

LOK JAGRUTI UNIVERSITY (LJU)
INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of Robotics and Artificial Intelligence (706)

Bachelor of Engineering (B.E.) – Semester – I

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|----------------------|----------------------------|
| Course Code: | 117061191 |
| Course Name: | Mathematics - I |
| Category of Course: | Basic Science Course (BSC) |
| Prerequisite Course: | --- |

| Teaching Scheme | | | | |
|-----------------|--------------|---------------|--------|-------------|
| Lecture (L) | Tutorial (T) | Practical (P) | Credit | Total Hours |
| 4 | 2 | 0 | 6 | 60 |

| Syllabus | | | | |
|----------|---|---|------------------|----------------|
| Unit No. | Topic | Prerequisite Topic | Successive Topic | Teaching Hours |
| 01 | Basic Algebra | | | 2 (2%) |
| | 1.1 Indices | --- | --- | |
| | 1.2 Surds | --- | --- | |
| | 1.3 Expansions and factorization | --- | --- | |
| | 1.4 Logarithm and Exponential Function with its Application | --- | --- | |
| 02 | Trigonometry and Geometry | | | 2 (3%) |
| | 2.1 Angles | --- | --- | |
| | 2.2 Trigonometric functions of sum and difference of two angles | --- | --- | |
| | 2.3 Law of sines and cosines | --- | --- | |
| 03 | Basic Differentiation | | | 3 (4%) |
| | 3.1 Basic differentiation by formulae | --- | --- | |
| | 3.2 Product and quotient rule | --- | --- | |
| | 3.3 Chain rule and composite function | --- | --- | |
| | 3.4 Roll's theorem | Basic differentiation (017061191-Unit-3) | --- | |
| | 3.5 Lagrange's theorem | Basic differentiation (017061191-Unit-3) | --- | |
| | 3.6 Cauchy's mean value theorem | First and higher order partial derivatives (017061191-Unit-3) | --- | |
| | 3.7 Indeterminate forms and L'Hospital's rule | --- | --- | |
| 04 | Partial Derivatives | | | 6 (9%) |
| | 4.1 Functions of several variables | --- | --- | |
| | 4.2 Geometric interpretation of partial derivatives | --- | --- | |
| | 4.3 Limits and continuity of function of several variables | Basic differentiation (017061191-Unit-3) | --- | |
| | 4.4 First and higher order partial derivatives | --- | --- | |
| | 4.5 Euler's theorem and modified Euler's theorem | Basic differentiation (017061191-Unit-3) | --- | |
| | 4.6 Total derivatives and chain rule | First and higher order partial derivatives (017061191-Unit-3) | --- | |
| | 4.7 Implicit function | --- | --- | |
| 05 | Application of Partial Derivatives | | | 4 (7%) |
| | 5.1 Tangent plane and normal line | First order partial derivatives(017061191-Unit-3) | --- | |
| | 5.2 Total differentiation and approximation | | --- | |
| | 5.3 Extreme values | First and higher order partial derivatives(017061191-Unit-3) | --- | |
| | 5.4 Method of Lagrange multipliers. | --- | --- | |
| | 5.5 Jacobian | First order partial derivatives(017061191-Unit-3) | --- | |
| 06 | Multiple Integral | | | 15 (25%) |
| | 6.1 Basic integration by formulae | --- | --- | |
| | 6.2 Integration by parts | --- | --- | |
| | 6.3 Double integral over rectangles and general regions | Basic integration(017061191-Unit-3) Double integral over rectangles and general regions (017061191-Unit-7) | --- | |
| | 6.4 Change of order of integration | Basic integration(017061191-Unit-3) Double integral over rectangles and general regions (017061191-Unit-7) | --- | |
| | 6.5 Double integration in polar coordinates | Basic integration(017061191-Unit-3) | --- | |
| | 6.6 Change of variables in double integration by Jacobian | --- | --- | |
| | 6.7 Triple integration | --- | --- | |

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|----|---|---|--|--------------------|
| | 6.8 Area enclosed by plane curve using double integration | Double integral over rectangles and general regions, Double integration in polar coordinates (017061191-Unit-7) | --- | |
| | 6.9 Triple integration in cylindrical and spherical co-ordinates | Triple integration (017061191-Unit-7) | --- | |
| 07 | Vector Calculus-I | | | 7 (13%) |
| | 7.1 Vector and its properties | --- | --- | |
| | 7.2 Parametrization of curves | --- | --- | |
| | 7.3 Arc length of curve in space | Basic integration (017061191-Unit-3) First order partial derivatives(017061191-Unit-3) | --- | |
| | 7.4 Gradient of a scalar point function and surface normal vector | --- | Models: Linear Modeling (017062391-Unit -4), Stochastic Gradient Descent (017062391-Unit -4) | |
| | 7.5 Directional derivatives | Gradient(017061191-Unit-9) | --- | |
| | 7.6 Divergence of vector field | First order partial derivatives(017061191-Unit-3) | --- | |
| | 7.7 Curl of vector field | --- | --- | |
| | 7.8 Scalar potential function of conservative field | --- | --- | |
| 08 | Vector Integral | | | 7 (12%) |
| | 8.1 Line integral | Basic integration (017061191-Unit-3) | --- | |
| | 8.2 Work done | Line integral (017061191-Unit-10) | --- | |
| | 8.3 Circulation and Flux | Line integral (017061191-Unit-10) | --- | |
| | 8.4 Green's theorem in the plane (without proof) | Line integral (017061191-Unit-10), Double integral over rectangles and general regions (017061191-Unit-8) | --- | |
| 09 | Graph Theory | | | 8 (15%) |
| | 9.1 Introduction to Graphs and Definitions | --- | --- | |
| | 9.2 Path and Circuits | --- | --- | |
| | 9.3 Cut Sets and Cut Vertices | --- | --- | |
| | 9.4 Graph Representations and Matrix Theory | | | |
| | 9.5 Graph Coloring, Chromatic Polynomial and Matching | --- | --- | |
| 10 | Trees | | | 6 (10%) |
| | 10.1 Mathematical Foundations of Trees | Carrier Generation (creation of EHP) and carrier recombination (017061192 -Unit-6.3) | --- | |
| | 10.2 Spanning Trees | --- | --- | |

| Proposed Theory + Practical Evaluation Scheme by Academicians (% Weightage Category Wise and it’s Marks Distribution) | | | | | |
|---|------------------------------------|----------------------|-------------------------------------|-------------|-----------------|
| L : | 4 | T: | 2 | P: | 0 |
| Note : In Theory Group, Total 4 Test (T1+T2+T3+T4) will be conducted for each subject. Each Test will be of 25 Marks. Each Test Syllabus Weightage: Range should be 20% - 30% | | | | | |
| Group (Theory or Practical) | Group (Theory or Practical) Credit | Total Subject Credit | Category | % Weightage | Marks Weightage |
| Theory | 6 | 6 | MCQ | 15% | 15 |
| Theory | | | Theory Descriptive | 5% | 5 |
| Theory | | | Formulas and Derivation | 5% | 5 |
| Theory | | | Numerical | 75% | 75 |
| Expected Theory % | 100% | | Calculated Theory % | 100% | 100 |
| Practical | 0 | | Individual Project | 0% | 0 |
| Practical | | | Group Project | 0% | 0 |
| Practical | | | Internal Practical Evaluation (IPE) | 0% | 0 |
| Practical | | | Viva | 0% | 0 |
| Practical | | | Seminar | 0% | 0 |
| Expected Practical % | 0% | | Calculated Practical % | 0% | 0 |
| Overall % | 100% | | | 100% | 100 |

| Course Outcome | |
|---------------------------|---|
| | <i>Upon completion of the course students will be able to</i> |
| CO1 | To solve problems of differentiation, integration, trigonometry and some practical problems, such as constrained optimization problems and other problems involving Partial differentiation and to calculate directional derivatives and gradients. |
| CO2 | Evaluate a double integral in polar coordinates and triple integral to find area and volume in rectangular coordinates, cylindrical coordinates, and spherical coordinates. |
| CO3 | Apply gradient to solve problems involving normal vectors to level surfaces and to Explain the concept of a vector integration in a plane(2-dimensions) and in the space(3-dimensions). |
| CO4 | To understand concepts of Graph theory in context of computer science and to solve problems related to nonlinear structures like Tree |
| Suggested Reference Books | |
| 1 | Calculus with Early Transcendental Functions, James Stewart, Cengage Learning. |
| 2 | Thomas’ Calculus, Maurice D. Weir, Joel Hass, Frank R. Giordano, Pearson Education. |
| 3 | Higher Engineering Mathematics, B.S.Grewal, Khanna Publishers. |
| 4 | Advanced Engineering Mathematics, Erwin Kreysig, Wiley Publication. |
| 5 | Graph Theory with Applications to Engineering & Computer Science, Narsingh Deo, Dover Publications, INC.Mineola, New York |

| List of Open Source Software/Learning website | |
|---|---|
| 1 | http://nptel.ac.in/ |