DEPARTMENT OF PHYSICS

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Name of the program and specialization	M.Sc., Physics		
Course Title	Mathematical Physics - I		
Course Code	PH 651	**No. of Credits**	3
Course Code of Pre-requisite subject(s)	Physics and Mathematical concepts in the B.Sc. level		
Session	July 2018	**Section (if, applicable)**	-
Name of Faculty	Dr. Prabal Singh Verma	**Department**	Physics
Email	psverma@nitt.edu	**Telephone No.**	-
Name of Course Coordinator(s) (if, applicable)	Dr. Santhosh Kumar M.C.		
E-mail	santhoshmc@nitt.edu	**Telephone No.**	+91-431-2503611
Course Type	[√] **Core course** [ ] **Elective course**		

Syllabus (approved in BoS)

Unit – I: Vector Analysis Definition of vectors – scalar and vector product – triple products – gradient, divergence, curl – vector integration – Gauss's theorem – Green's theorem – Stoke's theorem – Dirac delta function – Helmholtz theorem.

Unit – II: Curved coordinates, Tensors Orthogonal coordinates – differential vector operators: gradient, divergence, curl – special coordinate systems: rectangular, spherical, cylindrical – tensors of rank two – contraction, direct product – quotient rule.

Unit – III: Linear Algebra Determinants – matrices – inner product, direct product – orthogonal matrices – Euler angles – symmetry properties – relation to tensors – Pauli matrices – eigenvalue equation and diagonalization – Cayley-Hamilton theorem – functions of matrices – hermitian matrices.

Unit – IV: Ordinary Differential Equations First order equation – second order homogeneous equation – Wronskian – second solution – inhomogeneous equation – forced oscillation and resonance – power series method – Hermite and Legendre equations – Frobenius method – Bessel equation.

Unit-V: Probability Definition – basic theorems – permutation and combination – method of counting – random variables – binomial and Poisson distributions – normal distribution – central limit theorem

COURSE OBJECTIVES	
To introduce basic mathematical topics necessary to understand and appreciate various physical laws of nature.	
COURSE OUTCOMES (CO)	
Course Outcomes	**Aligned Programme Outcomes (PO)**
On successful completion of this course,	
students will acquire enough mathematical skills to handle the courses on mechanics and Electromagnetic theory	Students will be capable of handling variety of courses on mechanics and electromagnetic theory.

COURSE PLAN – PART II
COURSE OVERVIEW
The Mathematical Physics - I course is offered in the first semester to M.Sc. (Physics) students. The subject has 3 credit weightage.

COURSE TEACHING AND LEARNING ACTIVITIES			
S.No.	**Week/Contact Hours**	**Topic**	**Mode of Delivery**
1.	First 2- 3 weeks	**Unit-I : Vector analysis** Definition of vectors, – scalar and vector product – triple products –gradient, divergence, curl –vector integration– Gauss's theorem, – Green's theorem Stoke's theorem – Dirac delta function Helmholtz theorem.	Lectures & Class room discussions
2.	Next 2- 3 weeks	**Unit II: Curved Co-ordinates, Tensors** Orthogonal coordinates – differential vector operators: gradient, divergence, curl –special coordinate systems: rectangular, spherical, cylindrical – tensors of rank two contraction, direct product – quotient rule	Lectures & Class room discussions

3.	Next 2- 3 weeks	**Unit-III: Linear Algebra** Determinants –matrices – inner product, direct product –orthogonal matrices –Euler angles –symmetry properties –relation to tensors –Pauli matrices – eigenvalue equation and diagonalization – Cayley - Hamilton theorem – functions of matrices hermitian matrices.	Lectures & Class room discussions
4.	Next 2- 3 weeks	**Unit-IV: Ordinary Differential Equations** First order equation – second order homogeneous equation –Wronskian – second solution – inhomogeneous equation forced oscillation and resonance – power series method – Hermite and Legendre equations – Frobenius method – Bessel equation.	Lectures & Class room discussions
5.	Next 2- 3 weeks	**Unit-V: Probability** Definition – basic theorems – permutation and combination – method of counting – random variables – binomial and Poisson distributions – normal distribution – central limit theorem	Lectures, power point and discussion

COURSE ASSESSMENT METHODS

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assignment-I	4th week	1 week	5%
2	Test-I	6th week	1 Hour	20%
3	Test-II	11th week	1 Hour	20%
4	Assignment-II	13th Week	1 week	5%
CPA	Compensation Assessment*	14th Week	1 Hour	Appropriate Weightage
5	Final Exam	December 1st week	3 Hours	50%

ESSENTIAL READINGS : Textbooks, reference books Website addresses, journals, etc

1. G. B. Arfken and H.J. Weber, Mathematical Methods for Physicists, 5th edition, Academic Press (2001).
2.E. Kreyszig, Advanced Engineering Mathematics,8thedition, John Wiley & SonsInc. (1999).
3.Mathematical Methods in the Physical Sciences, 3rd edition, Mary L. Boas, Wiley - India (2011).
4. L.A. Pipes and L.R. Harvill, Applied Mathematics for Engineers and Physicists, McGraw -Hill (1970).
5. P. Dennery and A. Krzywicki, Mathematics for physicists, Dover Publications Inc, New York (1996)

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

Feedback from the students will be collected and analyzed after 15th week on knowledge gained, subject's relevant to the course, methodology adopted, aspect of improvement, fulfilment of the course outcome and program outcome etc.

COURSE POLICY (preferred mode of correspondence with students, compensation assessment policy to be specified)

MODE OF CORRESPONDENCE (email/ phone etc) : Email

COMPENSATION ASSESSMENT POLICY

- It is a test with duration of 60 min. Appropriate weightage will be calculated.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- **At least 75% attendance in each course is mandatory.**
- **A maximum of 10% shall be allowed under On Duty (OD) category.**
- Students with **less than 65% of attendance** shall be prevented from writing the final assessment and **shall be awarded 'V' grade.**

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

The above policy against academic dishonesty shall be applicable for all the programs.

ADDITIONAL INFORMATION

- Cell Phones must be turned-off in the classroom. Usages of mobile phone during the lecture will be treated as punishable dishonesty.
- **The minimum passing marks shall be 40%**.

FOR APPROVAL

Course Faculty P.S.Verma 30/08/2018 **CC-Chairperson** 30/08/2018 **HOD** 30/8/201