questions: Unit-I**

**Differential Calculus-1.**

| Review Questions | ULO | BLL | PI addressed |
|---|---|---|---|
| 1. Geometrical meaning of radius of curvature. | 1 | L3 | 1.1.1 |
| 2. Find a polar equation for the circle $(x-2)^2 + y^2 = 4$. | 1 | L1 | 1.1.1 |
| 3. Convert $r = 5 \sin\theta$ into Cartesian form | 2 | L3 | 1.1.1 |
| 4. Derive the angle between radius vector and the tangent to the curve $r = f(\theta)$ at any point $p(r,\theta)$ in the form $\tan\varphi = r\,(d\theta/dr)$. | 3 | L1 | 1.1.1 |
| 5. Find the angle between radius vector and the tangent to the curve $r = a\,(1-\cos\theta)$. Also find the slope of the curve at $\theta = \pi/6$. | 3 | L2 | 1.1.1 |
| 6. Show that the radius vector is inclined at a constant angle to the tangent at any point on the equiangular spiral $r = a\,e^{\theta \cot\alpha}$ . | 3 | L2 | 1.1.1 |
| 7. Find the angle of intersection of the curves $r = a/(1+ \cos\theta)$, & $r = b\ /(1-\cos\theta)$ | 3 | L2 | 1.1.1 |
| 8. Show that the curves $r^n = a^n \sin^n\theta$ & $r^n = b^n \cos^n\theta$ cut orthogonally. | 3 | L2 | 1.1.1 |
| 8a Find the pedal equation of $(1- \cos\theta)\, r = 2a$ | 5 | | |
| 9. Find the radius of curvature at the point $(3a/2, 3a/2)$ of the Folium $x^2 + y^2 = 3axy$. | 6 | L3 | 1.1.1 |
| 10. Show that the radius of curvature at any point of the cycloid $x = a\,(\theta + \sin\theta)$, $y = a\,(1+\cos\theta)$ is $4a \cos(\theta/2)$. | 6 | L1 | 1.1.1 |
| 11. Show that the radius of curvature at any point of the Cardioid $r = a\,(1-\cos\theta)$ varies as square root of r. | 6 | L2 | 1.1.1 |

## Unit Learning Outcomes (ULO): Unit-II

**Differential Calculus-2.** **L-10 Hours**

| | Unit Learning Outcome (ULO) | CO | BLL | PI addressed |
|---|---|---|---|---|
| 1. | Able to learn how confidently calculate partial derivative functions | CO2 | L1,L2 | 1.1.2 |
| 2. | Ability to solve problems in which different quantities have different rates of changes. | CO2 | L3 | 1.1.2 |
| 3. | Able to solve engineering problems on composite functions | CO2 | L3 | 1.1.2 |
| 4. | Apply the concept of Jacobian to solve engineering problems | CO3 | L2,L3 | 1.1.2 |
| 5. | Ability to solve engineering problems on stationary values | CO3 | L3 | 1.1.2 |

## Course Content: Unit-II

**Differential Calculus-2.** **L-10 Hours.**

| Hours Required | Topic to be covered | Mode of Delivery |
|---|---|---|
| 01 | Introduction to functions of several variables | Chalk and talk in classroom |
| 01 | Introduction to partial derivatives | Chalk and talk in classroom |
| 01 | Examples on partial derivatives | Chalk and talk in classroom |
| 01 | Ask the students to solve variety of problems on partial derivatives and total derivatives | Chalk and talk in classroom |
| 01 | Utilization of composite functions for several variables. | Chalk and talk in classroom |
| 01 | Introduction to stationary values / examples | Chalk and talk in classroom |
| 01 | Ask to solve the problems on composite functions, stationary values and method of Langrage's multipliers. | Chalk and talk in classroom |
| 01 | Introduction to Jacobians-Problems | Chalk and talk in classroom |
| 01 | Solve variety of examples on Jacobians | Chalk and talk in classroom |
| 01 | Summary: Inquire by asking questions, sum up the entire unit, and try to clear their doubts about the entire unit. | Chalk and talk in classroom |

Note: L – Lecture

## Review Questions: Unit-II

**Differential Calculus-2.**

| Review Questions | ULO | BL L | PI addressed |
|---|---|---|---|
| 1. If $x^x y^y z^z = c$ show that at $x = y = z$ $\dfrac{\partial^2 z}{\partial x \partial y} = -(x \log ex)^{-1}$ | 1 | L2 | 1.1.2 |
| 2. If $u = \sin^{-1}\left(\dfrac{x+2y+3z}{x^8+y^8+z^8}\right)$ find the value of $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} + z\dfrac{\partial u}{\partial z}$ | 1 | L1 | 1.1.2 |
| 3. If $u = \log(x^3+y^3+z^3-3xyz)$ show that $\left(\dfrac{\partial}{\partial x}+\dfrac{\partial}{\partial y}+\dfrac{\partial}{\partial z}\right)^2 u = -\dfrac{9}{(x+y+z)^2}$ | 1 | L2 | 1.1.2 |
| 4. If $\mathbf{z} = \dfrac{\mathbf{x}^2+\mathbf{y}^2}{(\mathbf{x}+\mathbf{y})}$ show that $\left(\dfrac{\partial z}{\partial x} - \dfrac{\partial z}{\partial y}\right)^2 = 4\left(1 - \dfrac{\partial z}{\partial x} - \dfrac{\partial z}{\partial y}\right)$. | 1 | L2 | 1.1.2 |
| 5. The height of the right circular cone is increasing at 3mm/s. Determine, correct to 3 significant figures, the rate at which the volume is changing (in $cm^3$ / s ) when the height is 3.2 cm and the radius is 1.5 cm. | 2 | L3 | 1.1.2 |
| 6. If $u = \sin(x/y)$, $x = e^t$ and $y = t^2$, find du/dt as a function of t. Verify your result by direct substitution. | 2 | L3 | 1.1.2 |
| 7. If $u = f(y-z, z-x, x-y)$ prove that $\dfrac{\partial u}{\partial x} + \dfrac{\partial u}{\partial y} + \dfrac{\partial u}{\partial z} = 0$ | 3 | L3 | 1.1.2 |
| 8. If $z = e^{(ax+by)} f(ax-by)$ then prove that $\mathbf{b}\dfrac{\partial \mathbf{z}}{\partial \mathbf{x}} + \mathbf{a}\dfrac{\partial \mathbf{z}}{\partial \mathbf{y}} = 2\mathbf{abz}$ | 3 | L2 | 1.1.2 |
| 9. If $z = f(x,y)$ where $x = e^u + e^{(-v)}$ and $y = e^{(-u)} - e^v$, then prove that $\dfrac{\partial z}{\partial u} - \dfrac{\partial z}{\partial v} = \mathbf{x}\dfrac{\partial z}{\partial x} - \mathbf{y}\dfrac{\partial z}{\partial y}$. | 3 | L2 | 1.1.2 |
| 10. In polar coordinates, $x = r\cos\theta$, $y = r\sin\theta$, show that $\dfrac{\partial(\mathbf{x},\mathbf{y})}{\partial(\mathbf{r},\boldsymbol{\theta})} = \mathbf{r}$ | 4 | L3 | 1.1.2 |
| 11 If $y_1 = (x_2 x_3/x_1)$, $y_2 = (x_3 x_1/x_2)$, $y_3 = (x_1 x_2/x_3)$, show that the Jacobian of $y_1, y_2, y_3$ with respect to $x_1, x_2, x_3$, is 4 | 4 | L3 | 1.1.2 |
| 12. If $u = x + 3y^2 - z^3$, $v = 4x^2yz$, $w = 2x^2 - xy$, evaluate $\dfrac{\partial(\mathbf{u},\mathbf{v},\mathbf{w})}{\partial(\mathbf{x},\mathbf{y},\mathbf{z})}$ at (1,-1,0) | 4 | L3 | 1.1.2 |
| 13. In a plane triangle, find the maximum value of cosA, cosB, cosC. | 5 | L3 | 1.1.2 |
| 14. An open rectangular container is to have a volume of 62.5 $cm^3$. Determine the least surface area of material required. | 5 | L3 | 1.1.2 |
| 15. Show that the rectangular solid of maximum volume that can be inscribed in a sphere is a cube. | 5 | L3 | 1.1.2 |
| 16. A tent on a square base of side x, has its sides vertical of height y and the top is regular pyramid of height h . Find x and y in terms of h , if the canvas required for its construction is to be minimum for the tent to have a given capacity. | 5 | L3 | 1.1.2 |

## Unit Learning Outcomes (ULO): Unit-III

**Integral Calculus.** **L-10Hours**

| Unit Learning Outcome (ULO) | CO | BLL | PI addressed |
|---|---|---|---|
| 1. Apply the concepts of integral of a function of two variables over a region in the plane and the integral of a function of three variables over a region in space. | CO4 | L1,L3 | 1.1.3 |
| 2. Ability to solve problems on change of order of integration. | CO4 | L2,L3 | 1.1.3 |
| 3. Able to solve engineering problems on changing into polar coordinates. | CO4 | L2,L3 | 1.1.3 |
| 4. Able to solve engineering problems on spherical coordinates | CO4 | L2,L3 | 1.1.3 |
| 5. Apply cylindrical coordinates to solve problems in engineering and geometry | CO4 | L3 | 1.1.3 |

## Course Content: Unit-III

**Integral Calculus.** **L-10 Hours**

| Hours Required | Topic to be covered | Mode of Delivery |
|---|---|---|
| 01 | Introduction to double integrals | Chalk and talk in classroom |
| 01 | Introduction to triple integrals | Chalk and talk in classroom |
| 01 | Various examples on double and triple integrals | Chalk and talk in classroom |
| 01 | Learn tricks to solve problems on double and triple integrals | Chalk and talk in classroom |
| 01 | Solve variety of examples on double/triple integrals. | Chalk and talk in classroom |
| 01 | Solve problems on change of order of integration. | Chalk and talk in classroom |
| 01 | Solve variety examples on changing into polar coordinates | Chalk and talk in classroom |
| 01 | Learn how to calculate area and volume using multiple integrals. | Chalk and talk in classroom |
| 01 | Ask to solve the problems on change of order of integration, and changing into polar coordinates. | Chalk and talk in classroom |
| 01 | Solve variety of examples on Spherical and cylindrical coordinates | Chalk and talk in classroom |

Note: L – Lecture

## Review Questions: Unit-III

**Integral Calculus.**

| | Review Questions | ULO | BLL | PI addressed |
|---|---|---|---|---|
| 1. | Evaluate $\int_0^2\int_1^2 (x^2+y^2)\, dx\, dy.$ | 1 | L1 | 1.1.3 |
| 2. | Evaluate $\int_0^1\int_{x^2}^{x} (x^2+3y+2)\, dy\, dx.$ | 1 | L1 | 1.1.3 |
| 3. | Evaluate $\int_0^a\int_0^{\sqrt{a^2+y^2}} \sqrt{a^2-x^2-y^2}\, dx\, dy.$ | 1 | L1 | 1.1.3 |

| | | | | |
|---|---|---|---|---|
| 4. | Prove that $\int_0^1 \int_y^{y^2+1} (x^2 y)\, dx\, dy = \frac{67}{120}$. | 1 | L1 | 1.1.3 |
| 5. | Evaluate $\iint_R xy\, dx\, dy$, where R is the positive quadrant of the circle $x^2 + y^2 = a^2$. | 1 | L3 | 1.1.3 |
| 6. | Find the volume bound by 3x+2y+z=12, z= 0, y=-2, y =3. X=0, x=1. | 1 | L3 | 1.1.3 |
| 7. | Find the area of ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, by double integration. | 1 | L3 | 1.1.3 |
| 8. | Using the double integration, find the area enclosed by the curve $r = a(1 + \cos\theta)$ and lying above the initial line. | 1 | L3 | 1.1.3 |
| 9. | Evaluate $\int_0^3 \int_0^2 \int_0^1 (x + y + z)\, dzdxdy$ | 1 | L1 | 1.1.3 |
| 9. | Evaluate $\int_1^3 \int_{1/x}^1 \int_0^{\sqrt{xy}} (xyz)\, dzdydx$ | 1 | L1 | 1.1.3 |
| 10. | Evaluate $\int_0^1 \int_{y^2}^1 \int_0^{1-x} (x)\, dzdxdy$ | 1 | L1 | 1.1.3 |
| 11. | Change the order of integration in $\int_0^1 \int_{x^2}^{2-x} (xy)\, dx\, dy$. | 2 | L3 | 1.1.3 |
| 12. | Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \frac{1}{(1+e^y)\sqrt{1-x^2-y^2}}\, dy\, dx$. | 2 | L3 | 1.1.3 |
| 13. | Evaluate $\iint_{x^2+y^2 \le 1, x, y \ge 0} (1 - x^2 - y^2)\, dA$ | 3 | L3 | 1.1.3 |
| 14. | Evalate $\iint (x^2 + y^2)^{7/2}\, dxdy$ over the circle $x^2 + y^2 \le 1$. | 3 | L3 | 1.1.3 |
| 15. | Evaluate $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)}\, dx\, dy$. | 3 | L3 | 1.1.3 |
| 16. | $\int\int_R \sqrt{x^2 + y^2}\; dxdy$ where R is the region between $x^2 + y^2 = 4 \;\; and \;\; x^2 + y^2 = 9$ <br> Hint: <br> $As\ \theta$ varies $0\ to\ 2\pi$ and $r$ varies from $r = 2\ to\ r = 3$ | 3 | L3 | 1.1.3 |
| 17. | Change the following to Spherical coordinates and hence evaluate $\iiint_V (x^2 + y^2 + z^2)\, dxdydz$ where V is the side region inside $x^2 + y^2 + z^2 =$ | 4 | L3 | 1.1.3 |
| 18 | Find, by triple integration, the volume of the sphere $x^2+y^2+z^2=a^2$. Hint: changing to polar spherical coordinates. | 4 | L3 | 1.1.3 |

| | | | | |
|---|---|---|---|---|
| 19 | Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_{\sqrt{x^2+y^2}}^1 \frac{dzdydx}{\sqrt{x^2+y^2+z^2}}$. | 4 | L3 | 1.1.3 |
| 20 | Use a triple integral in cylindrical coordinates to determine the volume of the solid bounded by $z = 0$ and $z = 9 - (x^2 + y^2)$. | 5 | L3 | 1.1.3 |
| 21 | Evaluate $\iiint z(x^2+y^2+z^2)\,dx\,dy\,dz$ through the volume of the cylinder intercepted by the planes $z = 0$ & $z = b$. | 5 | L3 | 1.1.3 |

## Unit Learning Outcomes (ULO): Unit-IV

**Beta , Gamma functions and Vector Differentiation**: **L-10 Hours**

| Unit Learning Outcome (ULO) | | CO | BLL | PI addressed |
|---|---|---|---|---|
| 1. | Ability to solve engineering problems on beta and gamma functions. | CO5 | L1,L2,L3 | 1.1.4 |
| 2. | Able to understand Gradient and directional derivative . | CO5 | L2,L3 | 1.1.5 |
| 3. | Able to understand their physical significance of Gradient and directional derivative . | CO5 | L1,L3 | 1.1.5 |
| 4. | Able to understand divergence and curl. | CO5 | L2 | 1.1.5 |
| 5. | Apply the concepts of irrotational and solenoidal vector fields to solve problems. | CO5 | L2 | 1.1.5 |

## Course Content: Unit-IV

**Beta , Gamma functions and Vector Differentiation.**

**L - 10Hours**

| Hours Required | Topic to be covered | Mode of Delivery |
|---|---|---|
| 01 | Define beta and gamma functions and discuss some properties of beta and gamma functions. | Chalk and talk in classroom |
| 01 | Solve standard examples on beta and gamma functions. | Chalk and talk in classroom |
| 01 | | Chalk and talk in classroom |
| 01 | Ask students to demonstrate beta and gamma functions by taking some numerical values under the supervision of course instructor. | Chalk and talk in classroom |
| 01 | Derive the relation between beta and gamma functions-problems | Chalk and talk in classroom |
| 01 | Discuss about directional derivative and solve examples on directional derivative | Chalk and talk in classroom |
| 01 | Del applied to vector point functions, physical interpretation of divergence. | Chalk and talk in classroom |
| 01 | Physical interpretation of Curl and solve variety of examples on curl. | Chalk and talk in classroom |
| 01 | Learn how to calculate directional derivative | Chalk and talk in classroom |
| 01 | Ask to solve the problems on curl | |
| 01 | Discuss the importance of solenoidal & irrotational vector fields - problems | Chalk and talk in classroom |

**Review Questions: Unit-IV**
**Beta ,Gamma functions and Vector Differentiation**.

| Review Questions | ULO | BLL | PI addressed |
|---|---|---|---|
| 1. Prove that $\beta$ (m, n) = $\beta$ (n, m) | 1 | L2 | 1.1.4 |
| 2. Prove that $\beta$ (m, n+1) + $\beta$ (m+1,n) = $\beta$ (m, n) | 1 | L2 | 1.1.4 |
| 3. Evaluate $\int_0^4 x^{3/2}(4-x)^{5/2}dx$ , | 1 | L2 | 1.1.4 |
| 4. Evaluate $\int_0^\infty xe^{-\sqrt{x}}dx$ , | 1 | L2 | 1.1.4 |
| 5. Show that $\int_0^1 \frac{x^2}{\sqrt{1-x^4}}dx \times \int_0^1 \frac{1}{\sqrt{1+x^4}}dx = \frac{\pi}{4\sqrt{2}}$ | 1 | L2 | 1.1.4 |
| 6. Evaluate $\int_0^{\pi/2} \sin^5\theta\cos^7\theta\, d\theta$. | 1 | L2 | 1.1.4 |
| 7. Find the directional derivative of f(x, y, z) = $xy^2 + yz^3$ at the point (2,-1.1) in the direction of vector I + 2j + 2k . | 2 | L2 | 1.1.5 |
| 8. Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ & $z = x^2 + y^2 - 3$ at the point (2,-1, 2) | 3 | L3 | 1.1.5 |
| 9. Find div F and Curl F where F = grad($x^3+y^3+z^3-3xyz$). | 4 | L2 | 1.1.5 |
| 10. Find the values of a , b and c so that the vector F= (x + y + az) i + (bx+2y-z) j + (-x +c y +2z)k may be irrotational. | 5 | L3 | 1.1.5 |
| 11. Prove that F = $(6xy+z^3)$I + $(3x^2-z)$ j + $(3xz^2-y)$k is irrotational & find the scalar potential given F = $\nabla\varphi$. | 5 | L3 | 1.1.5 |

**Details of course project:**

- Each student should prepare different problems and submit to the course instructor
- Students will identify by the members of the team by picking (Roll number) chits
- Total twelve teams in a class
- Problems may be based on the previous lectures delivered by the teacher( knowledge based)
- Each member of the team will demonstrate the mathematical problems in front of the other students

**Question paper pattern for SEE:**

1. Question paper consists Part-A and Part-B. Question number 1 is compulsory, it consists of short answer questions of 1 or 2 marks, covering entire syllabus (no multiple choice questions and No true or false questions, 50% of questions must be L3 and L4 level).
2. In Part-B total of eight questions with two from each unit; with internal choice to be set uniformly covering the entire syllabus.
3. Each question carries 20 marks and should not have more than four subdivisions.
4. In Part-B, any FOUR full questions are to be answered choosing at least one from each unit.

5. Sketches, figures and tables if any should be clearly drawn, as the same is scanned for printing.
6. The question paper should contain all the data / figures / marks allocated, with clarity.

**Evaluation Scheme:**

| Assessment | Marks | Weightage |
|---|---|---|
| **CIE-I** | **40** | **20** |
| **CIE-II** | **40** | **20** |
| **Assignments/ Quizzes/ Case Study/ Course Project/ Term Paper/Field Work** | **20** | **10** |
| **SEE** | **100** | **50** |
| **Total** | **200** | **100** |

**Question paper pattern for CIE-I and CIE-II:**

1. Question paper consists Part-A and Part-B. Question number 1 is compulsory, it consists of short answer questions of 1 or 2 marks, covering two units (no multiple choice questions and No true or false questions).
2. In Part-B, Four questions are to be set as per the following table.

| CIE | Number of questions / Maximum marks | Sub divisions | Covering entire unit |
|---|---|---|---|
| I | Two questions / Each question carry 15 marks. | Sub divisions shall not be mixed within the unit | Unit-I |
| | | | |
| | Two questions / Each question carry 15 marks. | Sub divisions shall not be mixed within the unit | Unit-II |
| II | Two questions / Each question carry 15 marks. | Sub divisions shall not be mixed within the unit | Unit-III |
| | | | |
| | Two questions / Each question carry 15 marks. | Sub divisions shall not be mixed within the unit | Unit-IV |
| | | | |

**BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT**
**DEPARTMENT OF MATHEMATICS**
**FIRST CIE**

| | | | |
|---|---|---|---|
| **Course** | **: B.E** | **Semester** | **:I** |
| **Subject** | **: Engineering Mathematics-I** | **Branch** | **:Common** |
| **Subject Code** | **: 21UMUA101C** | **Max. Marks** | **: 40** |
| **Duration** | **:** $1\frac{1}{2}$ hours | | |

| | | | | | |
|---|---|---|---|---|---|
| **Note :PART A: ALL questions are compulsory**<br>**PART B : Answer any one full question from each unit** | | | | | |
| **PART-A** | | | | | |
| **Q. No.** | **Question** | **MARKS** | **BL** | **CO** | **PI** |
| **1. a.** | Convert $y = 2x^2$, into polar form and evaluate when $\theta = \frac{\pi}{2}$, what is the value of r ? | 2 | L2 | 1 | 1.1.1 |
| **b.** | How do we obtain a pedal equation of a curve r = f(θ). | 2 | L1 | 1 | 1.1.1 |
| **c.** | Write the formula of radius of curvature of the curve y = f(x). | 2 | L3 | 1 | 1.1.2 |
| **d.** | Write down the interpretation of the following<br>i) )$H_1 = \frac{\delta H(X_1, X_2)}{X_1}$ ii) $H_2 = \frac{\delta H(X_1, X_2)}{X_2}$ | 2 | L2 | 2 | 1.1.2 |
| **e.** | Write down the necessary and sufficient conditions for F(x, y) to have Maximum or minimum values at (a, b). | 2 | L1 | 3 | 1.1.2 |
| **PART-B:** Answer any Two Full questions selecting at least one question from each unit | | | | | |
| **UNIT-I** | | | | | |
| **2. a.** | Derive the angle between radius vector and the tangent to the curve $r = f(\theta)$ at any point P(r , θ ) in the form $tan\emptyset = r\frac{d\theta}{dr}$. | 5 | L3 | 1 | 1.1.1 |
| **b.** | Find the angle between radius vector and the tangent to the curve r = a (1-cosθ). Also find the slope of the curve at θ = π/6. | 5 | L2 | 1 | 1.1.1 |
| **c.** | Show that the following curves intersect orthogonally $r = 4sec^2\frac{\theta}{2}\ and\ r = 9cosec^2\frac{\theta}{2}$. | 5 | L2 | 1 | 1.1.1 |
| | | | | | |
| **3a.** | Find the pedal equation of the curve r = a (1+cosθ ). | 5 | L2 | 1 | 1.1.1 |
| **b.** | Find the radius of curvature of the curve $x = alog(sect + tant),\ y = asect$. | 5 | L2 | 1 | 1.1.1 |

| | | | | | |
|---|---|---|---|---|---|
| c. | Find a polar equation for the circle $(x-2)^2 + y^2 = 4$. | 5 | L2 | 1 | 1.1.1 |
| UNIT-II | | | | | |
| 4. a. | If $u = \sin^{-1}\left(\frac{x+2y+3z}{x^8+y^8+z^8}\right)$ find the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z}$ | 5 | L2 | 2 | 1.1.1 |
| b. | If $u = f(x + ct) + g(x - ct)$ prove that $u_{tt} = c^2 u_{xx}$ | 5 | L1 | 2 | 1.1.2 |
| c. | If $u = x^2 cos3y$, $v = x^2 sin3y$ then verify that $JJ' = 1$. | 5 | L3 | 2 | 1.1.2 |
| | | | | | |
| 5. a. | In polar coordinates, $x = r\cos\theta$, $y = r\sin\theta$, show that $\frac{\partial(\mathbf{x},\mathbf{y})}{\partial(\mathbf{r},\boldsymbol{\theta})} = \mathbf{r}$ | 5 | L2 | 2 | 1.1.2 |
| b. | Find the minimum value of $x^2 + y^2 + z^2$ subject to the condition $xy + yz + zx = 3a^2$. | 5 | L3 | 2 | 1.1.2 |
| c. | The period of a simple pendulum is $T = 2\pi\sqrt{\frac{l}{g}}$ find the maximum error in T due to the possible error up to 1 % in $l$ and 2.5 % in $g$. | 5 | L3 | 2 | 1.1.2 |

| BASAVESHWAR ENGINEERING COLLEGE(AUTONOMOUS),BAGALKOT | |
|---|---|
| DEPARTMENT OF MATHEMATICS | |
| SECOND CIE | |
| **COURSE :B.E** | **SEMESTER :I** |
| **Subject : ENGINEERING MATHEMATICS-I** | **Branch :Common** |
| **Subject Code :21UMA101C** | **MAX.MARKS : 40** |
| **DURATION:** $1\frac{1}{2}$ **Hrs** | **Topics: UNIT- III and Unit-IV** |

**Note :PART A: ALL questions are compulsory**
**PART B : Answer any one full question from each unit**

| Q. No | Questions | Marks | BLL | CO | P.I |
|---|---|---|---|---|---|
| **PART A** | | | | | |
| 1. a) | Interpret the Geometrical meaning of Double Integration. | 2 | L2 | 4 | 1.1.3 |
| b) | Explain evaluation of double integration of the function $f(x,y)$ by changing into polar. | 2 | L2 | 4 | 1.1.3 |

| | | | | | |
|---|---|---|---|---|---|
| c) | Determine $\Gamma(7/2)$ | 2 | L2 | 5 | 1.1.4 |
| d) | Define Gradient of a Scalar function. | 2 | L2 | 6 | 1.1.5 |
| e) | Find the tangent vector to the curve $x = t^2, y = t^3, z = 2t$ at any point. | 2 | L2 | 6 | 1.1.5 |
| | **PART – B** | | | | |
| | **UNIT-III** | | | | |
| 2. a) | Evaluate $\int_0^1 \int_0^{\sqrt{1-y^2}} x^3 y \, dx \, dy$ | 5 | L3 | 4 | 1.1.3 |
| b) | Evaluate $\int_0^3 \int_0^2 \int_0^1 (\mathbf{x+y+z}) \ \mathbf{dzdxdy}$ | 5 | L3 | 4 | 1.1.3 |
| c) | Change the order of integration and hence Evaluate $\int_0^{4a} \int_{x^2/4a}^{2\sqrt{ax}} xy \, dy \, dx$ | 5 | L3 | 4 | 1.1.3 |
| | | | | | |
| 3. a) | Change the following to Spherical coordinates and hence evaluate $\iiint_V (\mathbf{x}^2 + \mathbf{y}^2 + \mathbf{z}^2)\mathbf{dxdydz}$ where V is the side region inside $\mathbf{x}^2 + \mathbf{y}^2 + \mathbf{z}^2 = 4$. | 5 | L3 | 4 | 1.1.3 |
| b) | Find, by triple integration, the volume of the sphere $x^2+y^2+z^2=a^2$. Hint: changing to polar spherical coordinates. | 5 | L3 | 4 | 1.1.3 |
| c) | Use a triple integral in cylindrical coordinates to determine the volume of the solid bounded by $z = 0$ and $z = 9 - (x^2 + y^2)$. | 5 | L3 | 4 | 1.1.3 |
| | **UNIT IV** | | | | |
| 4. a) | Prove that $\beta$ (m, n) = $\beta$ (n, m) | 5 | L3 | 6 | 1.1.4 |
| b) | Prove that $\beta$ (m, n+1) + $\beta$ (m+1,n) = $\beta$ (m, n) | 5 | L3 | 6 | 1.1.4 |
| c) | Evaluate $\int_0^4 x^{3/2}(4-x)^{5/2} dx$ , | 5 | L3 | 6 | 1.1.4 |
| | | | | | |
| 5.a | Find the directional derivative of $f(x, y, z) = xy^2 + yz^3$ at the point (2,-1.1) in the direction of vector I + 2j + 2k . | 5 | L3 | 6 | 1.1.5 |
| b. | Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ & $z = x^2 + y^2 - 3$ at the point (2,-1, 2) | 5 | L3 | 6 | 1.1.5 |
| c. | Prove that $F = (6xy+z^3)I + (3x^2-z)j + (3xz^2-y)k$ is irrotational & find the scalar potential given $F = \nabla\varphi$. | 5 | L3 | 6 | 1.1.5 |

**Question paper pattern for SEE:**

7. Question paper consists Part-A and Part-B. Question number 1 is compulsory, it consists of short answer questions of 1 or 2 marks, covering entire syllabus (no

multiple choice questions and No true or false questions, 50% of questions must be L3 and L4 level).

8. In Part-B total of eight questions with two from each unit; with internal choice to be set uniformly covering the entire syllabus.
9. Each question carries 20 marks and should not have more than four subdivisions.
10. In Part-B, any FOUR full questions are to be answered choosing at least one from each unit.
11. Sketches, figures and tables if any should be clearly drawn, as the same is scanned for printing.
12. The question paper should contain all the data / figures / marks allocated, with clarity.

**B.E. First Semester End Examination, 2021-2022**
**Model Question paper**

**Engineering Mathematics-I** **21UMA101C**
**Duration: 3 Hours** **Max.marks:100**

**Note :PART A: ALL questions are compulsory**
**PART B : Answer any one full question from each unit**

**PART A**

| Q.No. | | Question | Marks | BLL | CO | PO | P.I. |
|---|---|---|---|---|---|---|---|
| 1 | a | Convert y = $2x^2$ to polar form and evaluate when θ = π/4, what is the value of r. | 2 | L2 | 1 | 1 | 1.1.1 |
| | b | What are plane curves & how do we measure plane curves | 2 | L2 | 1 | 1 | 1.1.1 |
| | c | What is the curvature of the straight line. | 2 | L3 | 2 | 1 | 1.1.2 |
| | d | Define contour map and stationary point or Turning point | 2 | L2 | 2 | 1 | 1.1.2 |
| | e | $Z=3x^2 - 2y$ find the value of z corresponding to p(2,3) in the xy-plane and draw the diagram of the value of z corresponding to x & y | 2 | L3 | 3 | 1 | 1.1.3 |
| | f | Define double and triple integrals. | 2 | L3 | 3 | 1 | 1.1.3 |
| | g | Define B(m, n) and draw the diagram of B(2, 3). | 2 | L3 | 4 | 1 | 1.1.4 |
| | h | Write an equation for the function r(t)= t i + ($-t^2$ + 5)j in rectangular form. | 2 | L2 | 5 | 1 | 1.1.5 |
| | i | Explain the physical interpretation of Gradient | 2 | L3 | 5 | 1 | 1.1.5 |
| | j | Define Solenoidal and Irrotataional | 2 | L1 | 6 | 1 | 1.1.5 |

**PART B**
**Unit-I**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2 | a | Derive the angle between radius vector and the tangent to the curve $r = f(\theta)$ at any point $p(r,\theta)$ in the form $\tan\phi = r\frac{d\theta}{dr}$. | 6 | L3 | 1 | 1 | 1.1.1 |
| | b | Find the angle of intersection of the pair of curves $r = a\log\theta$ and $r = \frac{a}{\log\theta}$ | 7 | L2 | 1 | 1 | 1.1.1 |
| | c | Find the pedal equation of the curve $\frac{2a}{r} = (1+\cos\theta)$ | 7 | L2 | 1 | | 1.1.1 |
| | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3 | a | Find the radius of curvature at the point ( 3a/2 , 3a/2 ) of the Folium $x^3 + y^3 = 3axy$. | 6 | L1 | 1 | | 1.1.1 |
| | b | Show that the radius of curvature at any point of the cycloid $x = a(\theta + \sin\theta)$, $y = a(1+\cos\theta)$ is $4a\cos(\theta/2)$. | 7 | L2 | 1 | 1 | 1.1.1 |
| | c | Show that the radius of curvature at any point of the Cardioid $r = a(1-\cos\theta)$ varies as square root of r. | 7 | L2 | 1 | 1 | 1.1.1 |
| **Unit-II** | | | | | | | |
| 4 | a | If $u = \frac{1}{r}\left[f(r-at)+g(r+at)\right]$ show that $\frac{\partial^2 u}{\partial t^2} = \frac{a^2}{r^2}\frac{\partial}{\partial r}(r^2\frac{\partial u}{\partial r})$ | 6 | L1 | 2 | 1 | 1.1.2 |
| | b | If $z = f(x,y)$ where $x = e^u + e^{(-v)}$ and $y = e^{(-u)} - e^v$, then prove that $\frac{\partial z}{\partial u} - \frac{\partial z}{\partial v} = \mathbf{x}\frac{\partial z}{\partial x} - \mathbf{y}\frac{\partial z}{\partial y}$. | 7 | L3 | 2 | 1 | 1.1.2 |
| | c | If $z = e^{(ax+by)} f(ax-by)$ then prove that $\mathbf{b}\frac{\partial \mathbf{z}}{\partial \mathbf{x}} + \mathbf{a}\frac{\partial \mathbf{z}}{\partial \mathbf{y}} = 2\mathbf{abz}$ | 7 | L3 | 2 | 1 | 1.1.2 |
| | | | | | | | |
| 5 | a | If $x = e^u \cos v$ , $y = e^u \sin v$ then Verify that $J J' = 1$. | 6 | L1 | 2 | 1 | 1.1.2 |
| | b | Find the minimum value of $x^2 + y^2 + z^2$ when $x + y + z = 3a$. | 7 | L3 | 2 | 1 | 1.1.2 |
| | c | A tent on a square base of side x, has its sides vertical of height y and the top is regular pyramid of height h . Find x and y in terms of h , if the canvas required for its construction is to be minimum for the tent to have a given capacity. | 7 | L3 | 2 | 1 | 1.1.2 |
| **Unit-III** | | | | | | | |
| 6 | a | Evaluate $\int_0^2\int_1^2 (\mathbf{x}^2+\mathbf{y}^2)\ \mathbf{dx\,dy}.$ | 6 | L1 | 3 | 1 | 1.1.3 |
| | b | Evaluate $\int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a}(x^2+y^2+z^2)\,dx\,dy\,dz$ | 7 | L3 | 3 | 1 | 1.1.3 |
| | c | Find the area of ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, by double integration. | 7 | L3 | 3 | 1 | 1.1.3 |
| | | | | | | | |
| 7 | a | Change the order of integration $\int_0^1\int_{\mathbf{x}^2}^{2-\mathbf{x}} (\mathbf{xy})\ \mathbf{dx\,dy}.$ | 6 | L2 | 3 | 1 | 1.1.3 |
| | b | Change the following to Spherical coordinates and hence evaluate $\iiint_{\mathbf{V}}(\mathbf{x}^2+\mathbf{y}^2+\mathbf{z}^2)\mathbf{dxdydz}$ where V is the side region inside $\mathbf{x}^2+\mathbf{y}^2+\mathbf{z}^2 = 4.$ | 7 | L2 | 4 | 1 | 1.1.3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **c** | Evaluate $\iiint z\left(x^2+y^2+z^2\right)dx\,dy\,dz$ through the volume of the cylinder $x^2$ intercepted by the planes z = 0 & z = b. | **7** | L2 | 4 | 1 | 1.1.3 |
| **Unit-IV** | | | | | | | |
| **8** | **a** | Prove that $\beta$ (m, n) = $\beta$ (n, m) | **6** | L3 | 5 | 1 | 1.1.4 |
| | **b** | Evaluate $\int_0^{\pi/2} \sin^5\theta \cos^7\theta \, d\theta$. | **7** | L1 | 5 | 1 | 1.1.4 |
| | **c** | Show that $\int_0^1 \frac{x^2}{\sqrt{1-x^4}}dx \times \int_0^1 \frac{1}{\sqrt{1+x^4}}dx = \frac{\pi}{4\sqrt{2}}$ | **7** | L2 | 5 | 1 | 1.1.4 |
| | | | | | | | |
| **9** | **a** | Find the angle between the surfaces $x^2+y^2+z^2=9$ & $z=x^2+y^2-3$ at the point (2,-1, 2) | 6 | L2 | 6 | 1 | 1.1.5 |
| | **b** | Find div F and Curl F where F = grad($x^3+y^3+z^3-3xyz$). | 7 | L3 | 6 | 1 | 1.1.5 |
| | **c** | Prove that F = $(6xy+z^3)$ i + $(3x^2-z)$ j + $(3xz^2-y)$k is irrotational & find the scalar potential given F = $\nabla\varphi$. | 7 | L3 | 6 | 1 | 1.1.5 |

**END**

| | | | | | |
|---|---|---|---|---|---|
| **Title of Course** | **:** | **Engineering Mathematics-II** | **Course Code** | **:** | **21NUMA201C** |
| **Credits** | **:** | **03(L-T-P:3-0-0)** | **Contact Hours/ Week** | **:** | **03** |
| **Total Hours** | **:** | **40** | **Branch** | **:** | **Common to all** |
| **CIE Marks** | **:** | **50** | **SEE Marks** | **:** | **50** |
| **Semester** | **:** | **II** | **Year** | **:** | **2021-2022** |

**Course Objectives:** This course will enable students to

| | |
|---|---|
| 1 | Understand linear algebra and its applicability in different engineering fields. |
| 2 | Strengthen the analytical abilities and basic mathematical skills of students for effective understanding of engineering subjects. |
| 3 | Create and analyse mathematical models using higher order differential equations |
| 4 | Abel to understand basic concepts of Laplace transforms |
| 5 | Reduce a differential equation to an algebraic equation and apply the Laplace transforms techniques. |

**Course Outcomes:**

| | **At the end of the course the student should be able to** |
|---|---|
| 1 | Solve system of linear equations with different methods in linear algebra. |
| 2 | Solve first order differential equations of certain types and interpret the solutions. |
| 3 | Solve second and higher order linear differential equations. |
| 4 | Apply Laplace transforms for standard functions and its properties |
| 5 | Apply Inverse Laplace transforms for standard functions and solve differential equations. |

**Course Articulation Matrix: Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)**

| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **No** | **Programme Outcomes Course Outcomes** | | | | | | | | | | | | | | | |
| **The students will be able to:** | | | | | | | | | | | | | | | | |
| 1 | Solve systems of linear equations with different methods in linear algebra. | ✔ | ✔ | | | | | | | | | | | | | |
| 2 | Solve first order differential equations of certain types and interpret the solutions. | ✔ | ✔ | | | | | | | | | | | | | |
| 3 | Solve second and higher order linear differential equations. | ✔ | ✔ | | | | | | | | | | | | | |
| 4 | Apply Laplace transforms for standard functions and its properties | ✔ | ✔ | | | | | | | | | | | | | |
| 5 | Apply Inverse Laplace transforms for standard functions and to solve differential equations. | ✔ | ✔ | | | | | | | | | | | | | |

**Competencies Addressed in the course and Corresponding Performances Indicators**

**Programme Outcomes: Any of 1 to 12 Po's:**

| Competency | Indicators |
|---|---|
| 1.1Apply the knowledge of basic principles and Mathematics to the solution of Engineering problems | 1.1.1 Apply the knowledge of linear algebra and its applicability in different engineering fields. |
| | 1.1.2 Apply the knowledge of differential equation. |
| | 1.1.3 Apply the knowledge of second and higher order linear differential equations. |
| | 1.1.4 Apply Laplace transforms for standard functions and its properties |
| | 1.1.5 Apply Inverse Laplace transforms for standard functions and to solve differential equations. |

Example: 1.2.3: Represents program outcome '1' , competency '2' , & performance indicator '3' .

**PO**1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO**2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO**3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO**4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO**5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

**PO**6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO**7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO**8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO**9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO**10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO**11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12. Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

| | | | | | |
|---|---|---|---|---|---|
| **Title of Course** | **:** | **Engineering Mathematics-II** | **Course Code** | **:** | **NUMA201C** |
| **Credits** | **:** | **03(L-T-P:3-0-0)** | **Contact Hours/ Week** | **:** | **03** |
| **Total Hours** | **:** | **40** | **Branch** | **:** | **Common to all** |

| CIE Marks | : | 50 | SEE Marks | : | 50 |
|---|---|---|---|---|---|
| Semester | : | II | Year | : | 2021-2022 |

| Course Content | |
|---|---|
| **Unit - I** | |
| **Linear Algebra:** Recap of Matrices: Rank of a matrix-echelon form. Solution of system of linear equations –consistency, Gauss-elimination method and Gauss-Seidel method, Eigen values and Eigen vectors.<br><br>**Differential Equations-1:** Exact and reducible to exact differential equations. Linear and Bernoulli's differential equation. | **10 Hrs** |
| **Unit –II** | |
| **Applications of ODE**-orthogonal trajectories, Newton's law of cooling and L-R circuits.<br><br>**Differential Equations-2:** Second and higher order linear ODE's with constant coefficients-Inverse differential operator, method of variation of parameters (second order); Cauchy's and Legendre homogeneous equations. | **10 Hrs** |
| **Unit – III** | |
| **Laplace Transform:** Introduction, Definition of Laplace Transform, Laplace Transform of standard functions, Properties: Shifting, differentiation, Integral and division by t. Periodic function, Heaviside's Unit step function. | **10 Hrs** |
| **Unit – IV** | |
| **Inverse Laplace transforms:** Properties, Convolution theorem, Solutions of linear differential equations, Applications to Engineering problems. | **10 Hrs** |

**Text Books:**

- B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
- Erwin Kreyszing's Advanced Engineering Mathematics volume I and volume II,wiley India Pvt.Ltd.,2014.
- H K Das, Higher Engineering Mathematics

**Reference books**:

1. Erwin Kreyszing's Advanced Engineering Mathematics,wiley India Pvt.Ltd.,2014.
2. Elementary Differential Equations by Earl D. Rainville and Phillip E, Bedient, Sixth Edition.

| Course Outcomes | Programme Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| CO1 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO2 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO3 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO4 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO5 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

**Unit Learning Outcomes (ULO): Unit-I**

Linear Algebra L-10Hours

| Unit Learning Outcome (ULO) | CO | BLL | PI addressed |
|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| 1. | Able to recall the elementary matrices and find the rank of a matrix by reducing it into echelon form. | CO1 | L1 | 1.1.1 |
| 2. | Ability to find the consistency and solution of system linear equations by using Gauss elimination and Gauss Seidel methods. | CO1 | L1,L3 | 1.1.1 |
| 3. | Able to find the Eigen values and Eigen vectors of the matrix. | CO1 | L1,L2 | 1.1.1 |
| 4. | Able to solve the exact, reducible to exact differential equations. | CO2 | L1,L3 | 1.1.2 |
| 5. | Able to solve linear and Bernoulli's differential equations. | CO2 | L1,L3 | 1.1.2 |

**Course Content: Unit-I**

Linear Algebra L-10 Hours

| Hours Required | Topic to be covered | Mode of Delivery |
|---|---|---|
| 01 | Review of elementary matrix | Chalk and talk in classroom |
| 01 | Introduction to Rank of matrix and examples. | Chalk and talk in classroom |
| 01 | Solutions of system of linear equation – consistency. | Chalk and talk in classroom |
| 01 | Examples on Gauss-elimination and Gauss-Seidel methods. | Chalk and talk in classroom |
| 01 | Eigen values and Eigen vectors of the matrix and examples. | Chalk and talk in classroom |
| 01 | Introduction of ordinary differential equations of first order. | Chalk and talk in classroom |
| 01 | Examples on Exact and reducible to exact differential equations. | Chalk and talk in classroom |
| 01 | Linear and Bernoulli's differential equations. | Chalk and talk in classroom |
| 02 | Examples on Linear and Bernoulli's differential equations. | Chalk and talk in classroom |

**Review Questions: Unit-I**

| Review Questions | | ULO | BLL | PI addressed |
|---|---|---|---|---|
| 1. | Find the rank of the matrix $A=\begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix}$ by reducing it into echelon form. | 1 | L1,L3 | 1.1.1 |
| 2. | Test for consistency and solve: $x+y+z=6$ <br> $x-y+2z=5$ <br> $3x+y+z=8$ | 1 | L1,L3 | 1.1.1 |
| 3. | Solve the system of equations $x+y+z=9$ <br> $x-2y+3z=8$ <br> $2x+y-z=3$ <br> By Gauss elimination method. | 2 | L1,L3 | 1.1.1 |
| 4. | Solve the system of equations $10x+y+z=12$ <br> $x+10y+z=12$ <br> $x+y+10z=12$ <br> By Gauss – Seidel method. | 2 | L1,L3 | 1.1.1 |

| | | | | |
|---|---|---|---|---|
| 5. | Find the Eigen values and the corresponding Eigen vectors of the matrix $\begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$ | 3 | L1,L3 | 1.1.1 |
| 6. | Solve : (2x + y + 1)dx + (x + 2y + 1)dy = 0 | 4 | L1,L3 | 1.1.2 |
| 7. | Solve $\frac{dy}{dx} + \frac{y\cos x + \sin y + y}{\sin x + x\cos y + x} = 0$ | 4 | L1,L3 | 1.1.2 |
| 8. | Solve $(2x^2 + 3y^2 - 7)xdx - (3x^2 + 2y^2 - 8)ydy = 0$ | 4 | L1,L3 | 1.1.2 |
| 9. | Solve $y(2xy+)dx = e^x dy.$ | 5 | L1,L3 | 1.1.2 |
| 10. | Solve $\frac{dy}{dx} + y = x^3 y^6$ | 5 | L1,L3 | 1.1.2 |
| 11. | Solve : $\frac{dy}{dx} - \frac{2}{x} = x + x^2$ | 5 | L1,L3 | 1.1.2 |

**Unit Learning Outcomes (ULO): Unit-II**

Differential Equations-I L-10 Hours

| | Unit Learning Outcome (ULO) | CO | BLL | PI addressed |
|---|---|---|---|---|
| 1. | Applications of ODE’s | CO2 | L2, L3 | 1.1.2 |
| 2. | Examples on orthogonal trajectories. | CO2 | L2, L3 | 1.1.2 |
| 3. | Examples on Newton’s law of cooling and L-R circuits | CO2 | L2, L3 | 1.1.2 |
| 4. | Able to find complementary function of second and higher order linear ODE’s with constant coefficients | CO3 | L2, L3 | 1.1.3 |
| 5. | Ability to find Particular integral by Inverse differential operator | CO3 | L2, L3 | 1.1.3 |
| 6. | Able to find solution by method of variation of parameters (second order) | CO3 | L3 | 1.1.3 |
| 7. | Able to find solutions of Cauchy’s and Legendre’s homogeneous equations | CO3 | L3 | 1.1.3 |

**Course Content: Unit-II**

Differential Equations –I/II L-10Hours

| Hours Required | Topic to be covered | Mode of Delivery |
|---|---|---|
| 01 | Examples on orthogonal trajectories. | Chalk and talk in classroom |
| 01 | Examples on Newton’s law of cooling and L-R circuits | Chalk and talk in classroom |
| 01 | Solving Homogeneous differential equations | Chalk and talk in classroom |
| 02 | Particular integrals of the type $e^{ax}$ , sinax, cosax | Chalk and talk in classroom |
| 01 | Methods of finding Particular integrals of the type $x^m$ | Chalk and talk in classroom |
| 01 | Methods of finding Particular integrals of the type $e^{ax}V$, xv | Chalk and talk in classroom |
| 01 | Method of variation of parameters(second order) | Chalk and talk in classroom |
| 01 | Cauchy’s homogeneous equations | Chalk and talk in classroom |
| 01 | Legendre homogeneous equations | Chalk and talk in classroom |

Note: L – Lecture

**Review Questions: Unit-II**

| Review Questions | | ULO | BLL | PI addressed |
|---|---|---|---|---|
| **1.** | Find the orthogonal trajectories of family of parabolas $y^2 = 4ax$ | CO2 | L3 | 1.1.2 |
| **2.** | Find the orthogonal trajectories of family of $r = a(1+\cos\theta)$ | CO2 | L3 | 1.1.2 |
| **3.** | A body in air at $25^0 c$ cools from $100^0 c \;\; to \;\; 75^0 c$ in 1 minute . Find the temperature of the body at the end of 3 minute . | CO2 | L3 | 1.1.2 |
| **4.** | A series circuit with resistance R, inductance L and electromotive force E is governed by the differential equation $L\frac{di}{dt} + Ri = E$, where L and R are constants and initially the current is zero . Find the current at any time t . | CO2 | L3 | 1.1.2 |
| 5. | Find the Complementary function of $(D^2 + 6D + 9)y = 0$ | CO3 | L3 | 1.1.3 |
| 6. | Solve $(D^2 - 1)y = x \sin 3x + \cos x$ | CO3 | L3 | 1.1.3 |
| 7. | Using method of variation of parameters, solve $(D^2+4)y=\tan 2x$ | CO3 | L3 | 1.1.3 |
| 8. | Solve $x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = \log x$ | CO3 | L3 | 1.1.3 |
| 9. | Solve $(1+x)^2\frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = 2\sin[\log(1+x)]$ | CO3 | L3 | 1.1.3 |

**Unit Learning Outcomes (ULO): Unit-III**

Laplace transform L-10Hours

| Unit Learning Outcome (ULO) | | CO | BLL | PI addressed |
|---|---|---|---|---|
| 1. | Able to obtain the Laplace Transformation of elementary functions. | CO4 | L1,L2 | 1.1.4 |
| 2. | Able to determine the Laplace transform of continuous functions, piecewise functions, product of two functions using shifting property, derivative property and integral property. | CO4 | L2,L3 | 1.1.4 |
| 3. | Able to find the Laplace transforms of periodic functions. | CO4 | L2,L3 | 1.1.4 |
| 4. | Able to obtain the Laplace transform of Heaviside's unit step functions. | CO4 | L2,L3 | 1.1.4 |

**Course Content: Unit-III**

Laplace transform L-10Hours

| Hours Required | Topic to be covered | Mode of Delivery |
|---|---|---|
| 02 | Definition , Laplace Transform –standard function | Chalk and talk in classroom |
| 01 | Problems on piecewise, continuous and discontinuous functions. | Chalk and talk in classroom |
| 03 | Shifting Property, derivative property and integral property-statement with proof | Chalk and talk in classroom |
| 02 | Periodic function, theorem on Laplace transform of periodic function | Chalk and talk in classroom |
| 02 | Impulse function and Heaviside unit step function ,properties | Chalk and talk in classroom |

**Review Questions: Unit-III**

| Review Questions | | ULO | BLL | PI addressed |
|---|---|---|---|---|
| 1. | Find Laplace transform of $f(t)=e^{at}$ | 4 | L3 | 1.1.4 |
| 2. | Find Laplace transform of $f(t)=\sin at$ | 4 | L3 | 1.1.4 |
| 3. | Find Laplace transform of $f(t)=t^{n}$ | 4 | L3 | 1.1.4 |
| 4. | Find Laplace transform of $f(t)=e^{at}f(t)$ | 4 | L3 | 1.1.4 |
| 5. | Find Laplace transform of $f(t)=t^{n}f(t)$ | 4 | L3 | 1.1.4 |
| 6. | Find Laplace transform of $f(t)=\dfrac{f(t)}{t}$ | 4 | L3 | 1.1.4 |
| 7. | Find Laplace transform of the following functions<br>(i) $f(t)=e^{2t}+\sinh 3t+\cos 3t$ (ii) $f(t)=\sin 2t+2^{t}+e^{-2t}+t^{7}$ | 4 | L3 | 1.1.4 |
| 8. | Find Laplace transform of the following functions<br>(i) $f(t)=\sinh^{2}4t$ (ii) $f(t)=\sin^{3}3t$ (iii) $f(t)=\sin^{2}3t\cos 2t$ (iv) $f(t)=\sin 4t\ \sin 3t\ \sin 2t$ (v) $f(t)=\cosh^{3}2t$ (vi) $f(t)=\cos 4t\ \sin 2t$ | 4 | L3 | 1.1.4 |
| 9. | Find Laplace transform of the following functions<br>(i) $f(t)=\begin{cases}0 & for\ \ 0<t\le 2\\ t & for\ t>2\end{cases}$ (ii) $f(t)=\begin{cases}-1 & for\ \ 0<t\le 1\\ 1 & for\ 1<t\le 2\\ t^{2} & for\ t>2\end{cases}$ | 4 | L3 | 1.1.4 |
| 9. | Find Laplace transform of the following functions<br>(i) $f(t)=e^{-2t}\sin^{3}2t$ (ii) $f(t)=e^{t}\cos^{2}3t$ (iii) $f(t)=e^{-3t}t^{6}$<br>(iv) $f(t)=e^{-t}\cos^{3}3t+e^{2t}\sin^{2}2t$ (v) $f(t)=e^{t}\cos 3t\cos 2t$ | 4 | L3 | 1.1.4 |
| 10. | Find Laplace transform of the following functions<br>(i) $f(t)=t\sin 2t$ (ii) $f(t)=t\cos^{2}2t$ (iii) $f(t)=t\sinh 2t\sin 2t$ (iv) $f(t)=t^{2}\sin at$ (v) $f(t)=t^{2}\cos^{3}2t$ | 4 | L3 | 1.1.4 |
| | Find Laplace transform of the following functions<br>(i) $f(t)=\dfrac{e^{-at}-e^{-bt}}{t}$ (ii) $f(t)=\dfrac{\cos at-\cos bt}{t}$<br>(iii) $f(t)=\dfrac{\sin at-\sin bt}{t}$ (iv) $f(t)=\dfrac{e^{-2t}\sin 2t}{t}$<br>(v) $f(t)=\dfrac{e^{3t}-e^{4t}}{t}$ | 4 | L3 | 1.1.4 |
| | Find Laplace transform of $f(t)=t$ given that f(t+2)=f(t) | 4 | L3 | 1.1.4 |
| | Find Laplace transform of the periodic function<br>$f(t)=\begin{cases}t\ \ for\ \ 0<t<\pi\\ \pi-t\ \ for\ \pi<t<2\pi\end{cases}$ | 4 | L3 | 1.1.4 |

| | | | | |
|---|---|---|---|---|
| | Express $f(t)=\begin{cases}1 & ,0<t\le 1\\ t & ,1<t\le 2\\ t^2 & ,t>2\end{cases}$ in terms of unit step functions and hence determine Laplace transform. | 4 | L3 | 1.1.4 |
| | Express $f(t)=\begin{cases}\cos t & ,0<t<\pi\\ \cos 2t & ,\pi<t<2\pi\\ \cos 3t & ,t>2\pi\end{cases}$ in terms of unit step functions and hence determine L{f(t)} | 4 | L3 | 1.1.4 |

**Unit Learning Outcomes (ULO): Unit-IV**

Inverse Laplace Transforms L-10 Hours

| Unit Learning Outcome (ULO) | | CO | BLL | PI addressed |
|---|---|---|---|---|
| 1. | Definition of inverse transform | CO5 | L2,L3 | 1.1.5 |
| 2. | Able to determine Inverse Laplace transforms of some function by means of algebraic techniques | CO5 | L2,L3 | 1.1.5 |
| 3. | Able to solve convolution theorem and properties | CO5 | L2,L3 | 1.1.5 |
| 4. | Problems on ordinary differential equation using Laplace transform method. | CO5 | L2,L3 | 1.1.5 |

**Course Content: Unit-IV**

Inverse Laplace Transforms L-10Hours

| Hours Required | Topic to be covered | Mode of Delivery |
|---|---|---|
| 04 | Inverse Laplace transform of functions applying making square method ,resolving into fractions, shifting property and derivative property | Chalk and talk in classroom |
| 02 | Examples on Inverse Laplace Transform | |
| 02 | Convolution theorem and problems | Chalk and talk in classroom |
| 02 | Solution of Differential equations by Laplace transform Method | Chalk and talk in classroom |

**Review Questions: Unit-IV**

| Review Questions | | ULO | BLL | PI addressed |
|---|---|---|---|---|
| 1. | Find the inverse Laplace transform of the following functions: (i) $f(s)=\dfrac{4s^5+6s^2+10s+1}{s^6}$ (ii) $f(s)=\dfrac{1}{s(s+1)(s+2)}$ | 1 | L3 | 1.1.6 |

| | | | | |
|---|---|---|---|---|
| | (iii) $f(s)=\dfrac{s+2}{s^2-4s+13}$ (iv) $f(s)=\dfrac{s+1}{(s-1)^2(s+2)}$ (v) $f(s)=\dfrac{1}{2}Log\left(\dfrac{s^2+b^2}{s^2+a^2}\right)$ | | | |
| 2. | Using Convolution theorem, obtain the inverse transform of $\dfrac{s}{(s^2+a^2)^2}$ | 1 | L3 | 1.1.6 |
| 3. | Using Convolution theorem, obtain the inverse transform of $\dfrac{s}{(s+2)(s^2+9)}$ | 1 | L3 | 1.1.6 |
| 4. | Using Laplace transform method, solve the following differential equation<br>(i) $y''+2y'+2y=5\sin t\ , y(0)=y'(0)=0$<br>(ii) $y''+5y'+6y=5e^{2t}\ , y(0)=2, y'(0)=1$<br>(iii) $x''-2x'+x=e^t\ , x=2, x'(0)=-1$<br>(iv) $(D^2-3D+2)y=1-e^{2x}\ , y=1, y'=1\ at\ x=0$<br>(v) $(D^3-3D^2+3D-1)y=t^2e^x\ , y(0)=1, y'(0)=0$ and $y''(0)=-2$ | 1 | L3 | 1.1.6 |

**Evaluation Scheme:**

| Assessment | Marks | Weightage |
|---|---|---|
| CIE-I | 40 | 20 |
| CIE-II | 40 | 20 |
| Course Project | 10 | 10 |
| SEE | 100 | 50 |
| Total | 190 | 100 |
| | | |

**Question paper pattern for CIE-I**

3. Question paper consists Part-A and Part-B. Question number 1 is compulsory, it consists of short answer questions of 1 or 2 marks, covering Unit-I and Unit-II (no multiple choice questions and No true or false questions).

4. In Part-B, four questions are to be set as per the following table.

| CIE | Number of questions /Maximum marks | Sub divisions | Unit |
|---|---|---|---|
| I | One question of 15 marks | Sub divisions shall not be mixed within the unit | Unit-I |
| | OR | | |
| | One question of 15 marks | Sub divisions shall not be mixed within the unit | Unit-I |
| | One question of 15 marks | Sub divisions shall not be mixed within the unit | Unit-II |
| | OR | | |

| | | | |
|---|---|---|---|
| | One question of 15 marks | Sub divisions shall not be mixed within the unit | Unit-II |

**Question paper pattern for CIE-II**

1. Question paper consists Part-A and Part-B. Question number 1 is compulsory, it consists of short answer questions of 1 or 2 marks, covering Unit-III and Unit-IV (no multiple choice questions and No true or false questions).
2. In Part-B, four questions are to be set as per the following table.

| CIE | Number of questions /Maximum marks | Sub divisions | Unit |
|---|---|---|---|
| II | One question of 15 marks | Sub divisions shall not be mixed within the unit | Unit-III |
| | OR | | |
| | One question of 15 marks | Sub divisions shall not be mixed within the unit | Unit-III |
| | One question of 15 marks | Sub divisions shall not be mixed within the unit | Unit-IV |
| | OR | | |
| | One question of 15 marks | Sub divisions shall not be mixed within the unit | Unit-IV |

**Details of course project:**

- Each student should prepare different problems and submit to the course instructor
- Students will identify by the members of the team by picking (Roll number) chits
- Total twelve teams in a class
- Problems may be based on the previous lectures delivered by the teacher( knowledge based)
- Each member of the team will demonstrate the mathematical problems in front of the other students

**Question paper pattern for SEE:**

13. Question paper consists Part-A and Part-B. Question number 1 is compulsory, it consists of short answer questions of 1 or 2 marks, covering entire syllabus (no multiple choice questions and No true or false questions, 50% of questions must be L3 and L4 level).
14. In Part-B total of eight questions with two from each unit; with internal choice to be set uniformly covering the entire syllabus.
15. Each question carries 20 marks and should not have more than four subdivisions.
16. In Part-B, any FOUR full questions are to be answered choosing at least one from each unit.
17. Sketches, figures and tables if any should be clearly drawn, as the same is scanned for printing.
18. The question paper should contain all the data / figures / marks allocated, with clarity.

**B.E. Semester End Examination**
**Engineering Mathematics-II**
**SEE-Model Question Paper**

**Duration:3 Hours** **Maximum Marks:100**

| Q.No. | Question | Marks | BLL | CO | PI |
|---|---|---|---|---|---|
| | **PART A: COMPULSORY. Answer all questions.** | | | | |
| **1. a.** | Define Rank of a Matrix | **2** | **L3** | **1** | **1.1.1** |
| **b.** | Solve : (2x + y + 1)dx + (x + 2y + 1)dy = 0 | **2** | **L3** | **2** | **1.1.2** |
| **c.** | Write down the condition for the system $a_1 x + b_1 y = c_1$<br>$a_2 x + b_2 y = c_2$ has no solution. | **2** | **L2** | **2** | **1.1.3** |
| **d.** | Explain how we can find the solution of $\frac{dy}{dx} + Py = Q$ where P,Q are the functions of x. | **2** | **L3** | **3** | **1.1.3** |
| **e.** | What is the solution of $\left(D^2 + 6D + 9\right)y = 0$. | **2** | **L3** | **4** | **1.1.4** |
| **f.** | Give any one importance of Laplace transform of in engineering field. | **2** | **L2** | **5** | **1.1.4** |
| **g.** | State convolution theorem. | **2** | **L2** | **6** | **1.1.5** |
| **h.** | Verify the following system of equations 2x+y=4 and 4x+2y=8 are dependent or independent. | **2** | **L2** | **6** | **1.1.5** |
| **i.** | Find $L^{-1}\left\{\frac{3}{2s+5}\right\}$ | **2** | **L3** | **3** | **1.1.3** |
| **j.** | Laplace transform of first & second derivative | **2** | **L2** | **6** | **1.1.5** |
| | | | | | |
| | **PART-B**<br>**Answer any FOUR full questions choosing atleast one from each unit.** | | | | |
| | **UNIT-I** | | | | |
| **2. a.** | Find the rank of the following matrix by reducing it to row echelon form<br>$[3\ -1\ 2\ -6\ 2\ 4\ -3\ 1\ 2]$ | **6** | **L2** | **1** | **1.1.1** |
| **b.** | Solve the following system of equations by Gauss Seidel iterative method<br>$27x + 6y - z = 85,\ 6x + 15y + 2z = 72,\ x + y + 54z = 110$. Take the initial approximation (x=0,y=0,z=0).Carry out two iterations | **7** | **L3** | **1** | **1.1.1** |
| **c.** | Obtain the Eigen values and eigen vectors of the matrix<br>$[8\ -6\ 2\ -6\ 7\ -4\ 2\ -4\ 3]$ | **7** | **L3** | **1** | **1.1.1** |
| | **OR** | | | | |
| **3. a.** | Solve $\left(1 + 2xycosx^2 - 2xy\right)dx + \left(sinx^2 - x^2\right)dy = 0$ | **6** | **L3** | **2** | **1.1.2** |

| | | | | | |
|---|---|---|---|---|---|
| b. | Solve $xy\left(1 + xy^2\right)\frac{dy}{dx} = 1$ | 7 | L3 | 2 | 1.1.2 |
| c. | Solve $\frac{dy}{dx} + y = x^3y^6$ | 7 | L2 | 2 | 1.1.2 |
| | **UNIT-II** | | | | |
| **4. a.** | Find the orthogonal trajectory of the family of curves $x^2 + y^2 = c^2$ . | 6 | L3 | 3 | 1.1.3 |
| b. | Solve $\left(D^3 + 4D\right)y = sin2x$ | 7 | L3 | 3 | 1.1.3 |
| c. | Solve $\left(D^4 - 1\right)y = e^x cosx$ | 7 | L3 | 3 | 1.1.3 |
| | **OR** | | | | |
| **5. a.** | Apply the method of variation of parameters to solve $y'' - 6y' + 9y = \frac{e^{3x}}{x^2}$ | 6 | L3 | 3 | 1.1.3 |
| b. | Solve $x^2y'' + 4xy' + 2y = e^x$ | 7 | L3 | 3 | 1.1.3 |
| c. | Solve the Legendre's form of linear equation $(1+x)^2\frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = \sin 2[\log(1+x)]$ . | 7 | L3 | 3 | 1.1.3 |
| | **UNIT-III** | | | | |
| **6. a.** | Find Laplace transform of cosat | 6 | L2 | 4 | 1.1.4 |
| b. | Find $L\{e^{2t}cos^2t\}$ | | | | |
| c. | Evaluate $\int_0^{\infty} te^{-3t}sintdt$ | 7 | L3 | 4 | 1.1.4 |
| **7. a.** | If f (t) is a periodic function of period T then show that $L[f(t)] = \frac{1}{1-e^{-sT}}\int_0^T e^{-st}f(t)dt$ | 6 | L3 | 4 | 1.1.4 |
| b. | Express the following function in terms of unit step function and hence find its Laplace $f(t) = t^2,\ 0 < t < 2$; $= 4t,\ t > 2$ | 7 | L2 | 5 | 1.1.4 |
| c. | Express the function $f(t) = \{cost,\ 0 < t \le \pi\ 1,\ \ \pi < t \le 2\pi\ sint,\ \ t > 2\pi$ interms of Heaviside unit step function and hence find its Laplace transform. | 7 | L2 | 5 | 1.1.4 |
| | | | | | |
| | **UNIT-IV** | | | | |
| **8. a.** | Find $L^{-1}\left\{\frac{2s^2-6s+5}{s^3-6s^2+11s-6}\right\}$ | 6 | L2 | 6 | 1.1.5 |
| b. | Find the inverse Laplace transform of $\left(\frac{s+8}{(s^2+4s+5)}\right)$ | 7 | L3 | 6 | 1.1.5 |
| c. | Find $L^{-1}\left\{log\frac{s^2}{s(s+1)}\right\}$ | 7 | L3 | 6 | 1.1.5 |
| | **OR** | | | | |
| **9. a.** | Find the inverse Laplace transform of $\left(\frac{e^{-2s}}{(s-3)}\right)$ | 6 | L2 | 6 | 1.1.5 |
| b. | Evaluate $L^{-1}\left\{\frac{s}{(s^2+a^2)^2}\right\}$ by applying convolution theorem. | 7 | L3 | 6 | 1.1.5 |
| c. | Solve by the method of Laplace transforms the equation $y''' + 2y'' - y' - 2y = 0\ given\ y(0) = y'(0) = 0\ and\ y''(0) = 6$ | 7 | L3 | 6 | 1.1.5 |

B.E. V/VI/VII (OPEN ELECTIVE) Semester

# UMA001N: Mathematical Modeling with Geogebra

**3 Credits (3-0-0)**

**Total contact Hours: 40** **Duration of SEE: 03 Hrs.**
**CIE: 50 Marks** **SEE: 50 Marks**

**Prerequisite: Those who clear all Mathematics subjects up to 4th semester are eligible to opt this subject.**

**Purpose**: The main purpose of this course is to make our teaching more active and to improve the teaching outcomes of our students.

**Course Description**:

An introduction to mathematical modeling is a mathematical tool for solving real world problems. In this course, students study a problem solving process. They learn how to identify a problem, construct or select appropriate models, test the validity of a model, calculate solutions and implement the model. Emphasis lies on model construction in order to promote student creativity and demonstrate the link between theoretical mathematics and real world applications.

We are keenly aware that good teaching comes in many forms and that there are many different approaches to teaching and learning the concepts and skills of Mathematics.

The following are some special features that can be used to complement different teaching and learning styles.

i) **Concept Exercises:** These exercises ask students to use mathematical language to state fundamental facts about the topics of each section.
ii) Skills **Exercises:** These exercises reinforce and provide practice with all the learning objectives of each section.
iii) **Applications Exercises:** We have to include substantial applied problems from many different real world contexts. We believe that these exercises will capture student's interest.

**Course Goals:**

- The majority of student time and effort will be spent on "**rule of four**" (Verbally, Graphically, Numerically and Algebraically).
- This course, aims to develop student capabilities in reasoning, analytical thinking and problem solving skills.
- We make use of Geogebra graphing calculator tool and computers in examples and exercises throughout the course.
- Student needs to gain an appreciation for the power and utility of Mathematics in modeling the real world.

**Course outcomes**:

| | |
|---|---|
| CO1: | Students learn how to find models that can constructed using geometric or algebraic properties of the object under study. |
| CO2: | We study some problems of real world phenomena that are modeled by polynomial functions |

| | |
|---|---|
| CO3 | We study some problems of real world phenomena that are modeled by Exponential and Logarithmic functions: |
| CO4: | We learn process of mathematical modeling and formulating a model. |
| CO5: | We are able to solve and interpreting a model |

## Unit –I

**Functions and Linear functions:** **10 Hours**

Functions and function notation, domain and range , rates of change and behavior of graphs, composition of functions, transformation of functions, inverse functions, linear functions, graphs of linear functions, modeling with linear functions, fitting linear models to data, absolute value functions

## Unit-II

**Polynomial and rational functions:** **10 Hours**

Power functions and polynomial functions, quadratic functions graphs of polynomial functions, rational functions, inverses and radical functions.

**Exponential and Logarithemic functions**:

Exponential functions, graphs of exponential functions, logarithemic functions, logarithemic properties, graphs of logarithemic functions, exponential and logarithemic models, fitting exponentials to data.

## Unit –III

**Mathematical modeling:** **10 Hours**

Introduction, objectives, conservation laws and engineering, mathematical modeling-what and why, types of modeling, Limitations of a mathematical model. Constructing models to solve. Identifying the essentials of a problem, mathematical formulation, problems.

## Unit –IV

**Solving and interpreting a model:** **10 Hours**

Solution of a formulated problem, interpretation of the solution, summary, problems. Population dynamics, radioactive decay, Newton's law of cooling / warming, spread of disease, chemical reaction, mixtures, series circuits, falling bodies, and air resistance and modeling blood flow.

**Resources:**

1. Jonas Hall and Thomas Lingefjard, Mathematical modeling with Applications with Geogebra, John Wiley and Sons, 2017.
2. Steven C. Chapra and Raymond P. Canale, Numerical Methods for Engineers Sixth Edition, McGrawHill, 2010.
3. George F Simmons and Steven G Krantz Differential equations. Theory, technique and practice by, Tata McGRAW-Hill 5th Edition-2008
4. Dennis G Zill and Michael R Cullen, Advanced Engineering Mathematics, 3rd Edition, Narosa publication Delhi..

5. Erwin Kreyszing, Advanced Engineering Mathematics, $8^{th}$ edition, Awiley publication..
6. Mathematical modeling by J N Kapur, New age international(P) Ltd.Publisher, New Delhi


**Question paper pattern for SEE**:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

**Prepare mathematical model for 5 Marks:** Each student should prepare five different mathematical models and submit to the course instructor.

Procedures: 1.Students will identify the members of the team by picking (Roll number) chits.

2. Each team contains maximum five members and one member will be identified as a leader of the team. (Team members will identify the leader)
4. Total twelve teams in a class
5. Mathematical model may be based on the previous lectures delivered by the teacher ( knowledge based).
6. Each member of the team will demonstrate a mathematical model on a weekend (Saturday) and duration of the demonstration may be maximum five minutes.

**NOTE:** If you feel like you do not understand a topic. Don't wait, **ASK FOR HELP**!

**ASK** : **A**sk a teacher or tutor, **S**earch for ancillaries, **K**eep a detailed list of questions
**FOR** : **F**ind additional resources, **O**rganize the material, **R**esearch other learning options
**HELP:** **H**ave a support network; **E**xamine your weaknesses, **L**ist specific examples & **P**ractice

**At the successful completion of the course, the students will:**

- Integrate information from variety of sources (e.g. Teacher, Textbook, Library, Technology, other courses, your own experimentation and observations.)
- Identify key points in a problem situation
- Evaluate and transform mathematical expressions
- Read and interpret mathematics and technical information
- Express ideas in mathematical language using written notation
- Solve problems using tools of mathematical analysis
- Have knowledge and understanding of the terminology, concepts and methods of mathematical modeling of differential equations
- Learn important ideas and concepts of Calculus.

| Course Outcomes | Programme Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| CO1 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO2 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO3 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO4 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO5 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

## BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT

## MODEL COURSE PLAN

| | | | | | |
|---|---|---|---|---|---|
| **Title of Course** | **:** | **Subject Title: NUMERICAL TECHNIQUES & INTEGRAL TRANSFORMS** | **Course Code** | **:** | **UMA391C** |
| | | | **Branch** | | **ECE,EE,EI,CS,ISE&AI** |
| **Credits** | **:** | **03(L-T-P: 3-0-0)** | **Contact Hours/ Week** | **:** | **03** |
| **Total Hours** | **:** | **40** | **Tutorial Hours** | **:** | **00** |
| **CIE Marks** | **:** | **50** | **SEE Marks** | **:** | **50** |
| **Semester** | **:** | **III** | **Year** | **:** | **2021-2022** |

**Prerequisites:**

**Course Objectives:**

To apply the knowledge of Mathematics in various engineering fields, students are able

- *To be understand the numerical methods of solving algebraic, transcendental equations.*
- *To be acquired the knowledge about various methods of interpolation*
- *It is very much essential to understand the basic concepts of numerical differention, numerical integration and numerical solutions of ode.*
- *To be understand concepts of Fourier series, Fourier transforms, and z-transforms, because Fourier series is very powerful tool to solve ode and pde.*

**Course outcomes**:

On the successful completion of this course, students are able

*CO1: The ability to solve engineering problems using non-linear equations and interpolation techniques.*

*CO2: The ability to solve problems using numerical differention and numerical integration.*

*CO3: Be capable to perform numerical solutions of ordinary differential equations.*

*CO4: Fourier analysis provides a set of mathematical tools which enable the engineer to break down a wave into its various frequency components. It is then possible predict the effect of a particular waveform.*

*CO5: It is essential to understand the basic concepts of Fourier transforms and z –transforms,to solve ode, pde and difference equations.*

**Course Articulation Matrix: Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)**

| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| No | Programme Outcomes Course Outcomes | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **The students will be able to:** | | | | | | | | | | | | | | | | |
| 1 | Understand the concepts of finding the roots by using Numerical methods | 3 | 2 | | | | | | | | | | | | | |
| 2 | Learn the numerical techniques by finding the roots in different methods. Bisection Method, Newton-Raphsonmetho d and interpolation formulae. | 3 | 2 | | | | | | | | | | | | | |
| 3 | Apply the knowledge of solving problems using differentiation and integration. | 3 | 2 | | | | | | | | | | | | | |
| 4 | Apply the concepts of numerical solution of ODE | 3 | 2 | | | | | | | | | | | | | |
| 5 | Apply the knowledge of Fourier series, Fourier Transform and Z-Transform to solve the | 3 | 2 | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | engineering problems. | | | | | | | | | | | | | | |

**Course Content**

| | | | | | |
|---|---|---|---|---|---|
| **Title of Course** | **:** | **NUMERICAL TECHNIQUES & INTEGRAL TRANSFORMS** | **Subject Code** | **:** | **UMA391C** |
| **Credits** | **:** | **03 (L-T-P:3-0-0)** | **Contact Hours/ Week** | **:** | **03** |
| **Total Hours** | **:** | **40** | **Tutorial Hours** | **:** | **00** |
| **CIE Marks** | **:** | **50** | **SEE Marks** | **:** | **50** |
| **Semester** | **:** | **III** | **Year** | **:** | **2021-2022** |

| **Content** | **Hrs.(L)** |
|---|---|
| **Unit - I** | |
| **Numerical Analysis-I**<br>Introduction to root finding problems, Bisection Method, Newton-Raphson method. Finite differences, forward and backward difference operators (no derivations on relations between operators) Newton-Gregory forward and backward interpolation formulae. (Without proof), Lagrange's and Newton's divided difference interpolation formulae (without proof). . | **10** |
| **Unit – II** | |
| **Unit-II**<br>**Numerical Analysis-II**<br>Numerical differentiation using Newton's forward and backward formulae-problems. Trapezoidal rule, Simpson's one third rule, Simpson's three eighth rule and Weddle's rule (no derivation of any formulae)-problems. Euler’s and Modified Euler’s method, Runge-Kutta $4^{th}$ order method. | **10** |
| **Unit-III** | |
| **Fourier series**<br>Periodic functions, Conditions for Fourier series expansions, Fourier series expansion of continuous and functions having finite number of discontinuities, even and odd functions. Half-range series, practical harmonic analysis. | **10** |
| **Unit – IV** | |
| **Fourier transforms and z-transforms**<br>Infinite Fourier transforms and inverse Fourier transforms- simple properties, Fourier sine and Fourier cosine transforms, Inverse Fourier sine and cosine transforms. Z-transforms-definition, standard forms, linearity property, damping rule, shifting rule-problems. | **10** |

Note: L: Lecture

**Resources:**

1. Numerical Methods for Engineers by Steven C Chapra&Raymond P Canale.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
3. Advanced Engineering Mathematics By H. K. Das, S. Chand & company Ltd. Ram Nagar, New Delhi.
4. Advanced Engineering Mathematics by E Kreyszig ( John Wiley & Sons)

| Course Outcomes | Programme Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| CO1 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO2 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO3 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO4 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO5 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

**Details of course project:**

- Each student should prepare different problems and submit to the course instructor
- Students will identify by the members of the team by picking (Roll number) chits
- Total twelve teams in a class
- Problems may be based on the previous lectures delivered by the teacher( knowledge based)
- Each member of the team will demonstrate the mathematical problems in front of the other students

**Question paper pattern for SEE:**

1. Question paper consists Part-A and Part-B. Question number 1 is compulsory, it consists of short answer questions of 1 or 2 marks, covering entire syllabus (no multiple choice questions and No true or false questions, 50% of questions must be L3 and L4 level).
2. In Part-B total of eight questions with two from each unit; with internal choice to be set uniformly covering the entire syllabus.
3. Each question carries 20 marks and should not have more than four subdivisions.
4. In Part-B, any FOUR full questions are to be answered choosing at least one from each unit.
5. Sketches, figures and tables if any should be clearly drawn, as the same is scanned for printing.
6. The question paper should contain all the data / figures / marks allocated, with clarity.

## Evaluation Scheme:

| Assessment | Marks | Weightage |
|---|---|---|
| **CIE-I** | **40** | **20** |
| **CIE-II** | **40** | **20** |
| **Assignments/ Quizzes/ Case Study/ Course Project/ Term Paper/Field Work** | **10** | **10** |

| | | |
|---|---|---|
| **SEE** | **100** | **50** |
| **Total** | **190** | **100** |

**Question paper pattern for CIE-I and CIE-II:**

Question paper consists Part-A and Part-B. Part A is compulsory, it consists of short answer questions of 1 or 2 marks, covering Unit-I and Unit-II (no multiple choice questions and No true or false questions).

1. In Part-B, four questions are to be set as per the following table.

| CIE | Number of questions / Maximum marks | Sub divisions | Covering entire unit |
|---|---|---|---|
| I | Two question of 15 marks (Solve any one) | Sub divisions shall not be mixed within the unit | Unit-I |
| | Two question of 15 marks (Solve any one) | Sub divisions shall not be mixed within the unit | Unit-II |
| II | Two question of 15 marks (Solve any one) | Sub divisions shall not be mixed within the unit | Unit-III |
| | Two question of 15 marks (Solve any one) | Sub divisions shall not be mixed within the unit | Unit-IV |

**BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT**

## MODEL COURSE PLAN

| | | | | | |
|---|---|---|---|---|---|
| **Title of Course** | **:** | **NUMERICAL TECHNIQUES & FOURIER SERIES** | **Course Code** | **:** | **UMA392C** |
| **Credits** | **:** | **03(L-T-P:3-0-0)** | **Contact Hours/ Week** | **:** | **03** |
| **Total Hours** | **:** | **40** | | | |
| **CIE Marks** | **:** | **50** | **SEE Marks** | **:** | **50** |
| **Semester** | **:** | **III** | **Year** | **:** | **2021-2022** |

**Course Objectives: To apply the knowledge of Mathematics in various engineering fields, students are able**

| | |
|---|---|
| 1 | To apply the concept of numerical methods of solving algebraic, transcendental equations. |
| 2 | To apply the concept of interpolation to solve various engineering problems. |
| 3 | To apply the basic concepts of numerical integration, numerical solutions of ode and pde. |
| 4 | To apply the basic concepts of Fourier series and Fourier transforms to solve ode and pde. |

**Course Outcomes:**

| | **On the successful completion of this course, students are able to** |
|---|---|
| 1 | Solve engineering problems using non-linear equations and interpolation techniques. |
| 2 | Solve problems using numerical differentiation. |
| 3 | Perform numerical integration and solutions of ordinary differential equations. |
| 4 | Analyse Fourier series which provides a set of mathematical tools that enable the engineer to break down a wave into its various frequency components. It is then possible predict the effect of a particular waveform. |
| 5 | Analyse the basic concepts of Fourier transforms to solve ordinary differential equation and partial differential equations. |

**Course Articulation Matrix: Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)**

| | | PO | PO | PO | PO | PO | PO | PO | PO | PO | PO1 | PO1 | PO1 | PSO | PSO | PSO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **No** | **Programme Outcomes Course Outcomes** | | | | | | | | | | | | | | | |
| **The students will be able to:** | | | | | | | | | | | | | | | | |
| 1 | solve engineering problems using non-linear equations and interpolation techniques. | 3 | 2 | | | | | | | | | | | | | |
| 2 | solve problems using numerical differentiation. | 3 | 2 | | | | | | | | | | | | | |
| 3 | perform numerical integration and solutions of ordinary differential equations. | 3 | 2 | | | | | | | | | | | | | |
| 4 | Analyse Fourier series which provides a set of mathematical tools to the engineer to break down a wave into its various frequency components. It is then | 3 | 2 | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | possible to predict the effect of a particular waveform. | | | | | | | | | | | | | | | |
| 5 | Analyse the basic concepts of Fourier transforms to solve ordinary differential equation and partial differential equation. | 3 | 2 | | | | | | | | | | | | | |

**Course Content**

| | | | | | |
|---|---|---|---|---|---|
| **Title of Course** | **:** | **NUMERICAL TECHNIQUES & FOURIER SERIES** | **Course Code** | **:** | **UMA392C** |
| **Credits** | **:** | **03(L-T-P:3-0-0)** | **Contact Hours/ Week** | **:** | **03** |
| **Total Hours** | **:** | **40** | | | |
| **CIE Marks** | **:** | **50** | **SEE Marks** | **:** | **50** |
| **Semester** | **:** | **III** | **Year** | **:** | **2021-2022** |

| **Content** | **Hrs.(L)** |
|---|---|
| **Unit – I** | |
| **Numerical Analysis-I:**<br>Introduction to root finding problems, Newton-Raphson method. Finite differences, forward and backward difference operators (no derivations on relations between operators) Newton-Gregory forward and backward interpolation formulae. (Without proof), Lagrange's and Newton's divided difference interpolation formulae (without proof) Numerical differentiation using Newton's forward and backward formulae-problems. | **10** |
| **Unit –II** | |
| **Numerical analysis-II:**<br>Numerical Integration: Simpson's one third rule, Simpson's three eighth rule (no derivation of any formulae)-problems. Numerical solution of ODE and PDE: Euler’s | **10** |

| | |
|---|---|
| and Modified Euler's method, Runge-Kutta 4th order method, Numerical solutions of one-dimensional heat and wave equations by explicit method, Laplace equation by using five point formula. | |
| **Unit – III** | |
| **Fourier series:**<br>Periodic functions, Conditions for Fourier series expansions, Fourier series expansion of continuous and functions having finite number of discontinuities, even and odd functions. Half-range series, practical harmonic analysis. | **10** |
| **Unit – IV** | |
| **Fourier transforms:**<br>Infinite Fourier transforms and inverse Fourier transforms- simple properties, Fourier sine and Fourier cosine transforms. Inverse Fourier sine and cosine transforms. | **10** |

**Resources:**


1. Numerical Methods for Engineers by Steven C Chapra & Raymond P Canale.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
3. Advanced Engineering Mathematics By H. K. Das, S. Chand & company Ltd. Ram Nagar, New Delhi.
4. Advanced Engineering Mathematics by E Kreyszig ( John Wiley & Sons)


| **Course Outcomes** | **Programme Outcomes** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| CO1 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO2 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO3 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO4 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO5 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

**Details of course project:**

- Each student should prepare different problems and submit to the course instructor
- Students will identify by the members of the team by picking (Roll number) chits
- Total twelve teams in a class
- Problems may be based on the previous lectures delivered by the teacher( knowledge based)
- Each member of the team will demonstrate the mathematical problems in front of the other students

**Question paper pattern for SEE:**

1. Question paper consists Part-A and Part-B. Question number 1 is compulsory, it consists of short answer questions of 1 or 2 marks, covering entire syllabus (no multiple choice questions and No true or false questions, 50% of questions must be L3 and L4 level).
2. In Part-B total of eight questions with two from each unit; with internal choice to be set uniformly covering the entire syllabus.
3. Each question carries 20 marks and should not have more than four subdivisions.
4. In Part-B, any FOUR full questions are to be answered choosing at least one from each unit.
5. Sketches, figures and tables if any should be clearly drawn, as the same is scanned for printing.
6. The question paper should contain all the data / figures / marks allocated, with clarity.

**Evaluation Scheme:**

| Assessment | Marks | Weightage |
|---|---|---|
| **CIE-I** | **40** | **20** |
| **CIE-II** | **40** | **20** |
| **Assignments/ Quizzes/ Case Study/ Course Project/ Term Paper/Field Work** | **10** | **10** |
| **SEE** | **100** | **50** |
| **Total** | **190** | **100** |

**Question paper pattern for CIE-I and CIE-II:**

Question paper consists Part-A and Part-B. Part A is compulsory, it consists of short answer questions of 1 or 2 marks, covering Unit-I and Unit-II (no multiple choice questions and No true or false questions).

1. In Part-B, four questions are to be set as per the following table.

| CIE | Number of questions / Maximum marks | Sub divisions | Covering entire unit |
|---|---|---|---|
| I | Two question of 15 marks (Solve any one) | Sub divisions shall not be mixed within the unit | Unit-I |
| | Two question of 15 marks (Solve any one) | Sub divisions shall not be mixed within the unit | Unit-II |
| II | Two question of 15 marks (Solve any one) | Sub divisions shall not be mixed within the unit | Unit-III |
| | Two question of 15 marks (Solve any one) | Sub divisions shall not be mixed within the unit | Unit-IV |

**BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT**

## MODEL COURSE PLAN

| | | | | | |
|---|---|---|---|---|---|
| **Title of Course** | **:** | **Statistics and Probability Distributions** | **Course Code** | **:** | **UMA491C** |
| **Credits** | **:** | **03(L-T-P:3-0-0)** | **Contact Hours/ Week** | **:** | **03** |
| **Total Hours** | **:** | **40** | **Branch** | | **ECE,EE,EI,CS,ISE&AI** |
| **CIE Marks** | **:** | **50** | **SEE Marks** | **:** | **50** |
| **Semester** | **:** | **IV** | **Year** | **:** | **2021-2022** |

**Prerequisites:** Elementary Statistics and Probability.

**CourseObjectives:**Students are able

| |
|---|
| • To apply the knowledge of Mathematics in various Engineering fields |
| • To be acquired knowledge about predictions preferably on the basis of mathematical equations. |
| • To be understand the principal concepts about probability |

**Course Outcomes:**

| | **At the end of the course the student should be able to:** |
|---|---|
| 1 | Apply the least square sense method to construct the specific relation for the given group of data. |
| 2 | Solve problems on correlation and regression |
| 3 | Understand the concepts of probability |
| 4 | Understand the concepts of probability distributions |
| 5 | Apply the concept of Markov Chain for commercial and industry purpose. |

**Course Articulation Matrix: Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)**

| No | Programme Outcomes Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **The students will be able to:** | | | | | | | | | | | | | | | | |
| 1 | To apply the least square sense method to construct the specific relation for the given group of data. | 3 | 2 | | | | | | | | | | | | | |
| 2 | Solve problems on correlation and regression | 3 | 2 | | | | | | | | | | | | | |
| 3 | ly the concept of ility | 3 | 2 | | | | | | | | | | | | | |
| 4 | To understand the concepts of probability distributions | 3 | 2 | | | | | | | | | | | | | |
| 5 | ly the concept of v chain for rcial andindustry e. | 3 | 2 | | | | | | | | | | | | | |

**Course Content**

| | | | | | |
|---|---|---|---|---|---|
| **Title of Course** | **:** | **Statistics and Probability Distributions** | **Course Code** | **:** | **UMA491C** |
| **Credits** | **:** | **03(L-T-P:3-0-0)** | **Contact Hours/ Week** | **:** | **03** |
| **Total Hours** | **:** | **40** | **Semester** | **:** | **IV** |
| **CIE Marks** | **:** | **50** | **SEE Marks** | **:** | **50** |
| | | | **Year** | **:** | **2021-2022** |

| **Content** | **Hrs.(L)** |
|---|---|
| **Unit - I** | |
| **Statistics:** Curve fitting by the method of least squares: $y = a + bx$, $y = ab^x$, $y = a + bx + cx^2$. Correlation, expression for the rank correlation coefficient and regression. | **10** |
| **Unit –II** | |
| **Probability:** Probability: addition rule, conditional probability, multiplication rule, Baye's rule. Discrete and continuous random variables-Probability density function, Cumulative distribution function, Problems on expectation and variance. | **10** |
| **Unit – III** | |
| **Probability distributions:** Binomial distributions, Poisson distributions and Normal distributions. Concept of joint probability, Joint probability distributions. | **10** |
| **Unit – IV** | |
| **Markov chains:** Markov chains: Introduction, Probability vectors, Stochastic Matrices, Fixed Points and Regular stochastic Matrices, Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states. | **10** |

**Note: L: Lecture**

**Resources:**


1. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
2. Theory and problems of probability by Seymour Lipschutz (Schaum's Series).
3. Advanced Engineering Mathematics by H. K. Dass
4. Advanced Engineering Mathematics by E Kreyszig ( John Wiley & Sons)
5. Probability and stochastic processes by Roy D. Yates and David J. Goodman, wiley India pvt.ltd 2nd edition 2012.
6. Advanced Engineering Mathematics by Peter V. O'Neil.

| Course Outcomes | Programme Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| CO1 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO2 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO3 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO4 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO5 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

**Details of course project:**

- Each student should prepare different problems and submit to the course instructor
- Students will identify by the members of the team by picking (Roll number) chits
- Total twelve teams in a class
- Problems may be based on the previous lectures delivered by the teacher( knowledge based)
- Each member of the team will demonstrate the mathematical problems in front of the other students

**Question paper pattern for SEE:**

1. Question paper consists Part-A and Part-B. Question number 1 is compulsory, it consists of short answer questions of 1 or 2 marks, covering entire syllabus (no multiple choice questions and No true or false questions, 50% of questions must be L3 and L4 level).
2. In Part-B total of eight questions with two from each unit; with internal choice to be set uniformly covering the entire syllabus.
3. Each question carries 20 marks and should not have more than four subdivisions.
4. In Part-B, any FOUR full questions are to be answered choosing at least one from each unit.
5. Sketches, figures and tables if any should be clearly drawn, as the same is scanned for printing.
6. The question paper should contain all the data / figures / marks allocated, with clarity.

## Evaluation Scheme:

| Assessment | Marks | Weightage |
|---|---|---|
| CIE-I | 40 | 20 |
| CIE-II | 40 | 20 |
| Assignments/ Quizzes/ Case Study/ Course Project/ Term Paper/Field Work | 10 | 10 |
| SEE | 100 | 50 |
| Total | 190 | 100 |

## Question paper pattern for CIE-I and CIE-II:

Question paper consists Part-A and Part-B. Part A is compulsory, it consists of short answer questions of 1 or 2 marks, covering Unit-I and Unit-II (no multiple choice questions and No true or false questions).

1. In Part-B, four questions are to be set as per the following table.

| CIE | Number of questions / Maximum marks | Sub divisions | Covering entire unit |
|---|---|---|---|
| I | Two question of 15 marks (Solve any one) | Sub divisions shall not be mixed within the unit | Unit-I |
| | Two question of 15 marks (Solve any one) | Sub divisions shall not be mixed within the unit | Unit-II |
| II | Two question of 15 marks (Solve any one) | Sub divisions shall not be mixed within the unit | Unit-III |
| | Two question of 15 marks (Solve any one) | Sub divisions shall not be mixed within the unit | Unit-IV |

**BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT**
**BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT**

**MODEL COURSE PLAN**

| | | | | | |
|---|---|---|---|---|---|
| **Title of Course** | **:** | **Complex Analysis and Statistics** | **Course Code** | **:** | **UMA492C** |
| **Credits** | **:** | **03(L-T-P: 3-0-0)** | **Contact Hours/ Week** | **:** | **03** |
| **Total Hours** | **:** | **40** | **Branch** | **:** | **(Non IT)** |
| **CIE Marks** | **:** | **50** | **SEE Marks** | **:** | **50** |
| **Semester** | **:** | **IV** | **Year** | **:** | **2021-2022** |

**Course Objectives:** To apply the knowledge of Mathematics in various Engineering fields, students are able

| | |
|---|---|
| 1 | To examine functions of a single complex variable z = x+iy and the calculus of these functions. |
| 2 | To be acquired knowledge about predictions preferably on the basis of mathematical equations. |
| 3 | To be understand the principal concepts about probability |

**Course Outcomes:**

| | |
|---|---|
| | On completion of this course, students are able: |
| 1 | to attempt the real world problems using complex variable techniques |
| 2 | to use the concept of complex integration technique's for solving engineering problems |
| 3 | to understand the concepts of curve fitting and probability |
| 4 | to understand the concepts of probability distributions |
| 5 | to apply the concept of Markov Chain for commercial and industry purpose |

**Course Articulation Matrix: Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)**

| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **No** | **Programme Outcomes Course Outcomes** | | | | | | | | | | | | | | | |
| **The students will be able to:** | | | | | | | | | | | | | | | | |
| 1 | To attempt solve real world problems using complex variable techniques | 3 | 2 | | | | | | | | | | | | | |
| 2 | To use the concept of complex integration technique's for solving engineering problems | 3 | 2 | | | | | | | | | | | | | |
| 3 | To understand the concepts of curve fitting and probability | 3 | 2 | | | | | | | | | | | | | |
| 4 | To understand the concepts of probability distributions | 3 | 2 | | | | | | | | | | | | | |
| 5 | To apply the concept of Markov Chain for commercial and industry purpose | 3 | 2 | | | | | | | | | | | | | |

**Course Content**

| | | | | | |
|---|---|---|---|---|---|
| **Title of Course** | **:** | **Complex Analysis and Statistics** | **Course Code** | **:** | **UMA492C** |
| **Credits** | **:** | **03(L-T-P:3-0-0)** | **Contact Hours/ Week** | **:** | **03** |
| **Total Hours** | **:** | **40** | **Tutorial Hours** | **:** | **00** |
| **CIE Marks** | **:** | **50** | **SEE Marks** | **:** | **50** |
| **Semester** | **:** | **III** | **Year** | **:** | **2021-2022** |

| **Content** | **Hrs.( L)** |
|---|---|
| **Unit - I** | |
| **Complex Variables:**<br>Analytic function, Cauchy-Riemann equations in Cartesian and polar forms. Construction of analytic function (Cartesian and polar forms) | **10 Hours** |
| **Unit – II** | |
| **Complex Integration:**<br>Line integral, Cauchy's theorem – corollaries (without Proof), Cauchy's integral formula. Taylor’s and Laurent's series (statements only), singularities, poles, calculation of residues, Cauchy’s residue theorem (without proof) – problems. | **10 Hours** |
| **Unit – III** | |
| **Statistics and Probability**<br><br>**Statistics:** Curve fitting by the method of least squares: $y = a + bx$ , $y = ab^x$ and $y = a + bx + cx^2$ Correlation and regression.<br>**Probability**: addition rule, conditional probability, multiplication rule, Baye’s rule. Random variables, Problems on expectation and variance. | **10 Hours** |
| **Unit – IV** | |
| **Probability distributions:**<br>Binomial distributions Poisson distributions and Normal distributions (No derivations). Concept of joint probability, Joint distributions - discrete random variables,<br>**Markov chains:**<br>Markov chains: Introduction, Probability vectors, Stochastic Matrices, Fixed Points and Regular stochastic Matrices, Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states. | **10 Hours** |

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| CO3 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO4 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO5 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

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| **SEE** | **100** | **50** |
| **Total** | **190** | **100** |

**Question paper pattern for CIE-I and CIE-II:**

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| | Two question of 15 marks (Solve any one) | Sub divisions shall not be mixed within the unit | Unit-II |
| II | Two question of 15 marks (Solve any one) | Sub divisions shall not be mixed within the unit | Unit-III |
| | Two question of 15 marks (Solve any one) | Sub divisions shall not be mixed within the unit | Unit-IV |