SCHEME OF COURSE WORK

Course Details:

Course Title	**Mathematics-I**		
Course Code	**15BM1101**	**L T P C**	**3 0 0 3**
Program:	**B.Tech.**		
Specialization:	**Chemical Engineering**		
Semester	**I Semester**		
Prerequisites	• Basic formulae of differentiation, product rule, and quotient rule. • Basic Integration formulae, integration by parts, definite integrals and properties • Basic concept of partial differentiation		
Courses to which it is a prerequisite	**: For all Engineering Courses**		

PROGRAM OUTCOMES:

1. Able to apply the knowledge of mathematics, science, engineering fundamentals to solve complex chemical engineering problems.
2. Attain the capability to identify, formulate and analyse problems related to chemical engineering and substantiate the conclusions
3. In a position to design solutions for chemical engineering problems and design system components and processes that meet the specified needs with appropriate consideration to public health and safety.
4. Able to perform analysis and interpretation of data by using research methods such as design of experiments to synthesize the information and to provide valid conclusions.
5. Able to select and apply appropriate techniques from the available resources and modern chemical engineering and software tools, and will be able to predict and model complex engineering activities with an understanding of the practical limitations.
6. Able to carry out their professional practice in chemical engineering by appropriately considering and weighing the issues related to society and culture and the consequent responsibilities.
7. Able to understand the impact of the professional engineering solutions on environmental safety.
8. Transform into responsible citizens by resorting to professional ethics and norms of the engineering practice.
9. Able to function effectively in individual capacity as well as a member in diverse teams and in multidisciplinary streams.
10. Able to communicate fluently on complex engineering activities with the engineering community and society, and will be able to prepare reports and make presentations effectively.
11. Able to apply knowledge of engineering and management principles while managing projects in multidisciplinary environments.
12. Engage in independent and life-long learning in their specialized areas of chemical engineering.

Course Outcomes (COs):

1	Develop the ability to solve linear differential equations of first and higher order and use the knowledge gain to certain engineering problems.
2	Appraise the Laplace transform technique and use it to solve various engineering problems.
3	Apply the techniques of multivariable differential calculus to determine extrema and series expansions etc. of functions of several variables.
4	Extend the concept of integration to two and three dimensions and support it through applications in engineering mechanics.
5	Generalize calculus to vector functions and interpret vector integral theorems.

Course Outcome versus **Program Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	3	3										
CO-2	3	2										
CO-3	3	3										
CO-4	3	3										
CO-5	3	3										

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), put -: No Correlation

Assessment Methods:	Assignment / Quiz / Seminar / Case Study / Mid-Test / End Exam

Teaching-Learning and Evaluation

Week	TOPIC / CONTENTS	Course Outcomes	Sample questions	TEACHING-LEARNING STRATEGY	Assessment Method & Schedule
1	Linear differential equations of second higher order with constant coefficients.	**CO-1**	1. solve $(D^2 + a^2)y = tanax$ 2. Solve $(D^3 - D)y = e^x + 1 + 2x$	Lecture / Problem solving	Assignment (Week 2 - 4) / Quiz-I (Week -8)/ MidTest 1 (Week 9)
2	Method of Variation of parameters Cauchy's Linear Differential Equations	**CO-1**	Solve $(D^2 + 1)y = \sec x$ by method of parameters	Lecture / Problem solving	Assignment (Week 2 - 4)/ Quiz -I (Week -8)/ MidTest 1 (Week 9)

3	Orthogonal trajectories, Newton's law of cooling, Models on R-L-C circuits.	**CO-1**	Show that the family of confocal and coaxial parabolas $y^2 = 4a(x + a)$ where a is an arbitrary constant are self orthogonal.	Lecture / Problem solving	Mid-Test 1 (Week 9)/ Assignment (Week 2 - 4)/ Quiz -I (Week -8)
4	Laplace transform of elementary functions, Properties of Laplace transform, Transforms of Periodic function, Transforms of derivatives and integrals, Multiplication by t^n, division by t	**CO-2**	$f(t) = \frac{e^{-t}\sin t}{t}$ Find the Laplace transform of	Lecture / Problem solving	Mid-Test 1 (Week 9)/ Quiz -I (Week -8)
5	Evaluation of integrals by Laplace transforms, Elementary Inverse transforms, Inverse transform of Derivatives and Integrals.	**CO-2**	Find the inverse Laplace transform of the following function $\frac{s+2}{s^2(s^2-s-2)}$	Lecture / Problem solving	Mid-Test 1 (Week 9) / Quiz -I (Week -8)
6	Convolution theorem, Unit step function, second shifting theorem	**CO-2**	Using convolution theorem, evaluate $L^{-1}\left\{\frac{s}{(s^2+a^2)^2}\right\}$	Lecture / Problem solving	Mid-Test 1 (Week 9)/ Quiz -I (Week -8)
7	Unit impulse function, Application of Laplace transforms to ordinary differential equations (initial and boundary value problems)	**CO-2**	Solve $(D^2 + 4D + 3)y = e^{-t}$ given that $y(0) = y'(0) = 1$ at $t = 0$ by using Laplace transform.	Lecture / Problem solving	Mid-Test 1 (Week 9) / Quiz -I (Week -8)
8	Total derivative, change of variables Jocobians	**CO-3**	If $x = u(1 - v)$, $y = uv$, then find $\frac{\partial(x,y)}{\partial(u,v)}$	Lecture / Problem solving	Mid-Test 1 (Week 9) / Quiz -I (Week -8)
9	**Mid-Test 1**	-----	----------	-------	----------
10	Taylor's theorem for functions of two variables	**CO-3**	Find the Taylor's series expansion of $e^x \sin y$ in powers of x and y	Lecture / Problem solving	Mid-Test 2 (Week 18) / Quiz -II (Week -17)/ Assignment (1214)
11	Maxima and minima of functions of two variables, Lagrange method of undetermined multipliers	**CO-3**	In the plane triangle ABC, find the maximum value of $\cos A \cos B \cos C$	Lecture / Problem solving	Assignment (Mid-Test 2 (Week 18) / Quiz -II (Week -17)/ Assignment (1214)

12	Non Cartesian Coordinates, Double integrals, Change of order of integration.	**CO-3**	Evaluate $\int_{-1}^{2}\int_{x^2}^{x+2} dy\,dx$.	Lecture / Problem solving	Mid-Test 2 (Week 18) / Quiz -II (Week -17)/ Assignment (1214)
13	Double integral in polar co-ordinates Triple integrals, Change of variables in double integral.	**CO-3**	Evaluate $\int_0^{\infty}\int_0^{\infty} e^{-(x^2+y^2)}\,dxdy$ by	Lecture / Problem solving	Mid-Test 2 (Week 18) / Quiz -II (Week -17)
			changing to polar coordinates.		
14	Change of variables in triple integral, Simple Applications of multiple integrals : Area enclosed by a plane curves.	**CO-3**	Evaluate $\int_{x=0}^{1}\int_{y=0}^{x}\int_{z=0}^{x+y} x\,dzdydx$.	Lecture / Problem solving	Mid-Test 2 (Week 18) / Quiz -II (Week -17)
15	Differentiation of vectors, Scalar and vector point functions Gradient of a scalar function, properties, Directional derivative, Divergence of a vector point function and it's physical interpretation, Curl of a vector point function, properties, Physical interpretation of Divergence and Curl of a vector point function, Del applied twice to point functions	**CO-4**	Find angle between the surfaces $x^2+y^2+z^2=9$ and $x^2+y^2-z=3$ at $(2,-1,2)$.	Lecture / Problem solving	Mid-Test 2 (Week 18) / Quiz -II (Week -17)
16	Line integral, circulation, work done, surface and volume integrals	**CO-5**	Evaluate $\iint_R e^{2x-3y}dxdy$ over the triangle bounded by $x=0$, $y=0$ $and\ x+y=1$	Lecture / Problem solving	Mid-Test 2 (Week 18) / Quiz -II (Week -17)
17	Green's theorem in the plane, Stoke's theorem, Gauss Divergence theorem and related problems	**CO-5**	Verify Divergence theorem for $\bar{F}=4x\boldsymbol{i}-2y^2\boldsymbol{j}+z^2\boldsymbol{k}$ taken over the region bounded by the cylinder $x^2+y^2=4$, $z=0\ and\ z=3$.	Lecture / Problem solving	Mid-Test 2 (Week 18) / Quiz -II (Week -17)
18	**Mid-Test 2**				
19/20	**END EXAM**				