<table>
<tr><td>Course Title</td><td>Introductory Quantum Science for Engineers</td><td>Course No</td><td colspan="4">PH5XXX</td></tr>
<tr><td>Specialization</td><td>Physics</td><td>Structure (LTPC)</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>To be offered for</td><td>UG/PG</td><td>Status</td><td colspan="2">Core ☐</td><td colspan="2">Elective</td></tr>
<tr><td>Faculty Proposing the course</td><td>Dr Tapas Sil</td><td>Type</td><td colspan="2">New</td><td colspan="2">Modification</td></tr>
<tr><td rowspan="2">Date of DAC</td><td rowspan="2">09/07/2020</td><td>Members Present in DAC</td><td colspan="4">Dr. Naveen Kumar Vats
Dr. Vivek Kumar
Dr. JayachandraBingi
Dr. A. P. Khandale</td></tr>
<tr><td>External Member:</td><td colspan="4">Prof. Sibasish Ghosh, IMSC, Chennai</td></tr>
<tr><td>Pre-requisite</td><td>CoT</td><td>Submitted for approval</td><td colspan="4">43rd Senate</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• To develop in the student, an awareness of situations in engineering, which need ideas of quantum mechanics.
• The course emphasizes conceptual understanding rather than a heavily mathematical approach, but some amount of mathematics is essential for understanding and using quantum mechanics.
• To make the student understand the basic language and methods of quantum mechanics.
• To enable the student with those aspects of quantum mechanics, which are necessary to begin to deal with microscopic systems.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">Students will be able to
• understand the fundamental concepts and quantum mechanical processes in the nature.
• apply principles of quantum mechanics to calculate observables on known wave functions or potentials.
• pursue more advanced courses such as quantum optics, quantum computation, nanophotonic devices etc.</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours)</td><td colspan="6">Introduction to quantum mechanics
How quantum mechanics is important in the everyday world, the bizarre aspects and continuing evolution of quantum mechanics, and how we need it for engineering much of modern technology. Blackbody radiation, The photo-electric effect, Atomic spectra, The Frank-Hertz experiment, Compton effect, Wave-Particle duality, Wave functions, Expectation values, Uncertainty principle. [12]
Schrodinger’s wave equation
Getting to Schrodinger’s wave equation. Solution of stationary-state Schrodinger equation for one dimensional problem – particle in a box, square-well potential, linear harmonic oscillator. Potential barrier and tunneling and applications such as, Esaki diode, scanning tunneling microscope, vibrational modes of ammonia molecule, etc.
3D isotropic quantum harmonic oscillator, Particle in 3D box and related examples (quantum dot, quantum wire etc.) [18]
Aspects of spin
Angular momentum operators. Stern-Gerlach experiment—spin. Solution of hydrogen atom problem. [8]
Introduction to few advanced concepts
Entanglement, EPR paradox, Bells inequality [4]</td></tr>
<tr><td>Text Books</td><td colspan="6">David J. Griffiths and Darrell F.Schroeter,” Introduction to quantum mechanics”, (Cambridge University Press India, 3rd edition, 2019)</td></tr>
<tr><td>Reference Books</td><td colspan="6">• D. A. B. Miller, “Quantum Mechanics for Scientists and Engineers,” (Cambridge University Press, 2008)”
• R. Shankar, “Principles of Quantum Mechanics”, (Springer, 2012)</td></tr>
</table>

#