

## Academic Course Description

BHARATH University  
 Faculty of Science and Humanities  
 Department of Mechanical Engineering

**BMA101 ENGINEERING MATHEMATICS - I**  
**First Semester, 2015-16 (Odd Semester)**

### Course (catalog) description

In this course the first chapter we introduces to the concepts and definitions Characteristic equations, Eigen values and eigen vectors of the real matrix- Properties, Cayley-Hamilton theorem, and Orthogonal transformation of a symmetric matrix to diagonal form- Quadratic form- Reduction of quadratic form to canonical form by orthogonal transformation.

In Second Chapter we introduce the concepts Equation of a Sphere, Plane section of a sphere, Tangent plane, Equation of cone- Right circular cone, Equation of a cylinder and Right circular cylinder.

In Third Chapter we introduce the concepts Curvatures in Cartesian coordinates- Centre and radius of curvature, Circle of curvature- Evolutes- Envelopes and Evolute as envelope of normal's.

In The fourth Chapter we introduce the concept Partial derivatives, Euler's theorem for homogeneous functions- Total derivatives- Differentiation of implicit functions and Jacobian- Taylor's expansion, Maxima and Minima and Method of Lagrangian multipliers

In the Fifth Chapter we introduce the concept Double integration, Cartesian and Polar coordinates, Change of order of integration, Change of variables between Cartesian and Polar coordinates, Triple integration in Cartesian coordinates and Area as double integral, Volume as triple integral.

**Compulsory/Elective course:** Compulsory for all branch students  
 Credit & contact hours : 3 & 60  
 Course Coordinator : Dr.Deepa

**Instructors :**

| Name of the instructor | Class handling          | Office location          | Office phone | Email (domain:@bharathuniv.ac.in) | Consultation  |
|------------------------|-------------------------|--------------------------|--------------|-----------------------------------|---------------|
| Mr.P.Bhathmanaban      | All First Year Students | FIRST YEAR MAIN BULIDING |              | bhathrns@gmail.com                | 9.00-9.50 AM  |
| Mrs.K.Janaki           | All First Year Students | FIRST YEAR MAIN BULIDING |              | Janu89lava@gmail.com              | 12.45-1.15 PM |

### Relationship to other courses:

Pre –requisites : BPH101 Engineering Physics –I

Assumed knowledge : The students will have a physics and mathematics background obtained at a high school (or Equivalent) level. In particular, working knowledge of basic mathematics including Differentiation, integration and probability theories are assumed.

Following courses : Mathematics II, Mathematics –III

**Computer usage:** Nil

**Professional component**

|                                       |   |      |
|---------------------------------------|---|------|
| General                               | - | 0%   |
| Basic Sciences                        | - | 0%   |
| Engineering sciences & Technical arts | - | 00%  |
| Professional subject                  | - | 100% |

**Broad area :** Matrices | Calculus| Multiple Integrations

**Test Schedule**

| S. No. | Test                   | Tentative Date                 | Portions             | Duration  |
|--------|------------------------|--------------------------------|----------------------|-----------|
| 1      | Cycle Test-1           | August 1 <sup>st</sup> week    | Session 1 to 14      | 2 Periods |
| 2      | Cycle Test-2           | September 2 <sup>nd</sup> week | Session 15 to 28     | 2 Periods |
| 3      | Model Test             | October 2 <sup>nd</sup> week   | Session 1 to 45      | 3 Hrs     |
| 5      | University Examination | TBA                            | All sessions / Units | 3 Hrs.    |

**Mapping of Instructional Objectives with Program Outcome**

| To develop problem solving skills and understanding of Mathematics. This course emphasizes: | Correlates to program outcome |           |     |
|---|-------------------------------|-----------|-----|
|   | H                             | M         | L   |
| 1. To develop an understanding of the fundamental s in Matrices                             | b,c,d,j                       | a,f,k     | e,g |
| 2. To develop the ability to solve problems in Analytical Geometry in three dimension       | b,c,f                         | a,d,g,h   | j   |
| 3. To understand the concepts of Differential calculus.                                     | a,d,e                         | b,g       | j,k |
| 4. To develop students problem solving techniques in several variables                      | a,d,e                         | b,g,h,k   | f,j |
| 5. To learn the Multiple integration in polar and cylindrical coordinates                   | a                             | a,b,c,d,g | j,k |

H: high correlation, M: medium correlation, L: low correlation

**Draft Lecture Schedule**

| Session  | Topics  | Problem solving<br>(Yes/No) | Text / Chapter |
|--|---|-----------------------------|----------------|
| <b>UNIT I MATRICES</b>                               |   |                             |                |
| 1.   | Characteristic Equations  | Yes                         | [T1]           |
| 2.   | Cayley-Hamilton theorem   | Yes                         |                |
| 3.   | Eigen values of Eigen vectors 2*2 real matrix                               | Yes                         |                |
| 4.   | Eigen values of Eigen vectors 3*3 real matrix                               |                             |                |
| 5.   | Definition and Properties orthogonal transformation                         |                             |                |
| 6.   | Orthogonal transformation of a symmetric matrix to diagonal form            | Yes                         |                |
| 7.   | Quadratic form  | Yes                         |                |
| 8.   | Reduction of quadratic form to canonical form by orthogonal transformation. | Yes                         |                |
| <b>UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY</b> |   |                             |                |
| 9.   | Equation of a Sphere  | Yes                         | [T2]           |
| 10.  | Plane section of a sphere   | Yes                         |                |
| 11.  | Tangent plane   | Yes                         |                |
| 12.  | Equation of cone  | Yes                         |                |
| 13.  | Right circular cone   | Yes                         |                |
| 14.  | Equation of a cylinder  | Yes                         |                |
| 15.  | Right circular cylinder.  | Yes                         |                |
| <b>UNIT III DIFFERENTIAL CALCULUS</b>                |   |                             |                |
| 16.  | Curvature in Cartesian coordinates  | Yes                         | [T3]           |
| 17.  | Centre of curvature   | Yes                         |                |
| 18.  | radius of curvature   |                             |                |
| 19.  | Circle of curvature   | Yes                         |                |
| 20.  | Evolutes of parabola  | Yes                         |                |
| 21.  | Evolutes of Ellipse   |                             |                |
| 22.  | Envelopes   | Yes                         |                |
| 23.  | Evolute as envelope of normal's   | Yes                         |                |
| <b>UNIT IV FUNCTIONS OF SEVERAL VARIABLES</b>        |   |                             |                |
| 24.  | Partial derivatives of second and higher order                              | Yes                         | [T4]           |
| 25.  | Euler's theorem for homogeneous functions                                   | Yes                         |                |
| 26.  | Total derivatives   | Yes                         |                |
| 27.  | Differentiation of implicit functions                                       | Yes                         |                |
| 28.  | Jacobian  | Yes                         |                |
| 29.  | Taylor's expansion  | Yes                         |                |
| 30.  | Maxima and Minima   | Yes                         |                |
| 31.  | Method of Lagrangian multipliers  | Yes                         |                |

| UNIT V      MULTIPLE INTEGRALS |   |     |      |
|--------------------------------|---|-----|------|
| 32.                            | Double integration  | Yes | [T5] |
| 33.                            | Cartesian and Polar coordinates                             | Yes |      |
| 34.                            | Change of order of integration                              | Yes |      |
| 35.                            | Change of variables between Cartesian and Polar coordinates | Yes |      |
| 36.                            | Triple integration in Cartesian coordinates                 | Yes |      |
| 37.                            | Area as double integral                                     | Yes |      |
| 38.                            | Volume as triple integral                                   |     |      |

### Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

| Evaluation Strategies               |     |
|-------------------------------------|-----|
| Cycle Test – I                      | 5%  |
| Cycle Test – II                     | 5%  |
| Model Test                          | 10% |
| Seminar/Assignment/Online Test/Quiz | 5%  |
| Attendance                          | 5%  |
| Final Exam                          | 70% |

Prepared by: Dr.Deepa

*BMA101- Engineering Mathematics-1*

### Addendum

#### **ABET Outcomes expected of graduates of B.Tech / MECH / program by the time that they graduate:**

- a) The ability to apply knowledge of mathematics, science, and engineering fundamentals.
- b) The ability to identify, formulate and solve engineering problems.
- c) The ability to design a system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- d) The ability to design and conduct experiments, as well as to analyze and interpret data
- e) The ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- f) The ability to apply reasoning informed by the knowledge of contemporary issues.

- g) The ability to broaden the education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- h) The ability to understand professional and ethical responsibility and apply them in engineering practices.
- i) The ability to function on multidisciplinary teams.
- j) The ability to communicate effectively with the engineering community and with society at large.
- k) The ability in understanding of the engineering and management principles and apply them in project and finance management as a leader and a member in a team.
- l) The ability to recognize the need for, and an ability to engage in life-long learning.

### **Program Educational Objectives**

#### **PEO1: PREPARATION:**

Mechanical Engineering graduates are enthusiastic to provide strong foundation in mathematical, scientific and engineering fundamentals necessary to analyze, formulate and solve engineering problems in the field of Mechanical Engineering.

#### **PEO2: CORE COMPETENCE:**

Mechanical Engineering graduates have competence to enhance the skills and experience in defining problems in the field of Mechanical Engineering and Technology design and implement, analyzing the experimental evaluations, and finally making appropriate decisions.

#### **PEO3: PROFESSIONALISM:**

Mechanical Engineering graduates made competence to enhance their skills and embrace new thrust areas through self-directed professional development and post-graduate training or education.

#### **PEO4: PROFICIENCY:**

Mechanical Engineering graduates became skilled to afford training for developing soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, inter personal relationship, group discussion and leadership skill to become a better professional.

#### **PEO5: ETHICS:**

Mechanical Engineering graduates are morally merged to apply the ethical and social aspects of modern Engineering and Technology innovations to the design, development, and usage of new products, machines, gadgets, devices, etc.

*BMA101- Engineering Mathematics-1*

| <b>Course Teacher</b>             | <b>Signature</b> |
|-----------------------------------|------------------|
| Mr.P.Bhathmanaban<br>Mrs.K.Janaki |                  |

**Course Coordinator**      **HOD/Mech**  
Dr.Deepa