Course Name: Introduction to Engineering Mathematics

Course Outcomes(CO):

At the end of this course, the students will be able:

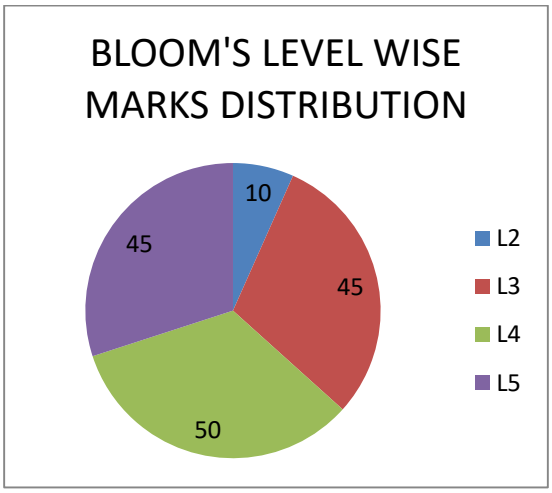
1. to visualize and conceptualize the engineering problems.
2. to model the engineering problem mathematically using theory of calculus and matrices.
3. to determine the solution of the studied engineering problem from application point of view.
4. to validate the solution.
5. to implement the solution for engineering problem.

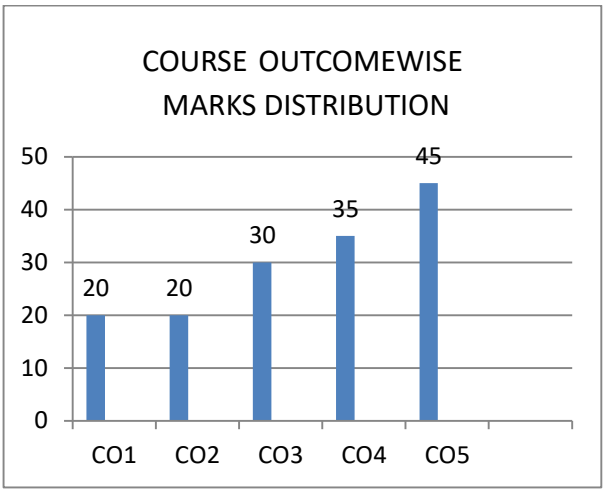
Modal Question Paper
Total Duration(H:M): 3:00
Course: Introduction to Engineering Mathematics
Maximum Marks:100

Note:- *Attempt all questions. All questions carry equal marks.*

Q.No	Questions	Marks	CO	BL	PL
	UNIT-I **Answer any four parts of the following:**				
1a)	Discuss the applicability of Rolle's theorem for the function $f(x) = \|x\|\ in\ [-1,1]$.	5	CO4	L4	
1b)	Using Lagrange's Mean Value Theorem, Show that $sinx < x$ for $x > 0$.	5	CO4	L3	
1c)	If in the Cauchy mean value Theorem $f(x) = sinx\ , g(x) = cosx$ then show that c is the arithmetic mean between a and b.	5	CO4	L3	
1d)	A rectangular box open at the top is to have a volume of 32cc.Find the dimension of the box requiring least material for its construction	5	CO1	L5	
1e)	Calculate the approximate value of $\sqrt{10}$ to four decimal places using Taylor's Theorem	5	CO4	L3	
1f)	Expand e^{ax} sinby in powers of x &y as far as terms of third degree.	5	CO5	L5	
	UNIT-II **Answer any four parts of the following:**				
2a)	Prove that : $\Gamma m\ \Gamma\left(m+\frac{1}{2}\right) = \frac{\sqrt{\pi}}{2^{2m-1}}\ \Gamma(2m)$, where m > 0.	5	CO3	L2	
2b)	Change the order of integration in $\int_0^1 \int_{x^2}^{2-x} xydxdy$ and hence evaluate it.	5	CO3	L3	
2c)	Trace the curve $y^2(2a-x) = x^3$ by giving all its features in detail.	5	CO4	L2	
2d)	Transform the double integral $\int_0^a \int_{\sqrt{ax-x^2}}^{\sqrt{a^2-x^2}} \frac{dydx}{a^2-x^2-y^2}$ into polar co-ordinates and then evaluate it.	5	CO4	L3	

2e)	The part of the parabola $y^2 = 4ax$ cut off by the latus – rectum revolves about the tangent at the vertex. Find the surface of the reel thus generated.	5	CO1	L5	
2f)	In estimating the number of bricks in a pile which is measured to be (5m ×10m × 5m),count of bricks is taken as 100 bricks per m^3. Find the error in the cost when the tape is stretched 2% beyond its standard length. The cost of bricks is Rs.2,000 per thousand bricks.	5	CO4	L4	
	UNIT-III **Answer any two parts of the following.**				
3a)	If $u = xy + yz + zx$, $v = x^2 + y^2 + z^2$ and $w = x + y + z$, determine whether there is a functional relationship between u, v, w and if so, find it.	10	CO3	L4	
3b)	Find the mass of the tetrahedron bounded by the co-ordinate planes and the plane $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$,the variable density being given by $\rho = xyz$.	10	CO1	L5	
3c)	If the density at any point of the solid octant of the sphere $x^2 + y^2 + z^2 = 9$ varies as $2xyz$, find the co-ordinate of C.G. of the solid.	10	CO5	L5	
	UNIT-IV **Answer any two parts of the following.**				
4a)	Evaluate the line integral $\int_c (y^2dx - x^2dy)$about the triangle whose vertices are (1,0), (0,1) and (-1,0).	10	CO3	L4	
4b)	If $\vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$ and $r = \lvert\vec{r}\rvert$,show that div (gradr^m) = m (m +1) r^{m-2}.	10	CO5	L3	
4c)	Verify Green's theorem for $\int (3x^2 - 8y^2)\,dx + (4y - 6xy)dy$, where C is the boundary of the region defined by x = 0, y = 0, x + y = 1.	10	CO5	L4	
	UNIT-V **Answer any two parts of the following.**				
5a)	Find non – singular matrices P and Q so that PAQ is a normal form where A = $\begin{bmatrix} 2 & 1 & -3 & -6 \\ 3 & -3 & 1 & 2 \\ 1 & 1 & 1 & 2 \end{bmatrix}$	10	CO2	L5	
5b)	Determine the values of λ and μ such that the system $x + y + z = 6$, $x + 2y + 5z = 10$, $2x + 3y + \lambda z = \mu$has:(i) no solution (ii) unique solution (iii) infinite solutions. Also find the solution for $\lambda = 2$ and $\mu = 8$.	10	CO2	L4	
5c)	A square matrix A is defined by A= $\begin{bmatrix} 1 & 2 & -2 \\ 1 & 2 & 1 \\ -1 & -1 & 0 \end{bmatrix}$. Find the modal matrix P and the resulting diagonal matrix D of A.	10	CO5	L3	





BL- Bloom's Taxonomy Levels(1 – Remembering, 2- Understanding, 3- Applying, 4- Analysing, 5- Evaluating, 6- Creating)

CO – Course Outcomes