

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

Course Title	MAGNETISM AND SUPERCONDUCTING LEVITATION		
Course Code	PH683	No. of Credits	3
Department	Physics	Faculty	Dr. R. Justin Joseyphus
Pre-requisites Course Code			
Course Coordinator(s) (if, applicable)	Dr. N. Baskaran		
Other Course Teacher(s)/Tutor(s) E-mail	rjustinj@nitt.edu	Telephone No.	2503614
Course Type	<input type="checkbox"/> Core course	<input checked="" type="checkbox"/> Elective course	
COURSE OVERVIEW			
<p>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.</p>			
COURSE OBJECTIVES			
<p>The objectives of the course is to</p> <ul style="list-style-type: none"> ➤ Understand the magnetic behavior of superconducting materials. ➤ Learn the fundamentals of magnetism, superconductivity and materials used for superconducting levitation applications. 			
COURSE OUTCOMES (CO)			
Course Outcomes		Aligned Programme Outcomes (PO)	
<ol style="list-style-type: none"> 1. Identify the magnetic and superconducting materials used in superconducting levitation 2. Understand the concept of magnetism and superconductivity 3. Classify the types of magnetic and superconducting materials 4. Apply basic concepts of magnetism and superconductivity in technology 		<ul style="list-style-type: none"> ➤ Obtain indepth knowledge on important Physics concepts ➤ Carry out independent research work in interdisciplinary areas 	

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5. Evaluate suitable materials and methods for superconducting levitation		<ul style="list-style-type: none"> ➤ Interact with professionals in related areas ➤ Communicate ideas and learn new technologies 	
COURSE TEACHING AND LEARNING ACTIVITIES			
S.No.	Week	Topic	Mode of Delivery
	Total of 15 weeks		
1.	First 3 weeks	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.	Lectures (C&T).
2.	3 rd - 6 th week	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	Lectures (C&T).
3.	6 th – 9 th week	Magnetic anisotropy – magnetocrystalline and	Lectures (C&T).

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		<p>shape anisotropy – Random anisotropy model – Magnetostriction – Domain Theory –Coercivity mechanism- Fine particle magnetism –Magnetocaloric effect</p>	
4.	9 th – 12 th week	<p>Superconductivity basics – Physical properties below T_c- Duration of persistent currents –Magnetic field effects on superconductors- High T_c Superconductors – Cuprate superconductors – Wires and Tapes – MgB₂ -Iron and Carbon based superconductors – Superconducting magnets</p>	Lectures (C&T).
5.	12 th – 15 th week	<p>Magnetic levitation systems – Stability and Levitation – Superconducting bearings – Levitation forces – Static and Dynamic –Superconducting Maglev Vehicles – Equation of motion – Aerodynamic effects – Guideway</p>	Lectures (C&T).

COURSE ASSESSMENT METHODS				
S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1.	Quiz-I	4 th Week	30 min	10 %
2.	Mid semester exam	9 th week	120 min	30 %
3.	Quiz – II/ Seminar/ Assignment	13 th week	30 min	10 %
4.	Semester exam	As per institute time table	180 min	50 %

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

Text Books
 1. B. D. Cullity and C.D. Graham, Introduction to Magnetic Materials, Wiley, NJ, (2009).
 2. C. Kittel, Introduction to Solid State Physics, 7th edition, Wiley (2006).
 3. F. C. Moon, Superconducting Levitation, Wiley (2004).

Reference Books
 1. S. Chikazumi, Physics of Ferromagnetism, Oxford University Press (1997).

COURSE EXIT SURVEY (mention the ways in which the feedback about the course is assessed and indicate the attainment also)
<ul style="list-style-type: none"> > Performance in the assessment methods. > Questionnaire about the effectiveness of the delivery method, topics and the knowledge gained. > Oral feedback.
COURSE POLICY (including plagiarism, academic honesty, attendance, etc.)
<ul style="list-style-type: none"> > 75% attendance is mandatory.

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- Those who indulge in malpractice such as copying, plagiarism in a particular assessment shall be awarded zero marks.
- Those who are absent during any of the assessment method on genuine grounds can undertake the assessment method once.
- Assignment/Seminar shall be conducted for students as per their choice. Weightage shall be 5% for such assessment and rest shall be Quiz (5%).

ADDITIONAL COURSE INFORMATION

The teacher can be contacted through phone or in person for clarifications by the student on a mutually convenient time.

FOR SENATE'S CONSIDERATION

Course Faculty R. Jothi Joseph CC-Chairperson N. Bashera
17/7/18
HOD M. Gopalakrishna

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