# NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

## DEPARTMENT OF PHYSICS

| COURSE PLAN – PART I | | | |
|---|---|---|---|
| Name of the programme and specialization | II Semester – B.Tech. Chemical Engineering | | |
| Course Title | Physics - II | | |
| Course Code | PHIR12 | No. of Credits | 4 |
| Course Code of Pre-requisite subject(s) | NIL | | |
| Session | January. 2019 | Section (if, applicable) | NIL |
| Name of Faculty | Dr. M. Dhavamurthy | Department | Physics |
| Official Email | dhavam@nitt.edu | Telephone No. | NIL |
| Name of Course Coordinator(s) (if, applicable) | Dr. N.V. Giridharan<br>Dr. S. Manivannan | | |
| Official E-mail | giri@nitt.edu<br>ksmani@nitt.edu | Telephone No. | 0431-250-3613<br>0431-250-3616 |
| Course Type (please tick appropriately) | [√] Core course | [ ] Elective course | |

**Syllabus (approved in BoS)**

**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.



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Introduction-Direct and indirect band gap semiconductors - Intrinsic semiconductor at 0K-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 make a bridge between the Physics in school and engineering courses.
- 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

**MAPPING OF COs with POs**

| Course Outcomes | Programme Outcomes (PO) (Enter Numbers only) |
|---|---|
| 1. Understand the inadequacy of Classical mechanics and how it is overcome by Quantum mechanics with its fundamentals. | P1, P2,P9, P11 |
| 2. Experience the behavior of matter at atomic scale, role of nuclear and particle physics in applications like radioactivity and nuclear reactions. | P1, P2, P10, P11 |
| 3. Acquire an exposure to nanomaterial synthesis, liquid crystal display and shape memory alloys. | P1, P4, P7, P8, P10 |
| 4. Appraise the types of semiconductors with their electrical conduction properties. | P1, P2, P5, P7, P8 |
| 5. Familiarize the different concepts of electrostatic, time varying electromagnetic systems with their transmittance and significance of Maxwell's equation. | P1, P2, P3, P5, P7 |



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| COURSE PLAN – PART II | | | |
|---|---|---|---|
| **COURSE OVERVIEW** | | | |
| - The Physics- II course (Code: PH-IR12) is offered in the second semester to all the branches of engineering.<br>- 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 | 07-11 Jan.2019 | Inadequacy of classical mechanics-black body radiation, photoelectric effect, Compton effect - wave and particle duality of | Chalk & Talk, CD |
| 2 | 16-18 Jan.2019 | radiation – de-Broglie concept of matter waves - electron diffraction – Heisenberg's uncertainty principle – | Chalk & Talk, CD |
| 3 | 21-25 Jan.2019 | Schrodinger's wave equation – Eigen values and Eigen functions- one dimensional infinite square well potential. | Chalk & Talk, CD |
| 4 | 28-01 Jan.- Feb.2019 | Nuclear properties and forces - Nuclear models - Shell model - Nuclear reaction - Radioactivity | Chalk & Talk, CD, PPT |
| 5 | 04-08 Feb.2019 | Types of radioactivity - Stellar nucleo-synthesis. Fundamental forces - Particle physics. | Chalk & Talk, CD |
| 6 | 11-15 Feb.2019 | Classification of matter - quark model - neutrino properties and their detection | Chalk & Talk, CD, PPT |
| 7 | 18-22 Feb.2019 | *Nanomaterials:* introduction and properties – synthesis - chemical vapor deposition - ball milling - applications. Carbon nanotubes: structure and properties; | Chalk & Talk, CD, PPT |
| 8 | 25-01 Feb.-Mar.2019 | Structure and properties - synthesis - arc method - pulsed laser deposition-applications.<br>*Liquid Crystals:* types - nematic, cholesteric, smectic - modes; | PPT, Class Discussion |
| 9 | 04-08 Mar.2019 | Dynamic light scattering, twisted nematic – display systems.<br>Shape memory alloys-one way and two-way memory effect-pseudoelasticity-applications-thermoelectric materials. | Chalk & Talk, CD |



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|---|---|---|---|
| 10 | 11-15 Mar.2019 | Introduction-Direct and indirect band gap semiconductors - Intrinsic semiconductor at 0K -Intrinsic semiconductor at room temperature-Intrinsic carriers | Chalk & Talk, CD |
| 11 | 18-22 Mar.2019 | Electron and Hole concentrations-doping-n-type - p-type-temperature variation of carrier concentration in extrinsic semiconductor-Extrinsic conductivity- | Chalk & Talk, CD |
| 12 | 25-29 Mar.2019 | Law of Mass action-Charge neutrality-Fermi level in extrinsic semiconductors-Electrical conduction in extrinsic semiconductors | Chalk & Talk, CD, PPT |
| 13 | 01-05 Apr.2019 | Electrostatics: Coulomb's law - Gauss's law – proof of Gauss's law-Electrostatic field in matter: dielectric polarization, polarizability and susceptibility - types of polarization | Chalk & Talk, CD |
| 14 | 08-12 Apr.2019 | Internal field and Claussius-Mosotti equation. Magetostatics: Lorentz force -Steady current and equation of continuity - Biot-Savart law – Ampere's law. | Chalk & Talk, CD |
| 15 | 15-19 Apr.2019 | Magnetostatic field in matter: torques and forces on magnetic dipoles-Magnetization-Faraday's law of induction | Chalk & Talk, CD |
| 16 | 22-26 Apr.2019 | Maxwell's equations: generalization of Ampere's law – propagation of EM waves in free space. | Chalk & Talk, CD |
| Laboratory | | | |
| 1 | 17, Jan.2019 | Experiments 1,2,3,4 & 5 | Demonstration and Hands-on training |
| 2 | 24, Jan.2019 | Experiments 1,2,3,4 & 5 | Demonstration and Hands-on training |
| 3 | Feb.-Apr.2019 | Experiments 1,2,3,4 & 5 | Assessments Hands-on training |
| | | | |



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**COURSE ASSESSMENT METHODS** (shall range from 4 to 6)

| S.No. | Mode of Assessment | Week/Date | Duration | % Weightage |
|---|---|---|---|---|
| 1 | Cyclic Test - I | Feb. 2nd Week | 60 min | 15 |
| 2 | Quiz/Seminar | Feb. 1st Week | 30 min | 05 |
| 3 | Cyclic Test - II | Apr. 2nd Week | 60 min | 15 |
| CPA | Compensation Assessment | Apr. 3rd Week | 60 min | 15 (or) 05 |
| 4 | Laboratary Tests | During the Course | 180 min | 25 |
| 6 | Final Assessment | Apr. 4th Week | 180 min | 40 |

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

- Asking summary of each class at the end of class.
- Performance in the assessment methods.
- 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)**

- Both e-mail and phone

**COMPENSATION ASSESSMENT POLICY**

- It is a test with duration of 60 min. Appropriate weightage will be calculated.

**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.



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- 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**

**ESSENTIAL READINGS : Textbooks, reference books, website addresses, journals, etc**


1. Concepts of Modern Physics. Arthur Beiser, Tata McGraw-Hill, New Delhi (2010).
2. Fundamentals of Physics II, R. Shankar, Yale University Press, New Haven and London (2016).
3. Modern Physics, S.L. Kakani, Shubhara kakani, Viva books, (2011)
4. Hand Book of Non-destructive evaluation, C.J. Hellier, McGraw-Hill, New York (2001).
5. Vacuum Science and Technology, V.V. Rao, T.B. Ghosh, K.L. Chopra, Allied Publishers, New Delhi (2008).
6. Introduction to Nanotechnology, C.P. Poole and F.J. Owens, Wiley, New Delhi (2007).
7. Introduction to Liquid Crystals Chemistry and Physics, 2nd Ed, Peter J. Collings, Princeton University Press, New Jersey, (2002).
8. Shape memory alloys - modeling and engineering applications, Ed. D. C. Lagoudas, Springer, New York (2008).


**FOR APPROVAL**

Course Faculty _____ 24/9/19 CC- Chairperson _____ HOD _____

(M. Dhavamurthy) (K-MUTHUKUMAR) (K.M. Meera S. Begum)



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## 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.



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