NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF PHYSICS

COURSE PLAN – PART I			
Name of the programme 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)	**-**		
Session	**July 2019**	**Section (if, applicable)**	**NA**
Name of Faculty	**Dr. J. Hemalatha**	**Department**	**Physics**
Official Email	**hemalatha@nitt.edu**	**Telephone No.**	**2503608**
Name of Course Coordinator(s) (if, applicable)	**Dr. M.C. Santhoshkumar**		
Official E-mail		**Telephone No.**	
Course Type (please tick appropriately)	☒ **Core course**	☐ **Elective course**	

Syllabus (approved in BoS)

Please refer to Annexure

COURSE OBJECTIVES

To introduce basic mathematical topics necessary to understand and appreciate various physical laws of nature.

MAPPING OF COs with POs

Course Outcomes	**Programme Outcomes (PO)** (Enter Numbers only)
1.	
2.	
3.	
4.	
5.	

COURSE PLAN – PART II			
COURSE OVERVIEW			
Mathematical Physics- I course (3 credits) is offered as one of the core courses in the first semester to I year M.Sc (Physics) Students.			
COURSE TEACHING AND LEARNING ACTIVITIES			
S.No.	**Week/Contact Hours**	**Topic**	**Mode of Delivery**
1	First 2- 3 weeks	**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	**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	**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	**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	**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 (shall range from 4 to 6**)**

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assignment-I	4th week	1 week	5%
2	Cycle Test-I	6th week Vector analysis, Curved Co-ordinates & Tensors	1 Hour	20%
3	Cycle Test-II	11th week Linear Algebra and Ordinary Differential Equations	1 Hour	20%
4	Assignment-II	12th Week	1 week	5%
CPA	Compensation Assessment	13th Week Vector analysis, Curved Co-ordinates & Tensors, Linear Algebra and Ordinary Differential Equations.	1 Hour	20%
5	Final Assessment*	As per NIT-T Schedule (Entire syllabus)	3 Hours	50%

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

- the course, delivery method, topics and the knowledge gained shall be assessed through the questionnaire

COURSE POLICY (including compensation assessment to be specified**)**

MODE OF CORRESPONDENCE

The faculty member can be contacted in person for any discussion and clarifications at cabin # PH216 in the first floor of OJAS building on a mutually convenient time.

COMPENSATION ASSESSMENT POLICY

Those who are absent for Cycle Test I or Cycle Test II, **on genuine grounds,** shall be given an opportunity only once for the retest with the prior permission of the faculty member and Head of Physics Department.

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 programmes.

ADDITIONAL INFORMATION, IF ANY

- A student has to score a minimum of 40 % marks to get a pass.
- Those who fail in the course can appear for the re-assessment exam. The internal

marks shall be considered for the entire programme duration.

- Any misbehavior, indiscipline in the classroom/laboratory/exam hall will be dealt with seriously. In the worst case of misbehavior/malpractice, the departmental disciplinary committee is empowered to impose penalties appropriate and proportionate to the offence.

FOR APPROVAL

-Sd-	**-Sd-**	**-Sd-**
Course Faculty _____	**CC- Chairperson** _____	**HOD** _____

Guidelines

a) The number of assessments for any theory course shall range from 4 to 6.

b) Every theory course shall have a final assessment on the entire syllabus with at least 30% weightage.

c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.

d) The passing minimum shall be as per the regulations.

B.Tech. Admitted in				P.G.
2018	2017	2016	2015	
35% or (Class average/2) whichever is greater.		(Peak/3) or (Class Average/2) whichever is lower		40%

e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.

f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.

g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.

Annexure

PH651 –MATHEMATICAL PHYSICS –I

Objective: To introduce basic mathematical topics necessary to understand and appreciate various physical laws of nature.

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.

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.

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.

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.

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

Text Books

1.G. B. Arfken and H.J. Weber, Mathematical Methods for Physicists, 5thedition, Academic Press (2001).
2.E. Kreyszig, Advanced Engineering Mathematics, 8thedition, John Wiley & Sons Inc. (1999).
3.Mary L. Boas, Mathematical Methods in the Physical Sciences, 3rdedition,Wiley-India (2011).
4. B. S. Grewal, Advanced engineering mathematics, 43rd edition, Khanna Publications.

Reference Books

1.L.A. Pipes and L.R.Harvill, Applied Mathematics for Engineers and Physicists, Dover (2014).
2.S. Lipschutz, D. Spellman and M. Spiegel, Schaum's Outline of Vector Analysis -, 2nd edition, Tata McGraw-Hill (2009).

3.V. Balakrishnan, Mathematical Physics with Applications, Problems and Solutions, Ane Books (2017).

Outcome: Students will be capable of handling variety of courses on mechanics and electromagnetic theory.