DEPARTMENT OF PHYSICS

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Course Title	PHYSICS		
Course Code	PHIR 12	No. of Credits	4 (3 credit theory+1 credit lab)
Course Code of Pre-requisite subject(s)	NIL	BRANCH	CIVIL ENGINEERING
Session	Jan. 2018	Section (if, applicable)	B
Name of Faculty	Dr. R. ELILARASSI	Department	PHYSICS
Email	elil@nitt.edu	Telephone No.	9942913018
Name of Course Coordinator(s) (if, applicable)	Dr. S. Manivannan Dr. N. V. Giridharan		
E-mail	ksmani@nitt.edu giri@nitt.edu	Telephone No.	9629505060 9443689391
Course Type	✓ Core course	☐ ~~Elective course~~	

Syllabus (approved in BoS)

Course content:

Quantum Mechanics

Inadequacy of classical mechanics (black body radiation, photoelectric effect) – wave and particle duality of radiation – de Broglie concept of matter waves – electron diffraction – Heisenberg's uncertainty principle – Schrodinger's wave equation – eigenvalues and eigen functions – superposition principle – interpretation of wave function – particle confined in one dimensional infinite square well potential.

Nuclear and Particle Physics

Fundamental forces - Nuclear properties and forces - Nuclear models - Shell model - Nuclear reaction - Radioactivity - types and half lives - application in determining the age of rock and fossils- Neutrons and its applications (neutron diffraction, nuclear reaction etc)-Stellar nucleosynthesis. Particle physics - classification of matter - quark model-neutrino properties and their detection.

Advanced Materials

Nanomaterials - Introduction and properties – synthesis – chemical vapour deposition – ball milling – applications. Carbon nanotubes: structure and properties – synthesis– arc method – pulsed laser deposition- applications. ***Liquid Crystal*** types – nematic, cholesteric, smectic – modes: dynamic scattering, twisted nematic – display systems. ***Shape memory alloys***-one way and two way memory effect- pseudoelasticity-applications

Non-Destructive Testing

Principle of ultrasonic testing – inspection methods – different types of scans – liquid penetrant testing – magnetic particle inspection – principle and types of radiography – exposure factor – attenuation of radiation – real time radiography – principle of thermography – thermographic camera – advantages and limitations of all methods.

Vacuum Technology

Introduction-Exhaust pump and their characteristics-different types of pumps-rotary vane pump-roots pump-diffusion pump-turbo-molecular pump-measurement of low pressure-pirani gauge-penning guage - applications of vacuum technology - thin film deposition: thermal evaporation-sputtering.

Text Books

1. 'A text book of Engineering Physics', M.N. Avadhanulu and P.G. Kshirsagar, S. Chand and Company, New Delhi 2009.

2. 'Engineering Physics', R.K. Gaur and S.L. Gupta, Dhanpat Rai Publications (P) Ltd., 8th ed., New Delhi 2001.

Reference Books

1. 'Concepts of Modern Physics. Arthur Beiser', Tata McGraw-Hill, New Delhi 2010.

2. 'Hand Book of Non-destructive evaluation', C.J. Hellier, McGraw-Hill, New York 2001.

3. 'Vacuum Science and Technology', V.V. Rao, T.B. Ghosh, K.L. Chopra, Allied Publishers, New Delhi 2008.

4. 'Introduction to Nanotechnology', C.P. Poole and F.J. Owens, Wiley, New Delhi 2007.

5. 'Introduction to Liquid Crystals Chemistry and Physics', 2nd Ed, *Peter J. Collings, Princeton University Press, New Jersey, 2002.*

6. D. C. Lagoudas 'Shape memory alloys - modeling and engineering applications', Ed., Springer, New York 2008.

COURSE OBJECTIVES

The main objectives of the subject are

- **To make a bridge between the Physics in school and engineering courses.**
- **To introduce the basic concepts of Modern Physics like fundamentals of Quantum Mechanics, Nuclear Physics and Advanced Materials.**
- **To introduce the concepts of Non-Destructive Techniques NDT and Vaccum Technology**

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)
1. Understand the basic concepts of quantum mechanics	Obtain in-depth knowledge on important Physics concepts.
2. Exposure to most modern and advanced concepts in nuclear physics	Carry out independent research work in interdisciplinary areas.
3. Gain knowledge on advanced materials, their preparation and their diverse applications	Interact with professionals in related areas.
4. Acquire basic knowledge on NDT techniques	Communicate ideas and learn new technologies
5. Understand the basic concepts of vacuum technology and its applications in modern devices	

COURSE PLAN – PART II

COURSE OVERVIEW

The Physics course (PHYSICS II) has been offered to B. Tech first year students of Civil engineering students for semester II. The Present course PHYSICS II has a weightage of 3 credits for theory and 1 credit for practical lab weightage.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Weeks	Topic	Mode of Delivery
1	Jan (2nd- 4th week)	**QUANTUM MECHANICS** Brief introduction to failure of classical mechanics, Introduction to Black body radiation, Planck"s Quantum theory (derivation), Deduction of Wien's displacement law and Rayleigh – Jeans" Law from Planck"s theory, Photoelectric effect, Eintein's photoelectric equation, experimental verification.de Broglie's hypothesis of matter waves and their properties, verification of de Broglie hypothesis by electron diffraction experiment conducted by Davisson and Germer. Heisenberg's Uncertainty principle,Physical significance and applications of uncertainty principle. Characteristics of wave function,Schrodinger's wave equations (time dependent and time independent), eigenvalues and eigen functions, superposition principle, interpretation of wave function – Application of Schrodinger's wave equation to a particle (electron) enclosed in a one dimensional infinite square well potential.	Lectures, PPT, Class room discussions
2	Feb (1st- 3rd week)	**NUCLEAR AND PARTICLE PHYSICS** Introduction to fundamental forces, Basic properties of Nucleus, concept of Nuclear forces, Nuclear models-Shell model, Nuclear reactions. Introduction to Radioactivity, their types and half lives, application of radioactivity in determining the age of rock and fossils- Properties of neutrons and its applications (neutron diffraction, nuclear reaction etc)-Stellar nucleosynthesis. Introduction to Particle physics, classification of matter -quark model, properties of neutrino and their detection	Lectures, PPT, Class room discussions
3	Feb 4th week- March 1st week	**ADVANCED MATERIALS** Introduction to nanomaterials and their properties, synthesis of nanomaterials using chemical vapour deposition and ball milling, applications of nanomaterials. Introduction to structure and properties of carbon nanotubes, synthesis of carbon nanotubes using arc method and pulsed laser deposition, applications of carbon nanotubes. Introduction to Liquid Crystal, structure of mesophase - nematic, cholesteric, smectic phases, role of dynamic scattering	Lectures, PPT, Class room discussions

		and twisted nematic modes in display systems. Introduction to Shape memory alloys, one way and two way memory effect, pseudoelasticity and their applications	
4	March (2nd -4th week)	**NON-DESTRUCTIVE TESTING** Principle of ultrasonic testing, different types of inspection methods used in NDT, different types of scans, methods of NDT-liquid penetrant testing, magnetic particle inspection, principle and types of radiography – exposure factor – attenuation of radiation – real time radiography, principle of thermography – thermographic camera –advantages and limitations of all methods.	Lectures, PPT, Class room discussions
5	April (1st-2nd week)	**VACUUM TECHNOLOGY** Introduction to Exhaust pump and their characteristics, different types of pumps-rotary vane pump, roots pump, diffusion pump, turbo-molecular pump, measurement of low pressure-pirani gauge, penning guage, applications of vacuum technology, thin film deposition techniques such as thermal evaporation and sputtering.	Lectures, PPT, Class room discussions

COURSE ASSESSMENT METHODS

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment– I	Quantum Mechanics (1st week of February)	30 min	**10**
2	Assessment- II	Quantum mechanics, Nuclear and Particle Physics and Advanced materials (2nd week of March)	90 min	**30**
3	Assessment- III	Non-Destructive Testing (1st week of April)	30 min	**10**
4	Assessment- IV (End Semester)	As per regular timetable	180 min	**50**
			Total	**100%**
5	**Practical's**	**TOTAL EXPERIMENTS : 5** 1. Specific rotation of a liquid- Half shade polarimeter 2. Wavelength of white light spectrometer 3. Wavelength of a LASER using diffraction grating 4. Calibration of voltmeter-potentiometer 5. Field along the axis of the circular coil	**3 h x 5**	**20** **20** **20** **20** **20**
			Total	**100 %**

Note:
No separate semester exam for laboratory
Each lab session carries equal weightage
Total Marks will be for 100 % : Theory weigtage : 3/4 (75 %) and Practicals weightage : 1/4 (25 %)

COURSE EXIT SURVEY

- Performance in the assessment methods
- Questionnaire about the knowledge gained, subjects relevant to the course, methodology adopted aspect of improvement. Whether the topics fulfil the course outcome and program outcome

COURSE POLICY

ATTENDANCE

- It is mandatory to have a minimum of 75% attendance to appear in the final examination. Student(s) having *less than 75% attendance* will *NOT* be *allowed* in semester examination. Further, the student(s) *should REDO* the course and can get a grade based on the performance in all the assessments.

COMPENSATION ASSESSMENT

- Those who are absent for the assessment tests on genuine grounds shall be given an opportunity only once for the retest with the prior permission of concerned faculty member and Head of Physics Department. The compensation assessment shall be conducted during 3rd week of April and the portion the portion will be from first IV units (Quantum Mechanics, Nuclear and Particle Physics, Advanced Materials and Non-destructive Techniques)

FINAL EVALUATION

- The marks for laboratory sessions shall be awarded based on independent experiments, observations, accuracy, etc.
- Each student should score a minimum of, (i) either Class Average/2 (ii) 35%, but whichever is higher to pass in the course.
- Those who fail in the course can appear for the supplementary exam. The marks including laboratory and internal marks shall be considered till his/her programme duration.
- The total marks will be for 100% including the theory and lab put together, of which 3/4 part will be for the theory and 1/4 part will be for the laboratory.

ACADEMIC HONESTY & PLAGIARISM

- Any misbehavior, indiscipline in the classroom/laboratory/exam hall will be dealt with seriously. In the worst case, the necessary action will be decided by the institute disciplinary committee.

ADDITIONAL INFORMATION

- The lecture materials will be available with the concerned course faculty members.
- The individual faculty members can be contacted through phone or in person for further discussions and clarifications on a mutually convenient time.

FOR APPROVAL

Course Faculty R. Shilaja 12/1/18 **CC-Chairperson** S. T. Rama **HOD** N. Gopala 12-01-18