NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF PHYSICS

COURSE PLAN – PART I			
Name of the programme and specialization	**B.Tech. (Metallurgical and Materials Engineering)**		
Course Title	Physics – I		
Course Code	PHIR11	**No. of Credits**	03
Course Code of Pre-requisite subject(s)	**NIL**		
Session	**January 2021**	**Section (if, applicable)**	**NIL**
Name of Faculty	Dr. S. Manivannan	**Department**	**Physics**
Official Email	ksmani@nitt.edu	**Telephone No.**	+91-431-2503616
Name of Course Coordinator(s) (if, applicable)	**Dr. T. Sonamani Singh**		
Official E-mail	**takhel@nitt.edu**	**Telephone No.**	**3600 (office)**
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 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. 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.

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).

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.*	**1,3,4,5,11,12**
2. *explain light propagation in optical fibers, types and their applications.*	**1,4,5,11**
3. *experience and appreciate the behaviour of matter at atomic scale, and to impart knowledge in solving problems in modern science and engineering.*	**1,2,5,10**
4. *understand the role of nuclear and particle physics in applications like radioactivity and nuclear reactions.*	**1,5,12**
5. *recognize, choose and apply knowledge to develop materials for specific applications for common needs.*	**1,2,3,4,10,11,12**

COURSE PLAN – PART II

COURSE OVERVIEW

The Physics- I course is offered in the second semester to **Metallurgical and Materials Engineering** students to teach basics of physics. The subject has 3 credits theory.

COURSE TEACHING AND LEARNING ACTIVITIES **(** Add more rows)

S.No.	**Week/Contact Hours**	**Topic***	**Mode of Delivery**
1	2nd week of April (5-9th April)	Introduction to Laser-characteristics of Lasers-spontaneous and stimulated emissions-Einstein's coefficients-population inversion and lasing action	Online [power point presentation (PPT)/Digital writing pen (DWP)]
2	3rd week of April	laser systems: He-Ne Laser- semiconductor laser-applications.	PPT/DWP
3	4th week of April	Snell's law-optical fiber- principle and construction – acceptance cone - numerical aperture	PPT/DWP

4	Last week of April	types of fibers - fiber optic communication principle – fiber optic sensors.	PPT/DWP
5	1st week of May	Inadequacy of classical mechanics-black body radiation, photoelectric effect- wave and particle duality of radiation – de Broglie concept of matter waves – electron diffraction –	PPT/DWP
6	2nd week of May	Heisenberg's uncertainty principle - Schrodinger's wave equation – eigen values and eigen functions – superposition principle	PPT/DWP
7	3rd week of May	interpretation of wave function – particle confined in one dimensional infinite square well potential.	PPT/DWP
8	4th week of May	Nuclear properties and forces - Nuclear models - Shell model - Nuclear reaction - Radioactivity - types and half-life.	PPT/DWP
9	1st week of June	Fundamental forces - Particle physics - classification of matter - quark model.	PPT/DWP
10	2nd week of June	*Conductors:* classical free electron theory (Lorentz –Drude theory) – electrical conductivity.	PPT/DWP
11	3rd week of June	*Superconductors:* definition – Meissner effect – type I & II superconductors – BCS theory (qualitative).	PPT/DWP
12	4th week of June	*Nanomaterials:* introduction and properties – synthesis – top-down and bottom-up approach – applications.	PPT/DWP

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

S.No.	Mode of Assessment	Week/Date	Duration (Topics)	% Weightage (online mode)
1	Assessment –I (objective type/ short answer questions/ problems)	1st week of May	60 min. (Lasers and Fiber Optics)	25% (MS Teams)
2	Assessment – II (objective type/ short answer questions/ problems)	1st week of June	60 min. (Quantum mechanics, Nuclear and particle physics)	25% (MS Teams)
3	Assessment – III (objective type/ short answer questions/ problems)	3rd week of June	60 min. (All the topics)	20% (MS Teams)

4	Final Assessment (short and long descriptive questions, problems)	As per NITT time table	120 min. (All the topics)	30% (MS Teams)
CPA	Compensation Assessment	Last week of June	60/120 min. (All the topics)	(Appropriate weightage will be considered for the absentees)

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

- ✓ Performance in the assessment methods
- ✓ Questionnaire about the effectiveness of the delivery method, topics and the knowledge gained (will be done by The Academic Office, NITT)

COURSE POLICY (including compensation assessment to be specified)

MODE OF CORRESPONDENCE (email/phone, etc.)

The lecture materials such as power point presentation, problems and handouts shall be available with the faculty members and will be uploaded in MS Teams. Faculty can be contacted through office phone or in person for further discussions and clarifications on a mutually convenient time.

COMPENSATION ASSESSMENT

Those who are absent for any of the assessments I to III on genuine grounds shall be given an opportunity only once for the compensation assessment with the prior permission of the faculty member. The portions will be all the topics. The test would be objective type, descriptive, problems and short answer questions. Appropriate weightage will be considered for the absentees.

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

- **Due to COVID-19 pandemic; all the teaching-learning activities will be through online mode, including assessments. The above mentioned attendance policy, academic dishonesty & plagiarism, assessment methods will subject to change (if needed) as per NIT-T guidelines. Suggestions/regulations from NIT-T administration will be followed time to time according to the situation.**
- **Further details shall be followed from B.Tech regulations (2019 onwards).**

FOR APPROVAL

Course Faculty **CC- Chairperson** **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.