



DEPARTMENT OF PHYSICS

COURSE PLAN – PART I			
Name of the programme and specialization	M.Sc. Physics		
Course Title	MAGNETISM AND SUPERCONDUCTING LEVITATION		
Course Code	PH683	No. of Credits	3
Course Code of Pre-requisite subject(s)	Nil		
Session	July 2019	Section (if, applicable)	Nil
Name of Faculty	Dr. R. Justin Joseyphus	Department	Physics
Official Email	<a href="mailto:rjustinj@nitt.edu">rjustinj@nitt.edu</a>	Telephone No.	3614
Name of Course Coordinator(s) (if, applicable)	Dr. R. Nagalakshmi		
Official E-mail	<a href="mailto:nagalakshmi@nitt.edu">nagalakshmi@nitt.edu</a>	Telephone No.	3615
Course Type (please tick appropriately)	<input type="checkbox"/> Core course	<input type="checkbox"/> Elective course	
<b>Syllabus (approved in BoS)</b>			
<p>Magnetic moment – Magnetic Field - Field produced by solenoids –Lorentz Force Laws-BioSavart Law– Field and moment measurement – Demagnetizing field – Zeeman effect- Origin of magnetism- – g factor – Quantized angular momentum- Theory of diamagnetism.</p> <p>Langevin’s theory of paramagnetism- quantum theory of paramagnetism- Brillouin Function – Molecular Field Theory of Ferromagnetism – Exchange Interaction – band theory – Antiferromagnetism – sublattice magnetization - Internal Fields- Crystal field effects</p> <p>Magnetic anisotropy – magnetocrystalline and shape anisotropy – Random anisotropy model –Magnetostriction – Domain Theory –Coercivity mechanism- Fine particle magnetism –Magnetocaloric effect</p> <p>Superconductivity basics – Physical properties below T<sub>c</sub>- Duration of persistent currents –Magnetic field effects on superconductors- High T<sub>c</sub> Superconductors – Cuprate superconductors – Wires and Tapes – MgB<sub>2</sub> -Iron and Carbon based</p>			



superconductors - Superconducting magnets

Magnetic levitation systems – Stability and Levitation –Superconducting bearings  
– Levitation forces – Static and Dynamic –Superconducting Maglev Vehicles –  
Equation of motion – Aerodynamic effects – Guideway

**COURSE OBJECTIVES**

The objectives of the course is to

- Understand the magnetic behavior of superconducting materials.
- Learn the fundamentals of magnetism, superconductivity and materials used for superconducting levitation applications.

**MAPPING OF COs with POs**

Course Outcomes	Programme Outcomes (PO) (Enter Numbers only)
1. Identify the magnetic and superconducting materials used in superconducting levitation	1-5
2. Understand the concept of magnetism and superconductivity	1-5
3. Classify the types of magnetic and superconducting materials	1-5
4. Apply basic concepts of magnetism and superconductivity in technology	1-5
5. Evaluate suitable materials and methods for superconducting levitation	1-5

**COURSE PLAN – PART II**

**COURSE OVERVIEW**

The course ‘magnetism and superconducting levitation ‘ is offered to the M.Sc Physics students as an elective subject. The course offers topics on magnetism, magnetic materials, superconducting materials and their applications in superconducting levitation.

**COURSE TEACHING AND LEARNING ACTIVITIES**

( Add more rows)

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1.	First 3 weeks	Magnetic moment – Magnetic Field - Field produced by solenoids –Lorentz Force Laws-BioSavart Law– Field and moment measurement –	Lectures (C&T).



2.	3 <sup>rd</sup> - 6 <sup>th</sup> week	<p>Demagnetizing field –Zeeman effect- Origin of magnetism- – g factor – Quantized angular momentum-Theory of diamagnetism.</p> <p>Langevin’s theory of paramagnetism- quantum theory of paramagnetism- Brillouin Function – Molecular Field Theory of Ferromagnetism – Exchange Interaction – band theory – Antiferromagnetism – sublattice magnetization - Internal Fields- Crystal field effects</p>	Lectures (C&T).
3.	6 <sup>th</sup> – 9 <sup>th</sup> week	<p>Magnetic anisotropy – magnetocrystalline and shape anisotropy – Random anisotropy model – Magnetostriction – Domain Theory –Coercivity mechanism- Fine particle magnetism – Magnetocaloric effect</p>	Lectures (C&T).
4.	9 <sup>th</sup> – 12 <sup>th</sup> week	<p>Superconductivity basics – Physical properties below T<sub>c</sub>- Duration of persistent currents –Magnetic field effects on superconductors- High T<sub>c</sub> Superconductors – Cuprate superconductors – Wires and Tapes – MgB<sub>2</sub> -Iron and Carbon</p>	Lectures (C&T).



5.	12 <sup>th</sup> – 15 <sup>th</sup> week	<p>based superconductors - Superconducting magnets</p> <p>Magnetic levitation systems – Stability and Levitation – Superconducting bearings – Levitation forces – Static and Dynamic –Superconducting Maglev Vehicles – Equation of motion – Aerodynamic effects – Guideway.</p>	<b>Lectures (C&amp;T).</b>
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**COURSE ASSESSMENT METHODS** (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Quiz-I	4 <sup>th</sup> week	30 min	10
2	Mid semester	13 <sup>th</sup> week	90 min	30
3	Quiz-II	16 <sup>th</sup> week	30 min	10
CPA	Compensation Assessment*	16 <sup>th</sup> week	90 min	30#
4	Final Assessment *	As per institute schedule	180 min	50

\*mandatory; refer to guidelines on page 4. # shall be converted.

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

- Performance in the assessment methods.
- Questionnaire about the effectiveness of the delivery method, topics and the knowledge gained.
- Oral feedback.

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

- Those who are absent during any of the assessment method on genuine grounds can undertake the assessment method once.
- Quiz shall be conducted online/offline.

**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**

**FOR APPROVAL**

Approved  
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.