NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF PHYSICS

COURSE PLAN – PART I			
Name of the programme and specialization	**B.Tech.** **MECHANICAL ENGINEERING**		
COURSE	**PHYSICS - I**		
Course Code	**PHIR11**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	**NIL**		
Session	**Jan. 2021**	**Section (if, applicable)**	**B**
Name of Faculty	**Dr. B KARTHIKEYAN** **Dr.K. NILAVARASI**	**Department**	**PHYSICS**
Official Email	**nilavarasi@nitt.edu**	**Telephone No.**	**+91** **+91 9486467634**
Name of Course Coordinator(s) (if, applicable)	**Dr. R.B. Anand**		
Official E-mail		**Telephone No.**	
Course Type (please tick appropriately**)**	[√] **Core course**	[ ] **Elective course**	

Syllabus (approved in BoS)

Lasers

Introduction to Laser-characteristics of Lasers-spontaneous and stimulated emissions – Einstein's coefficients – population inversion and lasing action – laser systems: He-Ne Laser, semiconductor laser-applications.

Fiber Optics

Snell's law-optical fiber – principle and construction – acceptance cone - numerical aperture – types of fibers - fiber optic communication principle – fiber optic sensors.

Quantum Mechanics

Inadequacy of classical mechanics-black body radiation, photoelectric effectwave 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. Fundamental forces - Particle physics - classification of matter - quark model.

Physics of Advanced Materials

Conductors: classical free electron theory (Lorentz –Drude theory) – electrical conductivity. Superconductors: definition – Meissner effect – type I & II superconductors – BCS theory (qualitative). Nanomaterials: introduction and properties – synthesis – top-down and bottom-up approach – applications.

COURSE OBJECTIVES

1. To introduce the notions of light matter interaction, fabrication of lasers, light propagation in waveguides, applications of lasers and optical fibers to engineering students.
2. To comprehend and explain the concepts of matter waves, wave functions and its interpretation to understand the matter at atomic scale.
3. To teach the fundamentals of nuclear forces, models and classification of matter.
4. To impart knowledge about the basics of conductors, superconductors, nanomaterials and their applications in science, engineering and technology.

MAPPING OF COs with POs

Course Outcomes On completion of this course, the students will be able to	**Programme Outcomes (PO)** (Enter Numbers only)
1. Know principle, construction and working of lasers and their applications in various science and engineering.	**1,3,4,5,7**
2. Explain light propagation in optical fibers, types and their applications.	**1,3,4,5,7,8**
3. Experience and appreciate the behaviour of matter at atomic scale, and to impart knowledge in solving problems in modern science and engineering.	**1,2, 3,4,5,7**
4. Understand the role of nuclear and particle physics in applications like radioactivity and nuclear reactions.	**1,3,4,5,7,8,12**
5. Recognize, choose and apply knowledge to develop materials for specific applications for common needs.	**1,3,4,5,7,8,12**

COURSE PLAN – PART II

COURSE OVERVIEW

- The Physics-I course (Code: PHIR11) is offered to all branches of B.Tech. engineering students in the first year.
- The course carries 3 credits and have three hours every week.
- In the first semester (January 2020) non-circuit branchs of B.Tech. students take this course.

COURSE TEACHING AND LEARNING ACTIVITIES (Add more rows)

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	1st Week	Laser: Introduction to Laser - characteristics of lasers, Spontaneous and stimulated emissions. Einstein's coefficients	PPT (Online discussion), Class Discussion
2	2ndWeek	population inversion and lasing action.	PPT (Online discussion), Class Discussion
3	3rd Week	Laser systems - He-Ne Laser, semiconductor laser-applications. Revision of chapter-1	PPT (Online discussion), Class Discussion
4	4th Week	Fiber Optics: Snell's law-optical fiber – principle and construction. Acceptance cone - numerical aperture.	PPT (Online discussion), Class Discussion
5	5th Week	Types of fibers. Fiber optic communication principle – fiber optic sensors. Revision of chapter-2	PPT (Online discussion), Class Discussion
6	6th Week	Introduction to Advanced materials Conductors: Classical free electron theory (Lorentz–Drude theory) & electrical conductivity.	PPT (Online discussion), Class Discussion
7	7th Week	Superconductors: Definition – Meissner effect. Type I & II superconductors – BCS theory	PPT (Online discussion), Class Discussion
8	8th Week	Nanomaterials: Introduction & properties. Synthesis – top-down and bottom-up approach. Applications.	PPT (Online discussion), Class Discussion

9	9th Week	Quantum Mechanics: Inadequacy of classical mechanics-black body radiation. Photoelectric effect - wave and particle duality – de Broglie concept of matter waves – electron diffraction.	PPT (Online discussion), Class Discussion
10	10th Week	Heisenberg's uncertainty principle – Schrodinger's wave equation.	PPT (Online discussion), Class Discussion
11	11th Week	Eigen values and eigen functions – superposition principle. Interpretation of wave function – particle confined in one dimensional infinite square well potential.	PPT (Online discussion), Class Discussion
12	12th Week	Nuclear & Particle Physics: Nuclear properties and forces - Nuclear models - Shell model - Nuclear reaction - Radioactivity - types and half-life.	PPT (Online discussion), Class Discussion
13	13th Week	Fundamental forces - Particle physics - classification of matter - quark model. Revision of chapter 4	PPT (Online discussion), Class Discussion

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

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Cycle Test 1	5th Week	60 mins.	30
2	Cycle Test 2	10th Week	60mins.	30
3	Quiz/Assignment	12th Week	60 mins.	10
CPA	Compensation Assessment*	14th Week	60 mins.	As applicable
4	Final Assessment *	15th Week	2 hrs	30

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

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.
- Active participation of students in classroom discussions.
- Performance in the continuous and final assessments.
- 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 (bkarthik@nitt.edu; nilavarasi@nitt.edu) and phone/mobile (+91 ; +91 9486467634).

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.
- 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

Books for References

1. Laser Fundamentals, William T. Silfvast, 2nd edn, Cambridge University press, New York (2004).
2. Fundamentals of Physics, 6th Edition, D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, New York (2001).
3. Concepts of Modern Physics, Arthur Beiser, Tata McGraw-Hill, New Delhi (2010).
4. Fundamentals of Physics, R. Shankar, Yale University Press, New Haven and London (2014).
5. Fundamentals of Physics II, R. Shankar, Yale University Press, New Haven and London (2016).
6. Introduction to Nanotechnology, C.P. Poole and F.J. Owens, Wiley, New Delhi (2007). 7.Introduction to Solid State Physics, 8th Edition, Charles Kittel, John Wiley & Sons, NJ, USA (2005).

FOR APPROVAL

Course Faculty
Dr. B. Karthikeyan
Dr. K. Nilavarasi

CC- Chairperson

April 23, 2021
(Dr. R.B. Anand)

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.