MANIPAL UNIVERSITY JAIPUR

School of Engineering

Department of Mathematics & Statistics
Course Hand-out

Engineering Mathematics-II | MA 1201 | 4 Credits | 3 1 0 4

Session: March 22 – June 22 |**Dr Indeewar Kumar/Dr Pooja Sharma** | Class: Ist Year

A. Introduction: An engineering student needs to have some basic mathematical tools and techniques which emphasize the development of rigorous logical thinking and analytical skills. Based on this, the course aims at giving adequate exposure to the theory and applications. The course is aimed at developing the basic Mathematical skills of engineering students that are imperative for effective understanding of engineering

B. Course Outcomes: At the end of the course, students will be able to

[MA1201.1] Find the curvature, Asymptotes using analytical methods and tracing of the curve. Though which one could develop programming skills to solve complex problems which intern become employable in engineering sector

[MA1201.2] Understand the concept of partial derivatives and its applicability and test of convergence of a given series

[MA1201.3] Define the concept of 3-D geometry for Sphere, right circular cone and Cylinder

[MA1201.4] Able to solve the multiple integral problems under integral calculus in easier way by using Beta, Gamma functions and its properties

[MA1201.5] **S**olve the problems of Laplace transforms and further to apply these skills in solving Engineering applications

C. Program Outcomes and Program Specific Outcomes

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

[PO.2]. **Problem Analysis:** Identify, formulate, research literature and analyse 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 specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.

[PO.4]. **Conduct investigations** of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of 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 under- standing of the limitations.

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

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

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

[PO.9]. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary 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 engineering and management principles and apply these to owners own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

[PO.12]. **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.

[PSO.1]. Model and analyse engineering problems by using differential and Integral calculus

[PSO.2]. Analyse performance of solid geometry and Laplace transform in Engineering field.

[PSO.3]. Generate advance methods for engineering applications.

D. Assessment Rubrics:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	Quizzes (Open Book/Close Book) and Assignments	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Homework/ Home Assignment/ (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. A student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

E. Syllabus

MA1201: ENGINEERING MATHEMATICS – II [3 1 0 4]

Differential calculus: curvatures, asymptotes, curve tracing; Partial differentiation, total derivatives, errors and expansions, Taylor's theorem, maxima and minima, Lagrange's method. **Infinite series**, tests for convergence of series with positive terms, alternating series, power series. **Analytical solid geometry**- spheres. Cones and cylinders. **Multiple integrals** and their applications, beta and gamma functions. **Laplace transforms**, periodic functions, step functions, inverse transforms, convolution, solution of differential equations and applications.

References:

1. Grewal B. S., *Higher Engineering Mathematics*, (42e), Khanna Publishers, 2013
2. Rainville E. D. and Bedient P. E., *A Short Course in Differential Equations* (6e), Macmillan Pub., Mumbai, 1981.
3. Kreyszig E., *Advanced Engineering Mathematics*, (10e), Wiley Eastern, 2011
4. Ramana B. V., *Higher Engineering Mathematics* (6th reprint), Tata Mcgraw-Hill, New Delhi, 2008
5. Iyengar S.R.K. and Jain, Rajendra K. Advance Engineering Mathematics (3e), Narosa book distributors Pvt Ltd-New Delhi, 2007

H. Lecture Plan:

Lecture No.	Description of the Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1.	Introduction, Definition, Radius of curvature (Cartesian Coordinate)	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.1	Quizzes, assignments, Two Sessional, End Term Examination
2.	Radius of curvature (Parametric Coordinate)	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.1	Quizzes, assignments, Two Sessional, End Term Examination
3.	Radius of curvature (Polar Coordinate)	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.1	Quizzes, assignments, Two Sessional, End Term Examination
4.	Tutorial Class	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Problem solving	1201.1	Quizzes, assignments, Two Sessional, End Term Examination
5.	Centre of curvature, Circle of curvature & Chord of curvature	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.1	Quizzes, assignments, Two Sessional, End Term Examination
6.	Asymptotes (Parallel) in cartesian coordinate	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.1	Quizzes, assignments, Two Sessional, End Term Examination
7.	Asymptotes (Inclined) in cartesian coordinate	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.1	Quizzes, assignments, Two Sessional, End Term Examination

8.	Tutorial Class	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Problem solving	1201.1	Quizzes, assignments, Two Sessional, End Term Examination
9.	Curve tracing:	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.1	Quizzes, assignments, Two Sessional, End Term Examination
10.	Procedure for tracing Cartesian curves	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.1	Quizzes, assignments, Two Sessional, End Term Examination
11.	Problems based on above topic	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.1	Quizzes, assignments, Two Sessional, End Term Examination
12.	Procedure for tracing polar curves (only closed curve)	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Problem solving	1201.1	Quizzes, assignments, Two Sessional, End Term Examination
13.	Problems based on above topic	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.1	Quizzes, assignments, Two Sessional, End Term Examination
14.	Partial Differentiation	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.2	Quizzes, assignments, Two Sessional, End Term Examination
15.	Introduction & problems	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Problem solving	1201.2	Quizzes, assignments, Two Sessional, End Term Examination
16.	Euler's theorem on homogeneous functions	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.2	Quizzes, assignments, Two Sessional, End Term Examination
17.	Tutorial Class	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.2	Quizzes, assignments, Two Sessional, End Term Examination

18.	Total derivative	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Problem solving	1201.2	Quizzes, assignments, Two Sessional, End Term Examination
19.	Derivatives of composite and implicit functions	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.2	Quizzes, assignments, Two Sessional, End Term Examination
20.	Change of variables	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.2	Quizzes, assignments, Two Sessional, End Term Examination
21.	Taylor's theorem for a function of two variables	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Problem solving	1201.2	Quizzes, assignments, Two Sessional, End Term Examination
22.	Tutorial Class	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.2	Quizzes, assignments, Two Sessional, End Term Examination
23.	Extreme values of a function of two variables	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.2	Quizzes, assignments, Two Sessional, End Term Examination
24.	Lagrange's method of undetermined multipliers	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.2	Quizzes, assignments, Two Sessional, End Term Examination
25.	Errors and approximations	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Problem solving	1201.2	Quizzes, assignments, Two Sessional, End Term Examination
26.	Tutorial Class	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Problem solving	1201.4	Quizzes, assignments, Two Sessional, End Term Examination
27.	Infinite series: Tests for convergence of series with positive terms (Comparison tests, D'Alembert's Ratio test and Cauchy's Root test)	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.2	Quizzes, assignments, Two Sessional, End Term Examination

28.	Tests for convergence of series with positive terms (Comparison tests, D'Alembert's Ratio test and Cauchy's Root test)	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.2	Quizzes, assignments, Two Sessional, End Term Examination
29.	Tests for convergence of series with positive terms (Comparison tests, D'Alembert's Ratio test and Cauchy's Root test)	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.2	Quizzes, assignments, Two Sessional, End Term Examination
30.	Alternating series and Power series (Introduction only)	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Problem solving	1201.2	Quizzes, assignments, Two Sessional, End Term Examination
31.	Tutorial Class	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.3	Quizzes, assignments, Two Sessional, End Term Examination
32.	Basic Concepts and Definitions: Introduction to Sphere with properties	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.3	Quizzes, assignments, Two Sessional, End Term Examination
33.	Problems based on Sphere with properties	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Problem solving	1201.3	Quizzes, assignments, Two Sessional, End Term Examination
34.	Plane section of a sphere with problems (Section of a sphere by a plane, The equation of any sphere through the circle of intersection of the sphere and the plane)	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.3	Quizzes, assignments, Two Sessional, End Term Examination
35.	Plane section of a sphere with problems (Section of a sphere by a plane, The equation of any sphere through the circle of intersection of the sphere and the plane)	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.3	Quizzes, assignments, Two Sessional, End Term Examination
36.	Right circular cone with problems	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.3	Quizzes, assignments, Two Sessional, End Term Examination
37.	Right circular cylinder with problems	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Problem solving	1201.3	Quizzes, assignments, Two Sessional, End Term Examination

38.	Tutorial Class	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Problem solving	1201.4	Quizzes, assignments, Two Sessional, End Term Examination
39.	Beta and Gamma Functions: Definition	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.4	Quizzes, assignments, Two Sessional, End Term Examination
40.	Elementary properties of Beta Gamma functions	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.4	Quizzes, assignments, Two Sessional, End Term Examination
41.	Relation between Beta and Gama functions and problems	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.4	Quizzes, assignments, Two Sessional, End Term Examination
42.	Double and Triple Integrals and problems	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Problem solving	1201.4	Quizzes, assignments, Two Sessional, End Term Examination
43.	Double and Triple Integrals and problems	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Problem solving	1201.4	Quizzes, assignments, Two Sessional, End Term Examination
44.	Tutorial Class	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Problem solving	1201.4	Quizzes, assignments, Two Sessional, End Term Examination
45.	Laplace Transform: Introduction	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.5	Quizzes, assignments, Two Sessional, End Term Examination
46.	Periodic functions, step functions, inverse transforms and problems	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.5	Quizzes, assignments, Two Sessional, End Term Examination
47.	Properties of the Laplace Transforms	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Problem solving	1201.5	Quizzes, assignments, Two Sessional, End Term Examination

48.	Convolution theorem and problems	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.5	Quizzes, assignments, Two Sessional, End Term Examination
49.	Solution of differential equations (Ordinary differential equations with constant coefficient)	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.5	Quizzes, assignments, Two Sessional, End Term Examination
50.	Solution of differential equations (Ordinary differential equations with constant coefficient)	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.5	Quizzes, assignments, Two Sessional, End Term Examination
51.	Tutorial Class	Identify, formulate, apply appropriate techniques, professional ethics, Communicate effectively & life-long learning	Lecture, Discussion & Examples	1201.5	Quizzes, assignments, Two Sessional, End Term Examination

I. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
MA1201.1	Find the curvature, Asymptotes using analytical methods and tracing of the curve. Though which one could develop programming skills to solve complex problems which intern become employable in engineering sector	3	3	3	2	2				1		1	1	3	1	2
MA1201.2	Understand the concept of partial derivatives and its applicability and test of convergence of a given series	3	2	2	2	2				1		1	1	1	3	2
MA1201.3	Define the concept of 3-D geometry for Sphere, right circular cone and Cylinder	3	3	2	1	2				1		1	1	1	3	2

MA1201.4	Able to solve the multiple integral problems under integral calculus in easier way by using Beta, Gamma functions and its properties	3	2	3	3	2				2		1	1	1	1	3
MA1201.5	] **S**olve the problems of Laplace transforms and further to apply these skills in solving Engineering applications	3	2	2	3	2				2		1	1	1	1	2