NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF PHYSICS

COURSE PLAN – PART I			
Name of the programme and specialization	B.Tech. II Semester- Instrumentation and Control Engineering		
Course Title	Physics -II		
Course Code	PHIR 13	No. of Credits	4
Course Code of Pre-requisite subject(s)	PH IR 11		
Session	January 2019	Section (if, applicable)	A / B
Name of Faculty	Dr. Santhosh Kumar M C	Department	Physics
Official Email	santhoshmc@nitt.edu	Telephone No.	04312503611
Name of Course Coordinator(s) (if, applicable)	Dr. S. Manivannan, Dr. N.V. Giridharan		
Official E-mail	giri@nitt.edu	Telephone No.	04312503613
Course Type (please tick appropriately)	√ Core course	☐ Elective course	

Syllabus (approved by Senete)

Quantum Mechanics

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

Nuclear and Particle Physics

Nuclear properties and forces - Nuclear models - Shell model - Nuclear reaction - Radioactivity - types and half-life - Stellar nucleosynthesis. Fundamental forces - 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 Crystals: types – nematic, cholesteric, smectic – modes: dynamic light scattering, twisted nematic – display systems.

Shape memory alloys-one way and two-way memory effect- pseudoelasticity-applications-thermoelectric materials.

Semiconductor Physics

Introduction-Direct and indirect band gap semiconductors - Intrinsic semiconductor at 0 K- Intrinsic semiconductor at room temperature-Intrinsic carriers- Electron and Hole

concentrations-doping-n-type – p-type-temperature variation of carrier concentration in extrinsic semiconductor-Extrinsic conductivity-Law of Mass action-Charge neutrality-Fermi level in extrinsic semiconductors-Electrical conduction in extrinsic semiconductors. **Electrodynamics** **Electrostatics: Coulomb's law - Gauss's law – proof of Gauss's law- Electrostatic field in matter: dielectric polarization, polarizability and susceptibility - types of polarization – internal field and Claussius-Mosotti equation. Magetostatics: Lorentz force -Steady current and equation of continuity - Biot-Savart law – Ampere's law –Magnetostatic field in matter: torques and forces on magnetic dipoles-Magnetization-Faraday's law of induction – Maxwell's equations: generalization of Ampere's law – propagation of EM waves in free space.**
COURSE OBJECTIVES
To introduce the concepts of matter waves, wave functions and its interpretation to understand the matter at atomic scale. To understand the fundamentals of nuclear forces, models and classification of matter. To know the basics of advanced materials and their applications. To familiarize the laws of electricity and magnetism, Maxwell's equation and electromagnetic wave propagation. To impart the fundamentals and classification of semiconductors

MAPPING OF COs with POs

Course Outcomes	**Programme Outcomes (PO)** (Enter Numbers only)
1. Students will be able to experience the behaviour of matter at atomic scale	
2. Students will be able understand the role of nuclear and particle physics in applications like radioactivity and nuclear reactions	
3. Students will get an exposure to nanomaterial synthesis, liquid crystal display and shape memory alloys.	
4. Students will apprise electrical conduction in semiconductors	
5. Appreciate the significance of Maxwell's equations.	

COURSE PLAN – PART II

COURSE OVERVIEW

The Physics- II course is offered in the second semester to all the branches of engineering. The subject has 3 credit theory and 1 credit lab weightage.

COURSE TEACHING AND LEARNING ACTIVITIES (Add more rows)

S.No.	**Week/Contact Hours**	**Topic**	**Mode of Delivery**

1	2nd week of January	Inadequacy of classical mechanics (black body radiation, photoelectric effect) – wave and particle duality of radiation – de Broglie concept of matter waves	Conventional-Chalk& Talk
2	3rd week of January	Electron diffraction – Heisenberg's uncertainty principle – Schrodinger's wave equation – eigenvalues and eigen functions – superposition principle – interpretation of wave function	Conventional-Chalk& Talk
3	4th week of January	Particle confined in one dimensional infinite square well potential. Fundamental forces - Nuclear properties and forces	Conventional-Chalk& Talk
4	1st week of February	Nuclear models - Shell model. - Nuclear reaction - Radioactivity - types and half lives - application in determining the age of rock and fossils	PPT
5	2nd week of February	Stellar nucleosynthesis. Particle physics - classification of matter	PPT
6	3rd week of February	Quark model- neutrino properties and their detection	PPT
7	4th week of February	Nanomaterials - Introduction and properties – synthesis – chemical vapour deposition – ball milling – applications. Carbon nanotubes: structure and properties – synthesis– arc method – pulsed laser deposition- applications.	PPT
8	1st week of March	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	PPT
9	2nd week of March	Semiconductor Physics Introduction-Direct and indirect band gap semiconductors - Intrinsic semiconductor at 0 K-Intrinsic semiconductor at room temperature-Intrinsic carriers- Electron and Hole concentrations-doping-n-type – p-type	Conventional-Chalk & Talk

10	3rd week of March	Temperature variation of carrier concentration in extrinsic semiconductor-Extrinsic conductivity-Law of Mass action-Charge neutrality	Conventional-Chalk & Talk
11	4th week of March	Fermi level in extrinsic semiconductors-Electrical conduction in extrinsic semiconductors	Conventional-Chalk & Talk
12	1st week of April	Electrostatics: Coulomb's law - Gauss's law – proof of Gauss's law-Electrostatic field in matter: dielectric polarization, polarizability and susceptibility - types of polarization – internal field and Claussius-Mosotti equation	Conventional-Chalk & Talk
13	2nd week of April	Magetostatics: Lorentz force -Steady current and equation of continuity - Biot-Savart law – Ampere's law – Magnetostatic field in matter: torques and forces on magnetic dipoles-Magnetization	Conventional-Chalk & Talk
14	3rd week of April	Faraday's law of induction – Maxwell's equations: generalization of Ampere's law – propagation of EM waves in free space.	Conventional-Chalk & Talk
15	4th week of April	Final Assessment	

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Cycle Test -I	2nd week of February	1 Hour	15
2	Quiz	2nd week of March	30 minutes	5
3	Cycle Test - II	2nd week of April	1 Hour	15
4	Lab experiments			25
CPA	Compensation Assessment*	4th week of April	1 hour	Appropriate weightage will be taken
5	Final Assessment *	4th week of April	3 hour	40

***mandatory; refer to guidelines on page 4**

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

Questionnaire about the effectiveness of the delivery method, topics and the knowledge gained.

COURSE POLICY (including compensation assessment to be specified)

MODE OF CORRESPONDENCE (email/ phone etc)
e-mail: santhoshmc@nitt.edu, Phone: 9443843014

COMPENSATION ASSESSMENT

One descriptive compensation test for a duration of one hour is given with portions of cycle test-I and cycle test -II.

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

Course Faculty _____ **CC- Chairperson** _____ 4/2/19 **HOD** _____ 4/2/19

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.