

COURSE TEMPLATE

1.	Department/Centre proposing the course	Mathematics
2.	Course Title (<i>< 45 characters</i>)	LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS
3.	L-T-P structure	3-1-0
4.	Credits	4
5.	Course number	MAL120
6.	Status (<i>category for program</i>)	Core course

7.	Pre-requisites (<i>course no./title</i>)	Nil
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supercedes any existing course	No

9.	Not allowed for (<i>indicate program names</i>)	Nil
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10.	Frequency of offering	☒ Every sem ☐ 1 st sem ☐ 2 nd sem ☐ Either sem
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11.	Faculty who will teach the course Faculty of Mathematics Department	
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12.	Will the course require any visiting faculty?	No
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13.	Course objective (<i>about 50 words</i>): To introduce linear algebra and ordinary differential equations to undergraduate students of all disciplines.	
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Vector spaces over Q, R and C, subspaces, linear independence, linear span of a set of vectors, basis and dimension of a vector space, sum and direct sum. Systems of linear (homogeneous and non-homogeneous) equations, matrices and Gauss elimination, elementary row operations, row space, column space, null space and rank of a matrix. Linear transformation, rank-nullity theorem and its applications, matrix representation of a linear transformation, change of basis and similarity. Eigenvalues and eigenvectors, characteristic and minimal polynomials, Cayley-Hamilton theorem (without proof) and applications.	
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	Review of first order differential equations, Picard's theorem, linear dependence and Wronskian. Dimensionality of space of solutions, linear ODE with constant coefficients of second and higher order, Cauchy-Euler equations, Method of undetermined coefficients and method of variation of parameters. Boundary Value Problems: Sturm-Liouville eigenvalue problems. System of linear differential equations with constant coefficients, fundamental matrix, matrix methods. Power Series and its convergence, power series method, Fourier series, Laplace Transform Method.
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15. Lecture Outline *(with topics and number of lectures)*

Module no.	Topic	No. of hours
1	Vector spaces over $\mathbb{Q}$, $\mathbb{R}$ and $\mathbb{C}$, subspaces, linear independence, linear span of a set of vectors, basis and dimension of a vector space, sum and direct sum.	5
2	Systems of linear (homogeneous and non-homogeneous) equations, matrices and Gauss elimination, elementary row operations, row space, column space, null space and rank of a matrix.	5
3	Linear transformation, rank-nullity theorem and its applications, matrix representation of a linear transformation, change of basis and similarity.	6
4	Eigenvalues and eigenvectors, characteristic and minimal polynomials, Cayley-Hamilton theorem (without proof) and applications, Diagonalization of Matrices: Method and Characterization (without proof).	5
5	Review of first order differential equations, Picard's theorem, linear dependence and Wronskian. Dimensionality of space of solutions.	4
6	Initial Value Problems: linear ODE with constant coefficients of second and higher order, Cauchy-Euler equations, Method of undetermined coefficients and method of variation of parameters,	5
7	Boundary Value Problems: Sturm-Liouville eigenvalue problems and properties of eigenvalues and eigen functions.	3
8	System of linear differential equations with constant coefficients, fundamental matrix, matrix methods,	4
9	Power Series and its convergence, power series method, Fourier series and applications, Laplace transform method	5
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11		
12		
COURSE TOTAL (14 times 'L')		42

16. Brief description of tutorial activities

Problem sheets will be distributed in advance and students are expected to attempt the problems using the concepts learned in the lectures. During the tutorial hours teachers will help the students to clear doubts and to solve the difficult problems if any. Tutorial sheets will include problems covering theoretical, numeric and applications.

17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours
1	No Labs.	
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COURSE TOTAL (14 times 'P')	
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18. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1. E. Kreyszig, Advanced Engineering Mathematics, 8th Edition, John Wiley, 1999.
2. Alan Jeffrey, Advanced Engineering Mathematics, Academic Press, 2011
3. M. D. Greenberg, Advanced Engineering Mathematics, Pearson Education, 2004
4. S. Lang, An Introduction to Linear Algebra, 2nd Edition, Springer 2012.
5. G. Strang, Linear Algebra and Applications, 4th Edition, Thomson, 2006.

19. Resources required for the course (*itemized & student access requirements, if any*)

19.1	Software	Nil
19.2	Hardware	Nil
19.3	Teaching aides (videos, etc.)	Nil
19.4	Laboratory	Nil
19.5	Equipment	Nil
19.6	Classroom infrastructure	Mike, Tablet PC and Projector.
19.7	Site visits	Nil

20. Design content of the course (*Percent of student time with examples, if possible*)

20.1	Design-type problems	Nil
20.2	Open-ended problems	Nil
20.3	Project-type activity	Nil
20.4	Open-ended laboratory work	Nil
20.5	Others (please specify)	Nil

Date: 28th February, 2013


 (Signature of the Head of the Department)