Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Tut.	Pract.	Total
FEC202	Engineering Physics-II	2	--	--	2	--	--	2

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract. /oral	Total
		Internal Assessment			End Sem. Exam.	Exam. Duration (in Hrs)			
		Test1	Test 2	Avg.					
FEC202	Engineering Physics-II	15	15	15	60	2	--	--	75

Rationale:

Most of the engineering branches are being off-spring of basic sciences where physics is playing a pivotal role in concept and understanding of foundation of core engineering branches. This syllabus is developed by keeping in mind, needs of all branches that we offer in University of Mumbai.

The topic distribution is being done in systematic manner and whenever required, prerequisite to the topic are mentioned for frictionless teaching–learning process. In the distribution of topics, core physics and its applied form are given priority. At the same time few modules are introduced over emerging trends in the field of technology.

For the purpose of emphasis on applied part, list of suggestive experiments is added. As per new guidelines of AICTE, a scope is kept in the syllabus for simulation technique and use of information technology to supplement laboratory practices. Further, it is ensured that these modules will cover prerequisites needed for engineering courses to be introduced in higher semesters as core subjects or as interdisciplinary subjects in respective branches.

Objectives

1. To give exposure to the topics of fundamental physics in the area of electrodynamics and relativity.
2. To give exposure to fundamentals of physics related with current technology in the field of Nanotechnology and Physics of Sensor Technology.

Outcomes: Learners will be able to…

1. Describe the diffraction through slits and its applications.
2. Apply the foundation of laser and fiber optics in development of modern communication technology.
3. Relate the basics of electrodynamics which is prerequisite for satellite communications, antenna theory etc.
4. Explain the fundamentals of relativity.
5. Assimilate the wide scope of nanotechnology in modern developments and its role in emerging innovating applications.
6. Interpret and explore basic sensing techniques for physical measurements in modern instrumentations.

Module	Detailed Contents	Hrs.
01	**DIFFRACTION** (**Prerequisites** : Wave front and Huygen's principle, reflection and refraction, diffraction, Fresnel diffraction and Fraunhoffer diffraction)	04

	Diffraction: Fraunhoffer diffraction at single slit, Diffraction Grating, Resolving power of a grating; Applications of diffraction grating; Determination of wavelength of light using plane transmission grating	
02	**LASER AND FIBRE OPTICS** (**Prerequisites:** Absorption, recombination, energy bands of p-n junction, refractive index of a material, Snell's law) Laser: spontaneous emission and stimulated emission; metastable state, population inversion, types of pumping, resonant cavity, Einsteins's equations; Helium Neon laser; Nd:YAG laser; Semiconductor laser, Applications of laser- Holography Fibre optics: Numerical Aperture for step index fibre; critical angle; angle of acceptance; V number; number of modes of propagation; types of optical fibres; Fibre optic communication system;	06
03	**ELECTRODYNAMICS** (**Prerequisites** : Electric Charges, Coulomb's law-force between two point charges, Electric field, electric field due to a point charge, electric field lines, electric dipole, electric field due to a dipole, Gauss's law, Faraday's law) Scalar and Vector field, Physical significance of gradient, curl and divergence in Cartesian co-ordinate system, Gauss's law for electrostatics, Gauss's law for magnetostatics, Faraday's Law and Ampere's circuital law; Maxwell's equations (Free space and time varying fields).	05
04	**RELATIVITY** (**Prerequisites**: Cartesian co-ordinate system) Special theory of Relativity: Inertial and Non-inertial Frames of reference, Galilean transformations, Lorentz transformations (space – time coordinates), Time Dilation, Length Contraction and Mass-Energy relation.	02
05	**NANOTECHNOLOGY** (**Prerequisites** : Scattering of electrons, Tunneling effect, Electrostatic focusing, magneto static focusing) Nanomaterials : Properties (Optical, electrical, magnetic, structural, mechanical) and applications, Surface to volume ratio; Two main approaches in nanotechnology -Bottom up technique and Top down technique; Tools for characterization of Nanoparticles: Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), Atomic Force Microscope (AFM). Methods to synthesize Nanomaterials: Ball milling, Sputtering, Vapour deposition, Solgel	04
06	**PHYSICS OF SENSORS** (**Prerequisites** : Transducer concept, meaning of calibration, piezoelectric effect) Resistive sensors: a) Temperature measurement: PT100 construction, calibration, b) Humidity measurement using resistive sensors, Pressure sensor: Concept of pressure sensing by capacitive, flex and inductive method, Analog pressure sensor: construction working and calibration and applications. Piezoelectric transducers: Concept of piezoelectricity, use of piezoelectric transducer as ultrasonic generator and application of ultrasonic transducer for distance measurement, liquid and air velocity measurement. Optical sensor: Photodiode, construction and use of photodiode as ambient light measurement and flux measurement. Pyroelectric sensors: Construction and working principle, application of pyroelectric sensor as bolometer.	05

Assessment

Internal Assessment Test

Assessment consists of two class tests of 15 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 35% syllabus is completed. Duration of each test shall be one hour.

End Semester Examination

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

1. Question paper will comprise of 6 questions, each carrying 15 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total four questions need to be solved.

References

1. A text book of Engineering Physics-Avadhanulu&Kshirsagar, S.Chand
2. Optics - Ajay Ghatak, Tata McGraw Hill
3. A textbook of Optics - N. Subramanyam and Brijlal, S.Chand
4. Concepts of Modern Physics- ArtherBeiser, Tata Mcgraw Hill
5. Introduction to Electrodynamics- D. J. Griffiths, Pearson publication
6. Introduction to Special Relativity- Robert Resnick, John Wiley and sons
7. Advances In Nano Materials And Applications: History of Nanotechnology From Pre-Historic to Modern Times, Madhuri Sharon, Wiley, USA
8. Nano: The essentials, understanding Nanoscience and Nanotechnology, T. Pradeep, Tata McGraw Hill, 2007.
9. Electronic Instrumentation –H.S. Kalsi, Tata McGraw-Hill Education
10. Handbook of Modern Sensors Physics design and application- Jacob Fraden, Springer, AIP press.
11. Instrumentation & Measurement Techniques by Albert D. Helfrick& William D. Cooper (PHI) Edition