# APPLIED MATHEMATICS                                Course Code : 312301

| | |
|---|---|
| **Programme Name/s** | : Architecture Assistantship/ Automobile Engineering./ Artificial Intelligence/ Agricultural Engineering/ <br> Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Computing and Big Data/ <br> Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ <br> Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Digital Electronics/ <br> Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical Power System/ <br> Electronics & Communication Engg./ Electronics Engineering/ Computer Hardware & Maintenance/ Instrumentation & Control/ <br> Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Instrumentation/ <br> Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechanical Engineering/ <br> Mechatronics/ Medical Electronics/ Production Engineering/ Electronics & Computer Engg./ |
| **Programme Code** | : AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DE/ DS/ EE/ EJ/ EP/ ET/ EX/ HA/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ MU/ PG/ TE/ |
| **Semester** | : Second |
| **Course Title** | : APPLIED MATHEMATICS |
| **Course Code** | : 312301 |

## I.  RATIONALE

An Applied Mathematics course, covering integration, definite integration, differential equations, numerical methods, and probability distribution, equips engineering students with essential problem-solving tools. It enables them to model and analyze complex systems, make informed decisions and address real-world engineering challenges effectively.

## II.  INDUSTRY / EMPLOYER EXPECTED OUTCOME

Engineers applying Mathematics should proficiently solve complex real-world problems, enhancing decision-making, design and innovation with precision and efficiency.

## III.  COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Solve the broad-based engineering problems of integration using suitable methods.
- CO2 - Use integration to find area, volume, mean value and root mean square value for given engineering related problems.
- CO3 - Apply the differential equation to find the solutions of given programme specific problems.
- CO4 - Employ numerical methods to solve programme specific problems.
- CO5 - Use probability distributions to solve elementary engineering problems.

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## IV. TEACHING-LEARNING & ASSESSMENT SCHEME

| Course Code | Course Title | Abbr | Course Category/s | Learning Scheme | | | | | Credits | Paper Duration | Assessment Scheme | | | | | | | | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Actual Contact Hrs./Week | | | SLH | NLH | | | Theory | | | | Based on LL & TL | | | | Based on SL | | | |
| | | | | | | | | | | | | | | | Practical | | | | | | | |
| | | | | CL | TL | LL | | | | | FA-TH | SA-TH | Total | | FA-PR | | SA-PR | | SLA | | | |
| | | | | | | | | | | | Max | Max | Max | Min | Max | Min | Max | Min | Max | Min | | |
| 312301 | APPLIED MATHEMATICS | AMS | AEC | 3 | 1 | - | - | 4 | 2 | 3 | 30 | 70 | 100 | 40 | - | - | - | - | - | - | 100 |

**Total IKS Hrs for Sem. :** 2 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

## V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

| Sr.No | Theory Learning Outcomes (TLO's)aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|---|---|---|---|
| 1 | TLO 1.1 Solve the given simple problem(s) based on rules of integration. TLO 1.2 Evaluate the given simple integral(s) using substitution method. TLO 1.3 Integrate given simple functions using the integration by parts. TLO 1.4 Solve the given simple integral by partial fractions. | **Unit - I Indefinite Integration** 1.1 Simple Integration: Rules of integration and integration of standard functions 1.2 Integration by substitution. 1.3 Integration by parts. 1.4 Integration by partial fractions. | Improved Lecture Demonstration Chalk-Board Presentations Video Demonstrations |

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| Sr.No | Theory Learning Outcomes (TLO's)aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|---|---|---|---|
| 2 | TLO 2.1 Solve given examples based on definite Integration. <br> TLO 2.2 Use properties of definite integration to solve given problems. <br> TLO 2.3 Utilize the concept of definite integration to find the following (a) Area under the curve (b) Area between given two curves (c) Volume of revolution (d) Mean value (e) Root mean square value | **Unit - II Definite Integration and Applications** <br> 2.1 Definite Integration: Definition, rules of definite integration with simple examples. <br> 2.2 Properties of definite integral (without proof) and simple examples. <br> 2.3 Applications of integration: area under the curve, area between given two curves, volume of revolution, mean value and root mean square value. | Video <br> Simulation <br> Chalk-Board <br> Improved Lecture <br> Presentations |
| 3 | TLO 3.1 Find the order and degree of given differential equations. <br> TLO 3.2 Form simple differential equation for given elementary engineering problems. <br> TLO 3.3 Solve given differential equations using the methods of Variable separable and Exact Differential Equation(Introduce the concept of partial differential equation). <br> TLO 3.4 Solve given Linear Differential Equation. <br> TLO 3.5 Solve given programme specific problems using the category of differential equation. | **Unit - III Differential Equation** <br> 3.1 Concept of Differential Equation. <br> 3.2 Order, degree and formation of Differential equations <br> 3.3 Methods of solving differential equations: Variable separable form, Exact Differential Equation, Linear Differential Equation. <br> 3.4 Application of differential equations and related engineering problem(s). | Video <br> Demonstrations <br> Presentations <br> Chalk-Board <br> Improved Lecture <br> Presentations |
| 4 | TLO 4.1 Find roots of algebraic equations by using appropriate methods. <br> TLO 4.2 Solve the system of equations in three unknowns by using given methods. <br> TLO 4.3 Apply the concept of numerical integration to solve given engineering problems. <br> TLO 4.4 Solve problems using Yuktibhasa iterative methods for finding approximate square root. (IKS) | **Unit - IV Numerical Methods and Numerical Integrations** <br> 4.1 Solution of algebraic equations: Bisection method, Regula falsi method and Newton –Raphson method. <br> 4.2 Solution of simultaneous equations containing three Unknowns by Gauss elimination method. <br> 4.3 Solution of simultaneous equations containing three Unknowns by iterative methods: Gauss Seidal and Jacobi's method. <br> 4.4 Numerical Integration: Trapezoidal rule, Simpson's 1/3 rd rule, Simpson's 3/8 th rule. (Without proof) <br> 4.5 Yuktibhasa iterative methods for finding approximate square root. (IKS) | Video <br> SCILAB <br> Spreadsheet <br> Chalk-Board <br> Improved Lecture <br> Presentations |

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| Sr.No | Theory Learning Outcomes (TLO's)aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|---|---|---|---|
| 5 | TLO 5.1 Solve given problems based on repeated trials using Binomial distribution.<br>TLO 5.2 Solve given problems when number of trials are large and probability is very small.<br>TLO 5.3 Utilize the concept of normal distribution to solve related engineering problems. | **Unit - V Probability Distribution**<br>5.1 Binomial distribution.<br>5.2 Poisson's distribution.<br>5.3 Normal distribution. | Video<br>ORANGER<br>Chalk-Board<br>Improved Lecture<br>Presentations |

## VI.  LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|---|---|---|---|
| LLO 1.1 Solve simple problems of Integration by substitution | 1 | *Integration by substitution | 1 | CO1 |
| LLO 2.1 Solve integration using by parts | 2 | *Integration by parts | 1 | CO1 |
| LLO 3.1 Solve integration by partial fractions | 3 | *Integration by partial fractions. | 1 | CO1 |
| LLO 4.1 Solve examples on Definite Integral based on given methods. | 4 | Definite Integral based on given methods. | 1 | CO2 |
| LLO 5.1 Solve problems on properties of definite integral. | 5 | *Properties of definite integral | 1 | CO2 |
| LLO 6.1 Solve given problems for finding the area under the curve, area between two curves and volume of revolution. | 6 | Area under the curve, area between two curves and volume of revolution. | 1 | CO2 |
| LLO 7.1 Solve examples on mean value and root mean square value. | 7 | Mean value and root mean square value. | 1 | CO2 |
| LLO 8.1 Solve examples on order, degree and formation of differential equation. | 8 | Order, degree and formation of differential equation. | 1 | CO3 |
| LLO 9.1 Solve first order first degree D.E. using variable separable method and homogeneous method. | 9 | *Variable separable method and homogeneous method. | 1 | CO3 |
| LLO 10.1 Solve first order first degree D.E. using exact differential equation and linear differential equation. | 10 | *Exact differential equation and linear differential equation. | 1 | CO3 |
| LLO 11.1 Solve engineering application problems using differential equation. | 11 | Applications of differential equations. | 1 | CO3 |
| LLO 12.1 Solve problems on Bisection method and Regula falsi method. | 12 | *Bisection method and Regula falsi method. | 1 | CO4 |
| LLO 13.1 Solve problems on Newton-Raphson method and Gauss elimination method. | 13 | Newton- Raphson method and Gauss elimination method. | 1 | CO4 |
| LLO 14.1 Solve problems on Jacobi's method and Gauss Seidal Method. | 14 | Jacobi's method and Gauss Seidal Method. | 1 | CO4 |
| LLO 15.1 Solve examples on Trapezoidal rule, Simpson's 1/3 rd rule and Simpson's 3/8 th rule. | 15 | Trapezoidal rule, Simpson's 1/3 rd rule and Simpson's 3/8 th rule. | 1 | CO4 |

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| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|---|---|---|---|
| LLO 16.1 Solve problems on Bisection method, Regula falsi method, Newton-Raphson method using spreadsheet . | 16 | Bisection method, Regula falsi method, Newton- Raphson method problems using spreadsheet. | 1 | CO4 |
| LLO 17.1 Use Yuktibhasa iterative methods for finding approximate value of square root and cube root. (IKS) | 17 | *Yuktibhasa iterative methods for finding approximate value of square root and cube root. (IKS) | 1 | CO4 |
| LLO 18.1 Solve engineering problems using Binomial distribution. | 18 | *Binomial Distribution | 1 | CO5 |
| LLO 19.1 Solve engineering problems using Poisson distribution. | 19 | *Poisson Distribution | 1 | CO5 |
| LLO 20.1 Solve engineering problems using Binomial distribution. | 20 | *Normal Distribution | 1 | CO5 |
| LLO 21.1 Solve problems on Laplace transform and properties of Laplace transform. | 21 | # Laplace transform and properties of Laplace transform. | 1 | CO2 |
| LLO 22.1 Solve problems on Inverse Laplace transform and properties of Inverse Laplace transform. | 22 | # Inverse Laplace transform and properties of Inverse Laplace transform. | 1 | CO2 |

**Note : out of above suggestive LLOs -**

- Minimum 12 for 2 LL Hrs./Week or 24 for 4 LL hrs./Week are to be Performed.
- '*' Marked Practicals (LLOs) Are mandatory
- Judicial mix of LLOs are to be performed to complete minimum requirement of 12 / 24 as applicable

## VII.   SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

**Micro project**

- NA

**Assignment**

- NA

| Note : |
|---|
| NA |

## VIII.   LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

| Sr.No | Equipment Name with Broad Specifications | Relevant LLO Number |
|---|---|---|
| 1 | Open-source software like wolfram alpha, SageMaths, MATHS3D, GeoGebra, Graph, DPLOT, and Graphing Calculator (Graph Eq2.13), ORANGE can be used for Algebra, Calculus, Trigonometry and Statistics respectively. | All |

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## IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

| Sr.No | Unit | Unit Title | Aligned COs | Learning Hours | R-Level | U-Level | A-Level | Total Marks |
|-------|------|------------|-------------|----------------|---------|---------|---------|-------------|
| 1 | I | Indefinite Integration | CO1 | 9 | 2 | 6 | 4 | 12 |
| 2 | II | Definite Integration and Applications | CO2 | 10 | 2 | 4 | 10 | 16 |
| 3 | III | Differential Equation | CO3 | 10 | 2 | 6 | 8 | 16 |
| 4 | IV | Numerical Methods and Numerical Integrations | CO4 | 8 | 2 | 4 | 8 | 14 |
| 5 | V | Probability Distribution | CO5 | 8 | 2 | 4 | 6 | 12 |
| | | **Grand Total** | | **45** | **10** | **24** | **36** | **70** |

## X. ASSESSMENT METHODOLOGIES/TOOLS

**Formative assessment (Assessment for Learning)**

- Tests

**Summative Assessment (Assessment of Learning)**

- End Term Exam

## XI. SUGGESTED COS - POS MATRIX FORM

| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | | | Programme Specific Outcomes* (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 Basic and Discipline Specific Knowledge | PO-2 Problem Analysis | PO-3 Design/ Development of Solutions | PO-4 Engineering Tools | PO-5 Engineering Practices for Society, Sustainability and Environment | PO-6 Project Management | PO-7 Life Long Learning | PSO-1 | PSO-2 | PSO-3 |
| CO1 | 3 | 1 | - | - | 1 | - | 1 | | | |
| CO2 | 3 | 1 | - | - | 1 | - | 1 | | | |
| CO3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | | | |
| CO4 | 2 | 3 | 2 | 2 | 1 | 1 | 1 | | | |
| CO5 | 2 | 2 | 1 | 1 | 2 | 1 | 2 | | | |
| Legends :- High:03, Medium:02,Low:01, No Mapping: - <br> *PSOs are to be formulated at institute level | | | | | | | | | | |

## XII. SUGGESTED LEARNING MATERIALS / BOOKS

| Sr.No | Author | Title | Publisher with ISBN Number |
|-------|--------|-------|----------------------------|
| | | | |

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| Sr.No | Author | Title | Publisher with ISBN Number |
|---|---|---|---|
| 1 | Grewal B. S. | Higher Engineering Mathematics | Khanna publication New Delhi, 2013 ISBN: 8174091955 |
| 2 | Dutta. D | A text book of Engineering Mathematics | New age publication New Delhi, 2006 ISBN: 978- 81-224-1689-3 |
| 3 | Kreysizg, Ervin | Advance Engineering Mathematics | Wiley publication New Delhi 2016 ISBN: 978-81- 265-5423-2 |
| 4 | Das H.K. | Advance Engineering Mathematics | S Chand publication New Delhi 2008 ISBN: 9788121903455 |
| 5 | S. S. Sastry | Introductory Methods of Numerical Analysis | PHI Learning Private Limited, New Delhi. ISBN-978-81-203-4592-8 |
| 6 | c. S. Seshadri | Studies in the History of Indian Mathematics | Hindustan Book Agency (lndia) P 19 Green Park Extension New Delhi. ISBN 978-93-80250-06-9 |
| 7 | Marvin L. Bittinger David J.Ellenbogen Scott A. Surgent | Calculus and Its Applications | Addison-Wesley 10th Edition ISBN-13: 978-0-321-69433-1 |
| 8 | Gareth James, Daniela Witten,Trevor Hastie Robert andTibshirani | An Introduction to StatisticalLearning with Applications in R | Springer New York Heidelberg Dordrecht LondonISBN 978-1-4614-7137-0 ISBN 978-1-4614-7138-7 (eBook) |

## XIII .  LEARNING WEBSITES & PORTALS

| Sr.No | Link / Portal | Description |
|---|---|---|
| 1 | http://nptel.ac.in/courses/106102064/1 | Online Learning Initiatives by IITs and IISc |
| 2 | https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaddHoPig | Concept of Mathematics through video lectures and notes |
| 3 | https://www.wolframalpha.com/ | Solving mathematical problems, performing calculations, and visualizing mathematical concepts. |
| 4 | http://www.sosmath.com/ | Free resources and tutorials |
| 5 | http://mathworld.wolfram.com/ | Extensive math encyclopedia with detailed explanations of mathematical concepts |
| 6 | https://www.mathsisfun.com/ | Explanations and interactive lessons covering various math topics, from basic arithmetic to advanced |
| 7 | http://tutorial.math.lamar.edu/ | Comprehensive set of notes and tutorials covering a wide range of mathematics topics, including calc |
| 8 | https://www.purplemath.com/ | Purplemath is a great resource for students seeking help with algebra and other foundational math to |
| 9 | https://www.brilliant.org/ | Interactive learning in Mathematics |
| 10 | https://www.edx.org/ | Offers a variety of courses |
| 11 | https://www.coursera.org/ | Coursera offers online courses in applied mathematics from universities and institutions around the |
| 12 | https://ocw.mit.edu/index.htm | The Massachusetts Institute of Technology (MIT) offers free access to course materials for a wide ra |

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