Undergraduate
Course Catalog 2013-2014

COMSATS Institute of Information Technology
Registrar Secretariat, Principal Seat, Islamabad.
Undergraduate

Course Catalog 2013-2014

Department of Physics

Composed by: Mr. Asif Malik, Assistant Registrar, Principal Seat, CIIT, Islamabad.
Disclaimer:-
Every possible effort has been made to ensure that the information presented in this Catalog is correct at the time of going to press. However, this information is subject to change by appropriate action of the competent authority of CIIT.
Department of Physics

- Scheme of Studies of Bachelor of Science in Electronics
- Scheme of Studies of Bachelor of Science in Physics
- List of Courses offered by the Department of Physics
- Course Contents/Descriptions
Scheme of Studies of Bachelor of Science (BS) in Electronics

1. Minimum duration: 04 years
2. Minimum no. of semesters: 08
3. No. of credit hours in each semester: 17-19

4. Course work

- Core courses (List attached) 33 113
- Elective courses (List attached) 05 15-20
- Institutional elective courses (List attached) 03 09

Total no. of courses of the program: 41
Total no. of credit hours of the program: 137

Note: The regulations relating to undergraduate degree programs approved by the competent authority and amended from time to time shall be applicable.

List of Core Courses

<table>
<thead>
<tr>
<th>Serial No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Cr. Hrs.</th>
<th>Pre-requisite</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>CSC103</td>
<td>Introduction to Computers and Programming</td>
<td>4(3, 1)</td>
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<tr>
<td>2.</td>
<td>CSC241</td>
<td>Object Oriented Programming</td>
<td>4(3, 1)</td>
<td>CSC103</td>
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<tr>
<td>3.</td>
<td>EEE223</td>
<td>Signals and Systems</td>
<td>3(3, 0)</td>
<td>PHY221, MTH241</td>
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<tr>
<td>4.</td>
<td>EEE231</td>
<td>Electronics I</td>
<td>4(3, 1)</td>
<td>PHY221</td>
</tr>
<tr>
<td>5.</td>
<td>EEE232</td>
<td>Electronics II</td>
<td>4(3, 1)</td>
<td>EEE231</td>
</tr>
<tr>
<td>6.</td>
<td>EEE241</td>
<td>Digital Logic Design</td>
<td>4(3, 1)</td>
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<tr>
<td>7.</td>
<td>EEE324</td>
<td>Digital Signal Processing</td>
<td>4(3, 1)</td>
<td>EEE223</td>
</tr>
<tr>
<td>8.</td>
<td>EEE325</td>
<td>Control Systems</td>
<td>4(3, 1)</td>
<td>EEE223</td>
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<td>EEE342</td>
<td>Microprocessor Systems and Interfacing</td>
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<td>EEE241</td>
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<tr>
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<td>Principles of Communication Systems</td>
<td>4(3, 1)</td>
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<td>English Comprehension and Composition</td>
<td>3(3, 0)</td>
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<td>12.</td>
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<td>Report Writing Skills</td>
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<td>14.</td>
<td>HUM110</td>
<td>Islamic Studies</td>
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<td>15.</td>
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<td>16.</td>
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<td>Foreign Language</td>
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<td>18.</td>
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<td>Calculus II</td>
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<td>19.</td>
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<td>Linear Algebra</td>
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<td>20.</td>
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<td>Ordinary Differential Equations</td>
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<td>MTH263</td>
<td>Probability Theory and Random Variables</td>
<td>3(3, 0)</td>
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<td>22.</td>
<td>PHY100</td>
<td>Mechanics and Thermodynamics</td>
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<tr>
<td>23.</td>
<td>PHY120</td>
<td>Electricity, Magnetism and Optics</td>
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<td>24.</td>
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<td>Circuit Theory</td>
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<td>25.</td>
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<td>Modern Physics</td>
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<td>26.</td>
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<td>30.</td>
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<td>Optics and Laser</td>
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<tr>
<td>31.</td>
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<td>Microelectronics</td>
<td>3(3, 0)</td>
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<tr>
<td>32.</td>
<td>PHY498</td>
<td>Final Year Project Phase I</td>
<td>2(0, 2)</td>
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<td>33.</td>
<td>PHY498</td>
<td>Final Year Project Phase II</td>
<td>4(0, 4)</td>
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List of institutional elective courses

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<tr>
<td>1.</td>
<td>ECO102</td>
<td>Economics</td>
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<td>2.</td>
<td>ECO200</td>
<td>Introduction to Development Economics</td>
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<td>4.</td>
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<td>Business Communication Workshop</td>
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<td>5.</td>
<td>HUM220</td>
<td>Introduction to Psychology</td>
<td>3(3, 0)</td>
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<td>HUM221</td>
<td>International Relations</td>
<td>3(3, 0)</td>
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<td>7.</td>
<td>HUM223</td>
<td>Introduction to Philosophy</td>
<td>3(3, 0)</td>
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<td>8.</td>
<td>HUM310</td>
<td>Islamic History</td>
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<td>9.</td>
<td>HUM320</td>
<td>Introduction to Sociology</td>
<td>3(3, 0)</td>
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<td>10.</td>
<td>HUM430</td>
<td>French</td>
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<td>HUM431</td>
<td>German</td>
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<td>12.</td>
<td>HUM432</td>
<td>Arabic</td>
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<td>13.</td>
<td>HUM433</td>
<td>Persian</td>
<td>3(3, 0)</td>
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<td>14.</td>
<td>LAW300</td>
<td>Corporate Law</td>
<td>3(3, 0)</td>
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<tr>
<td>15.</td>
<td>MGT100</td>
<td>Introduction to Business</td>
<td>3(3, 0)</td>
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<tr>
<td>16.</td>
<td>MGT101</td>
<td>Introduction to Management</td>
<td>3(3, 0)</td>
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<tr>
<td>17.</td>
<td>MGT131</td>
<td>Financial Accounting</td>
<td>3(3, 0)</td>
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<tr>
<td>18.</td>
<td>MGT403</td>
<td>Entrepreneurship</td>
<td>3(3, 0)</td>
<td>MGT101</td>
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<tr>
<td>19.</td>
<td>MGT461</td>
<td>Project Management</td>
<td>3(3, 0)</td>
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<td>20.</td>
<td>MGT463</td>
<td>Productivity and Quality Management</td>
<td>3(3, 0)</td>
<td>MGT101</td>
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<tr>
<td>21.</td>
<td>MGT513</td>
<td>New Product Development</td>
<td>3(3, 0)</td>
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List of Elective courses:

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<th>Serial No.</th>
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<th>Course Title</th>
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<th>Pre-requisite</th>
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<tbody>
<tr>
<td>1.</td>
<td>EEE371</td>
<td>Electric Machines</td>
<td>4(3, 1)</td>
<td>PHY324</td>
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<tr>
<td>2.</td>
<td>EEE446</td>
<td>Real Time Embedded Systems</td>
<td>4(3, 1)</td>
<td>EEE342, PHY324</td>
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<tr>
<td>3.</td>
<td>PHY461</td>
<td>Industrial Automation</td>
<td>3(3, 0)</td>
<td>PHY221</td>
</tr>
<tr>
<td>4.</td>
<td>EEE353</td>
<td>Digital Communication Systems</td>
<td>4(3, 1)</td>
<td>EEE351</td>
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<tr>
<td>5.</td>
<td>EEE455</td>
<td>Optical Fiber Communications</td>
<td>3(3, 0)</td>
<td>PHY324</td>
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<tr>
<td>6.</td>
<td>EEE463</td>
<td>Antennas and Radio Wave Propagation</td>
<td>4(3, 1)</td>
<td>PHY324</td>
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<td>7.</td>
<td>EEE464</td>
<td>Wireless Communication Systems</td>
<td>3(3, 0)</td>
<td>EEE463</td>
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<td>8.</td>
<td>EEE465</td>
<td>Microwave and Satellite Communication Systems</td>
<td>3(3, 0)</td>
<td>EEE351, EEE463</td>
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<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
<td>Prerequisite(s)</td>
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<tr>
<td>9</td>
<td>PHY451</td>
<td>Semiconductor Devices</td>
<td>3(3, 0)</td>
<td>PHY350</td>
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<tr>
<td>10</td>
<td>PHY452</td>
<td>CMOS Technology</td>
<td>3(3, 0)</td>
<td>PHY425</td>
</tr>
<tr>
<td>11</td>
<td>PHY453</td>
<td>Semiconductor Device Design and Simulations</td>
<td>4(3, 1)</td>
<td>PHY425</td>
</tr>
<tr>
<td>12</td>
<td>PHY454</td>
<td>Optoelectronics</td>
<td>3(3, 0)</td>
<td>PHY353</td>
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<tr>
<td>13</td>
<td>PHY434</td>
<td>VLSI Design</td>
<td>4(3, 1)</td>
<td>EEE232, EEE241</td>
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<td>14</td>
<td>PHY464</td>
<td>Principles of Photonics</td>
<td>3(3, 0)</td>
<td>PHY353</td>
</tr>
<tr>
<td>15</td>
<td>PHY478</td>
<td>Quantum Computing</td>
<td>3(3, 0)</td>
<td>PHY231</td>
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</table>
Scheme of Studies of Bachelor of Science (BS) in Physics

5. Minimum duration: 04 years
6. Minimum no. of semesters: 08
7. No. of credit hours in each semester: 12-19
8. **Course work**

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<tr>
<th></th>
<th>Min No. of courses</th>
<th>Min Credit hours</th>
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<tr>
<td>iv. Core courses (List attached)</td>
<td>40</td>
<td>113</td>
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<tr>
<td>v. Elective courses (List attached)</td>
<td>03</td>
<td>09-12</td>
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<tr>
<td>vi. Minor courses (List attached)</td>
<td>04</td>
<td>12-16</td>
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</tbody>
</table>

Total no. of courses of the program: 47
Total no. of credit hours of the program: 134

9. Students will have to opt at least one PHY4** (four hundred level) course from list of elective courses.

**Note:**
The regulations relating to undergraduate degree programs approved by the competent authority and amended from time to time shall be applicable.

**List of Core courses**

<table>
<thead>
<tr>
<th>Serial No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
<th>Pre-requisite</th>
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<td>CSC101</td>
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<td>CSC141</td>
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<td>CSC101</td>
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<td>HUM100</td>
<td>English Comprehension and Composition</td>
<td>3(3, 0)</td>
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<tr>
<td>4.</td>
<td>HUM103</td>
<td>Communication Skills</td>
<td>3(3, 0)</td>
<td>HUM100</td>
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<tr>
<td>5.</td>
<td>HUM110</td>
<td>Islamic Studies</td>
<td>3(3, 0)</td>
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<td>6.</td>
<td>HUM111</td>
<td>Pakistan Studies</td>
<td>3(3, 0)</td>
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<td>7.</td>
<td>MTH101</td>
<td>Calculus I</td>
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<td>MTH101</td>
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<td>Calculus II</td>
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<td>MTH231</td>
<td>Linear Algebra</td>
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<td>MTH241</td>
<td>Ordinary Differential Equations</td>
<td>3(3, 0)</td>
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<td>11.</td>
<td>PHY101</td>
<td>Mechanics of Particles</td>
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<td>PHY103</td>
<td>Heat and Thermodynamics</td>
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<td>PHY108</td>
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<td>14.</td>
<td>PHY109</td>
<td>Physics Lab II</td>
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<td>15.</td>
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<td>Physics Lab III</td>
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<td>16.</td>
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<td>Physics Lab IV</td>
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<td>17.</td>
<td>PHY222</td>
<td>Electric and Magnetic Fields I</td>
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<td>PHY223</td>
<td>Electric and Magnetic Fields II</td>
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<td>Circuit Analysis Theory</td>
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<td>Modern Physics Concepts</td>
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<td>Course Title</td>
<td>Credit Hours</td>
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<td>1.</td>
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<td>Digital Logic Design</td>
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<td>Microprocessor Systems and Interfacing</td>
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<td>EEE241</td>
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<tr>
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<td>PHY353</td>
<td>Optics and Laser</td>
<td>4(3, 1)</td>
<td>PHY223, PHY232</td>
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<td>Microelectronics</td>
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<td>PHY354</td>
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<td>PHY451</td>
<td>Semiconductor Devices</td>
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<td>PHY354</td>
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<td>6.</td>
<td>PHY453</td>
<td>Semiconductor Device Design and Simulation</td>
<td>4(3, 1)</td>
<td>PHY425 or PHY354</td>
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<td>PHY454</td>
<td>Optoelectronics</td>
<td>3(3, 0)</td>
<td>PHY451 or PHY353</td>
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<td>PHY455</td>
<td>Basics of Biophysics</td>
<td>3(3, 0)</td>
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<td>9.</td>
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<td>Lasers and Their Applications</td>
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<td>Introduction to Nanoscience and Technology</td>
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<td>PHY354</td>
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<td>Principles of Photonics</td>
<td>3(3, 0)</td>
<td>PHY352</td>
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<td>Course Title</td>
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<td>PHY465</td>
<td>Fundamentals of Materials Science</td>
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<td>PHY468</td>
<td>Introduction to Group Theory</td>
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<td>PHY469</td>
<td>Introduction to Astrophysics and Cosmology</td>
<td>3(3, 0)</td>
<td>PHY341</td>
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<td>15.</td>
<td>PHY471</td>
<td>High Energy Physics I</td>
<td>3(3, 0)</td>
<td>PHY343</td>
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<tr>
<td>16.</td>
<td>PHY476</td>
<td>High Energy Physics II</td>
<td>3(3, 0)</td>
<td>PHY471</td>
</tr>
<tr>
<td>17.</td>
<td>PHY478</td>
<td>Quantum Computing</td>
<td>3(3, 0)</td>
<td>PHY343</td>
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</table>

**List of Minor courses**

<table>
<thead>
<tr>
<th>Serial No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
<th>Pre-requisite</th>
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<tr>
<td>1.</td>
<td>BIO100</td>
<td>Fundamentals of Biology</td>
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<td>2.</td>
<td>BSC100</td>
<td>Introduction to Biosciences</td>
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<td>CHM101</td>
<td>General Chemistry</td>
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<td>Introduction to Physical Chemistry</td>
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<td>ECO102</td>
<td>Economics</td>
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<td>6.</td>
<td>ENV101</td>
<td>Fundamentals of Environmental Sciences</td>
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<td>7.</td>
<td>HUM310</td>
<td>Islamic History</td>
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<td>HUM430</td>
<td>French</td>
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<td>12.</td>
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<td>13.</td>
<td>MET101</td>
<td>Meteorology</td>
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<td>14.</td>
<td>MET105</td>
<td>Climatology</td>
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<td>15.</td>
<td>MET201</td>
<td>Satellite Remote Sensing</td>
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<td>16.</td>
<td>MGT100</td>
<td>Introduction to Business</td>
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<td>17.</td>
<td>MGT101</td>
<td>Introduction to Management</td>
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### List of Courses Offered by the Department of Physics

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<thead>
<tr>
<th>Sr #</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
<th>Pre-require(s)</th>
<th>Co-require(s)</th>
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<tr>
<td>1.</td>
<td>PHY100</td>
<td>Physics I (Mechanics and Thermodynamics)</td>
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<td>2.</td>
<td>PHY101</td>
<td>Mechanics of Particles</td>
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<td>3.</td>
<td>PHY102</td>
<td>Newtonian Mechanics</td>
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<td>4.</td>
<td>PHY103</td>
<td>Heat and Thermodynamics</td>
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<td>PHY108</td>
<td>Physics Lab I</td>
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<td>6.</td>
<td>PHY109</td>
<td>Physics Lab II</td>
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<td>7.</td>
<td>PHY120</td>
<td>Physics II (Electricity, Magnetism and Optics)</td>
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<td>PHY121</td>
<td>Applied Physics for Engineers</td>
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<td>Electricity and Magnetism</td>
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<td>14.</td>
<td>PHY221</td>
<td>Circuit Theory</td>
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<td>15.</td>
<td>PHY222</td>
<td>Electric and Magnetic Fields I</td>
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<td>PHY101, MTH101 &amp; MTH102</td>
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<td>PHY223</td>
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<td>PHY225</td>
<td>Modern Physics Concepts</td>
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<td>Modern Physics</td>
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<td>Vibrations and Waves</td>
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<td>22.</td>
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<td>PHY101 &amp; PHY232</td>
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<td>23.</td>
<td>PHY271</td>
<td>Boundary Value Problems</td>
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<td>Relativity</td>
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<td>28.</td>
<td>PHY342</td>
<td>Quantum Mechanics I</td>
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<td>PHY241, PHY232 &amp; PHY225</td>
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<td>Optics and Laser</td>
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<td>Quantum Computing</td>
<td>3(3, 0)</td>
<td>PHY343</td>
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Course Contents/Description

PHY100  Mechanics and Thermodynamics

Course Objectives:-
The major objectives of this course are for students to learn the fundamental principles of classical mechanics, to develop solid and systematic problem solving skills, and to lay the foundations for further studies in physics, physical sciences, and engineering.

Theory Course outline:-
Physical quantities and Units, Vectors Components of a vector, Addition of vectors, Multiplication of vectors, Selected Problems, Motion with constant acceleration, Two dimensional motion, Projectile motion, Uniform circular motion, Relative motion, Force and mass, Newton's Laws, Applications of Newton's Laws, Frictional forces, Dynamics of uniform circular motion, Time dependent forces, Drag force, Work done by a constant force, Work done by a variable force (1 & 2 dimensional cases), Kinetic energy and work energy theorem, Conservative forces, Potential energy, One and two dimensional conservative system, Collisions in one and two dimensions, Impulse and momentum, Conservation of momentum, Gravitation, Newton's law of universal gravitation, Gravitational potential energy, Motion of planets and satellites, Kepler’s Laws, Temperature and its measurements, Thermal equilibrium & thermal expansion, Kinetic theory of ideal gas, Ideal gas laws, Internal energy of ideal gas, Heat Transfer Mechanisms, Reversible and irreversible processes, Second law of thermodynamics and its applications.

Lab Course Outline

•Experiment #1: Determination of Frequency of A.C. Supply
  By Melde's method.
•Experiment #2: To determine the variation of photoelectric
  Current with the change of intensity of light.
  (Verification of inverse Square Law).
•Experiment #3: Determination of value of “g” by Compound
  Pendulum.
•Experiment #4: Determination of value of “g” by Kater’s
  Reversible pendulum.
•Experiment #5: To determine the Resistivity and Conductivity
  of Eureka wire
•Experiment #6: To convert a Weston type Galvanometer into
  An Ammeter of range 0→1A.
•Experiment #7: To convert a Weston type Galvanometer into
  Voltmeter of range 0→5V.
•Experiment #8: To determine the “Low Resistance” by Cary
  Foster’s bridge.

Photogate timer Experiments

Experiment 1: Instantaneous vs Average Velocity
Experiment 2: Kinematics on an Inclined Plane
Experiment 3: Speed of a Projectile
Experiment 4: Newton's Second Law
Experiment 5: The Force of Gravity
Experiment 6: Conservation of Momentum
Experiment 7: Kinetic Energy
Experiment 8: Conservation of Mechanical Energy
Experiment 9: Elastic-Kinetic Energy
Experiment 10: Pendulum Motion

PHY101
Mechanics of Particles
Course Objectives:-
The main objective of this course is to provide the student a clear and a logical presentation of the basic concepts and principles of mechanics. Another aim of this course is associating the real world with physics to improve a better understanding of its concepts and principles, especially with the set of physical laws describing the motion of bodies under the action of a system of forces, the motion of macroscopic objects, from projectiles to parts of machinery, as well as astronomical objects, such as spacecraft, planets, stars and galaxies.

Course Contents:-
Dimensions and units, vectors and their algebra, vector and scalar triple products, straight-line kinematics, motion in a plane, forces and equilibrium, experimental basis of Newton's laws, particle dynamics, friction, universal gravitation, collisions and conservation laws, work, power and energy, vibrational motion, conservative forces, rigid bodies and rotational dynamics, elasticity, Cartesian, spherical and cylindrical coordinates.

PHY102
Newtonian Mechanics
Course Objectives:-
The major objectives of this course are for students to learn the fundamental principles of classical mechanics, to develop solid and systematic problem solving skills, and to lay the foundations for further studies in physics, physical sciences, and engineering.

Course Contents:-
Space and time, straight-line kinematics, motion in a plane, forces and equilibrium, experimental basis of Newton's laws, particle dynamics, universal gravitation, collisions and conservation laws, work and potential energy, vibrational motion, conservative forces, inertial forces and non-inertial frames, central force motions, rigid bodies and rotational dynamics.

PHY103
Heat and Thermodynamics
Course Objectives:-
To learn the basic principles of thermodynamics and statistical mechanics and apply them to describe equilibrium thermal properties of bulk matter.

Course Contents:-
Heat: Temperature, empirical temperature, Ideal Gas, kinetic theory of the ideal gas, internal energy of an ideal gas, equipartition of energy, intermolecular forces, Van der Waals equation of state. Thermodynamics: First law of thermodynamics and its applications to adiabatic, isothermal, cyclic and free expansion, reversible and irreversible processes, second law of thermodynamics, Carnot’s theorem, Carnot engines, heat engine, refrigerators, calculation of efficiency of heat engines. Thermodynamic temperature scale: Absolute zero, entropy, entropy in reversible and irreversible processes, entropy and consequences of the second law, entropy and probability. Thermodynamic functions (Internal energy, enthalpy, Gibb’s functions, entropy, Helmholtz functions), Maxwell’s relations, TdS equations, energy equations and their applications, low temperature physics, liquefaction of gases, Joule-Thomson effect and its equations, thermoelectricity, thermocouple, Seebeck’s effect, Peltier’s effect, Thomson effect. Statistics: Statistical distribution and mean values, mean free path and microscopic
calculations of mean path, distribution of molecular speeds, distribution of energies, Maxwell distribution of velocities, Maxwell-Boltzmann energy distribution, Brownian motion, Diffusion conduction and viscosity, Van der Waal’s forces, equipartition of energy.

**PHY120 Electricity, Magnetism and Optics**

**Course Objectives:**
To extend the scope of the student's understanding of electricity and magnetism, using the language of vector calculus.

**Theory Course Outline:**
Electric force and its applications and related problems, Conservation of charge, charge quantization, Electric fields due to point charge and lines of force. Ring of charge, Disk of charge, A Point charge in an electric field, Dipole in an electric field, The flux of vector field, The flux of electric field, Gauss’ Law, Application of Gauss’ Law, Spherically symmetric charge distribution, A charge isolated conductor, Electric potential energy, Electric potentials, Calculating the potential from the field and related problem Potential due to point and continuous charge distribution, Potential due to dipole, equipotential surfaces, Calculating the field from the potential, Electric current, Current density, Resistance, Resistivity and conductivity, Ohm’s law and its applications, The Hall effect, The magnetic force on a current, The Biot-Savart law, Line of B, Two parallel conductors, Amperes’s Law, Solenoid, Toroids, Faraday’s experiments, Faraday’s Law of Induction, Lenz’s law, Motional emf, Induced electric field, Induced electric fields, The basic equation of electromagnetism, Induced Magnetic field, The displacement current, Maxwell’s equations, Electromagnetic spectrum, Reflection and Refraction of light waves, Total internal reflection, Two source interference, Double Slit interference, related problems, Interference from thin films, Diffraction and the wave theory, related problems, Single-Slit Diffraction, related problems, Polarization of electromagnetic waves, Polarizing sheets, related problems.

**Lab Course Outline**

1) To determine the variation of photoelectric Current with the change of intensity of light.
(Verification of inverse Square Law).

2) To determine the Resistivity and Conductivity of Eureka wire.

3) Making an Electromagnet.

4) An experiment for mutual induction.

5) To find the internal resistance of a galvanometer.

6) To convert a Weston type Galvanometer into an Ammeter of range 0→1A.

7) To convert a Weston type Galvanometer into Voltmeter of range 0→5V.
PHY121  
Applied Physics for Engineers  

Course Objectives:-

The aim of this course is to prepare students for careers in engineering where physics principles can be applied to the development of technology. This education at the intersection of engineering and physics will enable students to seek employment in engineering upon graduation while, at the same time, provide a firm foundation for the pursuit of graduate studies in either engineering or physics. The Engineering Physics program will develop sufficient depth in both engineering and physics skills to produce engineers who can relate fundamental physics to practical engineering problems. This course gives understanding about the concept of basic electrostatics, electric circuit, direct electromagnetic, alternating current, semiconductor, wave and the students can use knowledge to related fields.

Theory Course Outline:-

Electric force and its applications and related problems, conservation of charge, charge quantization, Electric fields due to point charge and lines of force. Ring of charge, Disk of charge, A point charge in an electric field, Dipole in an electric field, The flux of vector field, The flux of electric field, Gauss’ Law, Application of Gauss’ Law, Spherically symmetric charge distribution, A charge isolated conductor, Electric potential energy, Electric potentials, Calculating the potential from the field and related problems, Potential due to point and continuous charge distribution, Potential due to dipole, equipotential surfaces, Calculating the field from the potential, Electric current, Current density, Resistance, Resistivity and conductivity, Ohm’s law and its applications, The Hall effect, The magnetic force on a current, The Biot-Savart law, Line of B, Two parallel conductors, Amperes’ Law, Solenoid, Toroids, Faraday’s experiments, Faraday’s Law of Induction, Lenz’s law, Motional emf, Induced electric field, Induced electric fields, The basic equation of electromagnetism, Induced Magnetic field, The displacement current, Reflection and Refraction of light waves, Total internal reflection, Two source interference, Double Slit interference, related problems, Interference from thin films, Diffraction and the wave theory, related problems, Single-Slit Diffraction, related problems, Polarization of electromagnetic waves, Polarizing sheets, related problems.

Lab Course Outline:

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<th>Experiment#</th>
<th>List of Experiments</th>
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<tr>
<td>Experiment#1</td>
<td>Color Coding of resistors.</td>
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<tr>
<td>Experiment#2</td>
<td>Verification of Ohm’s law.</td>
</tr>
<tr>
<td>Experiment#3</td>
<td>Kirchhoff’s voltage law &amp; voltage dividing rule.</td>
</tr>
<tr>
<td>Experiment#4</td>
<td>Kirchhoff’s current law &amp; current dividing rule.</td>
</tr>
<tr>
<td>Experiment#5</td>
<td>To determine the Resistivity &amp; Conductivity of Eureka wire.</td>
</tr>
<tr>
<td>Experiment#6</td>
<td>To determine the Resistivity &amp; Conductivity of Copper wire.</td>
</tr>
<tr>
<td>-------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Experiment#7</td>
<td>To convert a Weston type Galvanometer into Ammeter of range 0-1A.</td>
</tr>
<tr>
<td>Experiment#8</td>
<td>To convert a Weston type Galvanometer into Voltmeter of range 0-5V.</td>
</tr>
<tr>
<td>Experiment#9</td>
<td>Determination of Frequency of AC Supply by Meld’s Apparatus.</td>
</tr>
<tr>
<td>Experiment#10</td>
<td>To determine the variation of photoelectric current by changing Intensity of light (Verification of inverse square law).</td>
</tr>
</tbody>
</table>

**PHY122**

**Electricity and Magnetism**

**Course Objectives:**
The objective of studying electricity and magnetism is to give the students the ability to solve practical problems involving fields, forces, and energy, and simple boundary value problems. In addition, the course develops the concepts of circuit theory from the fundamental field relationships, and discusses capacitance, resistance, and inductance from a fundamental point of view.

**Course Contents:**

**PHY132**

**Physics for Chemical Engineers**

**Course Objectives:**
Physics for Chemical Engineers offers a vast range of studying physical world and physical phenomenon to understand the subject. From engineering point of view, it will cover the basic characteristics of materials and practical examples of some electromagnetic processes in engineering problems. Further, this course covers the semiconductor physics in engineering domains. Study of laser physics, quantum physics and nuclear physics has been included to explore the knowledge about the physical systems at very small levels and at higher energy ranges.

**Course Contents:**

**PHY212**

**Introduction to Astronomy and Astrophysics**

**Course Objectives:**

After completing this course the student:

- will be familiar with the basic ideas and Stellar formation and evolution
- will have developed an understanding of current cosmological models of the universe.
- will be able to understand the history and evolution of the early universe.

**Course Contents:**


**PHY221**

**Circuit Theory**

**Course Objectives:**

- Review the basic electrical concepts of voltage, amperage and resistance
- Introduce basic wiring diagram symbols
- Review the characteristics of voltage, amperage, and resistance in series and parallel circuits, showing how they are used when diagnosing electrical problem.

**Theory Course Lab:**

**DEPARTMENT OF PHYSICS**

Power, RMS value, Power factor, Passive Components: Capacitors and Inductors- construction, Types and Ratings, First order R/L/C circuits: Source free RC and RL Circuits- Step and Steady state response Second Order R/L/C Circuits, Frequency Response and Filters:


**Lab Course Outline:**
All the labs are to be conducted using oscilloscope. Multimeter can be used to verify the readings taken with the oscilloscope.

- Resistors, capacitors and inductors. Their sizes and colour codes
- multimeter, power supply, oscilloscope and their usage
- Ohm's law graph using different values of resistors
- Kirchoff's laws with single voltage source
- Kirchoff's laws continued
- circuits with multiple voltage sources
- voltage division and current division circuits
- series and parallel resistor combinations
- nodal analysis verification
- loop analysis verification
- opamp circuits: inverting and non-inverting amplifier
- opamp circuits: comparator, DAC (digital to analog converter)
- opamp circuits: adder, subtractor
- superposition theorem
- Thevenin and Norton theorem
- RC charge-discharge
- opamp circuits: integrator and differentiator

**PHY222**

**Electric and Magnetic Fields I**

**Course Objectives:**
Electric and magnetic field I is designed to help students develop analytical and problem-solving skills. It provides opportunities for students to understand and apply the principles and concepts of physics to practical situations

**Course Contents:**
- Vector and scalar fields, differential and integral vector analysis, electric charge, electric fields, dipoles, continuous charge distributions, line and surface integrals, electric potential, Gauss' law, electric field of continuous charge distributions, conductors and insulators, electrostatic force, capacitors and dielectrics, DC circuits, Kirchhoff's laws, loop analysis, nodal analysis and
network theorems, RC circuits, step response, magnetic fields, charges moving in magnetic fields, magnetic force, Lorentz force, Ampere's law, vector potential, Biot-Savart law, applications of Ampere’s and Biot-Savart’s law.

PHY223
Electric and Magnetic Fields II
Course Objectives:-
To understand the basic ideas about electric force, electric field and magnetic field etc. Concept of energy and electric potential, Study of the materials, electronic properties together with practice in problem-solving. Induced electromotive force, induction, Time varying electric and magnetic Fields, Maxwells equations, and optics. To achieve a broad competence in the subjects covered, and be able to apply it to the solution of problems

Course Contents:-

Course Code: PHY224
Course Title: Circuit Analysis Theory
Credit Hrs. : 3(3, 0)

Introduction to static electricity, international system of units, charge, current, voltage and power, conductivity and resistivity of materials, atomic structure, conductors and insulators, Ohm’s Law, series/parallel combinations of resistances, voltage source in series, current source in parallel, Kirchhoff’s voltage and current (KVL & KCL) laws, applications of KVL & KCL for mesh and Loop analysis, Thevenin Norton theorems, max power theorems and applications to circuits, alternating voltages and currents, sinusoidal, square and triangular wave shapes, RC and RL time domain step response, RL, RC and RLC steady state frequency response.

Recommended Books:

PHY225
Modern Physics Concepts
Course Objectives:-
The course will provide an overview of topics in modern physics and will provide an initial platform for core courses in quantum mechanics, atomic physics, condensed state physics, and nuclear physics

Course Contents:-
Experimental basis of quantum physics: photoelectric effect, Compton scattering, black body radiation, photons, Franck-Hertz experiment, the Bohr atom, electron diffraction, De Broglie waves, and wave-particle duality of matter and light. e/m ratio, spin and Stern Gerlach expt., quantum numbers, selection rules, Zeeman effect, Pauli exclusion principle, Hund’s rule, periodic
Physics
Course Objectives:
This course is an introductory survey of modern physics. It is a grand sweep of 20th century physics encompassing the study of waves, the wave/particle duality of light, the Bohr atom, deBroglie waves, and an introduction to quantum mechanics in order to develop a qualitative understanding of the experimental evidence that supports modern physical theories. Quantum mechanics provides the foundation and explanatory framework of much of modern physics. This course provides some of the history of and the motivation for quantum theory, and investigates ways in which classical laws of physics must be modified - or even replaced - in order to account for the behavior of atoms and subatomic particles. Atomic structure, molecular structure and particle physics are explored as application areas of quantum mechanics. The principal objectives for this course are to learn the fundamental concepts, principles, and theories of modern physics and to develop the ability to solve problems.

Theory Course Lab:
Waves, their types and properties, thermal radiation, the photoelectric effect, the Compton effect, matter waves, de Broglie’s hypothesis, waves and particles, Heisenberg’s Uncertainty Principle, wave function, probability, barrier tunneling, electrons-free and bound, potential well. Hydrogen atom, angular momentum, atomic magnetism, Stern-Gerlach experiment, nuclear magnetism, the Zeeman effect, quantum theory of solids, conduction electrons in metals, density of states, band gaps, conductors, insulators, semiconductors, pn junctions and diodes.

Lab Course Outline:
- Determination of the Specific Charge of the Electron with the help of Fine beam tube, Helmholtz coils with holder and measuring device.
- Diffraction of electrons in a polycrystalline lattice (Debye-Scherrer diffraction) using the electron diffraction tube.
- Determining Plank’s constant (Selection of wavelengths with interference filters on the optical bench) using h/e Apparatus and h/e Apparatus Accessory Kit.
- Millikan’s Oil Drop Experiment (Demonstration of the Quantization of Charge)
- The Wave Model of light versus the Quantum Model using h/e Apparatus and h/e Apparatus Accessory Kit.
- The Relationship between Energy, Wavelength, and Frequency using h/e Apparatus and h/e Apparatus Accessory Kit.

Physics IV (Applied Quantum Mechanics)
Course Objectives:
The objective of this course is to achieve clear understanding of the basic concept of quantum physics; to apply quantum theory to simple models and to real physical systems, by moving onto advanced techniques and exploring modern concepts. The mathematical tools of quantum
mechanics such as linear spaces, operator algebra, matrix mechanics and eigen value problems all these are treated by means of dirac’s bra-ket notation. The formal foundations of quantum mechanics will be discussed and then deal with exact solutions of the schrodinger equation when applied to one dimensional and three dimensional problems. We then look at the stationary and time dependent approximation methods and finally the theory of scattering.

**Course Contents:-**

Review of classical Physics and its inadequacy, need for quantum principles; wave particle duality wave function and superposition principle, Heisenberg Uncertainty principle, Operators and Observables, expectation values, Complementarity, kets and bras, Dirac delta function, postulates of Quantum mechanics, raising and lowering operators. Schrodinger equation, boundary conditions, Solution of Schrodinger Equation for Stationary states, potential step, potential barrier, potential well, simple harmonic oscillator, hydrogen atom, Quantum tunneling and its applications to Solid State Electronics, Angular momentum and spin (many particle systems), Introduction to perturbation theory.
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PHY232
Vibrations and Waves
Course Objectives:-
Acquire knowledge about a variety of physical phenomena, including vibration.
- examples of harmonic oscillators
- superposition
- driven oscillations and resonance
- coupled oscillators and normal modes
- normal modes of continuous systems
- Fourier analysis
- group velocity and wave packets
- diffraction
- interference

Gain an appreciation of the wide applicability of vibration and wave concepts, and build physical intuition and experience with the mathematical description of physical phenomena.

Course Contents:-
Mechanical vibrations and waves, simple harmonic motion, normal modes, forced vibrations, resonance, coupled oscillations, driven coupled oscillators, vibrations of continuous systems, reflection and refraction, phase and group velocity, polarization, Rayleigh scattering, Snell's law, Fresnel equations, interference, thin films, Huygens's principle, Fraunhoffer diffraction, and gratings.

Applications to: Musical instruments, blue skies, red sunsets, haloes around the sun and the moon, glories, rainbows, glass bows, Doppler effect.

Course Code: PHY233
Course Title: Fundamentals of Electronics
Credit Hrs.: 3(3, 0)
Introduction to conductors, insulators, semiconductors in terms of resistivity, intrinsic semiconductors, doping of semiconductors, P and N type materials, PN junction(diode) and biasing, forward and reverse characteristics of diode, applications of diode, as rectifier, clipper and clamper etc., other diode types, zener, photo, light emitting diode, construction operation and characteristics of bipolar junction transistor(BJT), application of (BJT) as amplifier and switch, construction and operation of field effect transistor(FET), multistage amplifiers, introduction to operational amplifiers and their use in inverting and non inverting amplifiers.

Recommended Books:

PHY241
Classical Mechanics
Course Objectives:-
The main objective of this course is to prepare the students for the study of modern physics. The formulations of classical mechanics serve as the springboard for the various branches of physics. This course will provide the opportunity to students to master many of the mathematical techniques necessary for quantum mechanics while still working in terms of the familiar concepts of classical physics.

Course Contents:-
Review of Newtonian mechanics, generalized coordinates and principle of virtual work problem, conserved quantities, Lagrange and Hamilton principle, Lagrangian with constraints, Lagrange equations of motion, central force motion, Kepler’s problem, orbits, elastic collisions,
Rutherford scattering, inelastic scattering, Lagrangian for rigid bodies, inertia, symmetric top, angular momentum, free top, Euler angles, Hamiltonian equation of motion, Noether's theorem, canonical equations and phase space, canonical transformation, Poisson brackets.

PHY271
Boundary Value Problems
Course Objectives:-
The objective of this course is to provide an introductory overview of linear partial differential equations (PDE) as they apply in engineering and physics problems. Basic physical laws are reviewed and applied to the derivation and interpretation of initial- and boundary-value problems. In more specific terms, the course has the following four objectives:

- to provide students with a basic knowledge of Fourier series and separation of variables
- to show students how to formulate physical problems in terms of partial differential equations
- to show students how to find insight into the physical behavior of systems from the mathematical solutions
- to motivate students to learn mathematics by presenting a number of interesting case studies

Course Contents:-

PHY324
Physics V (Electromagnetic Theory)
Course Objectives:-
To understand the basic ideas about electric and magnetic fields and their propagation. The study of electromagnetic waves. Concept of Energy and potential, Energy theorem and Poynting vector. Time varying fields, Maxwell's equations, Boundary conditions in EM fields. EM wave equations, To achieve a broad competence in the subjects covered, and be able to apply it to the solution of problems

Course Contents:-

PHY341
Relativity
Course Objectives:-
The purpose of this course is to provide a compact coverage of special relativity using the 4-vector formalism with an introduction to tensors at the level needed for special relativity. Successful completion of this course will open up to the student a big range of physics literature involving special relativity, in fields such as particle physics and astrophysics. The course will prepare students for later study of general relativity and relativistic quantum mechanic. There will be a strong focus on the development of problem solving skills.

Course Contents:-
Vectors and tensors, Euclidean and Minkowski space tensors, introduction and pre-Einstein relativity, Einstein's principle of relativity and a new concept of space-time, Lorentz transformations, the great kinematics consequences of relativity, inertial and non-inertial frames; velocity addition and other differential transformations, kinematics and “paradoxes”, relativistic Doppler effect, relativistic momentum and energy I: Basics, relativistic momentum and energy: four vectors and transformation properties, covariance of Maxwell equations, light cone, Ricci tensors, Robertson Walker metric, Einstein’s equations, cosmological redshift, Hubble’s law, microwave background, big bang cosmology, history of the universe, neutron stars, black holes.

PHY342
Quantum Mechanics I
Course Objectives:-
- Quantum mechanical solution of simple systems such as the harmonic oscillator and a particle in a potential well.
- Improved mathematical skills necessary to solve differential equations and eigen value problems.
- Experience in computer simulation and modeling.

The overall intent of this course is to build upon your foundation from Quantum Mechanics has many new concepts including operators, observables, Hilbert space, and state functions. The book starts with the Schrödinger equation and applies it to simple physical systems.

Course Contents:-
Review of basic concepts of quantum mechanics, time dependent and independent Schrodinger equation, solutions to Schrodinger's equation in one dimension: transmission and reflection at a step, barrier penetration (tunneling), potential wells, Schroedinger's equation in three dimensions: central potentials, Hydrogen atom, angular momentum and spin, the radial equation and operator methods, addition of angular momentum, the simple harmonic oscillator, introduction to Hydrogenic systems, atomic spectra, introduction to the quantum mechanics of identical particles.

PHY343
Quantum Mechanics II
Course Objectives:-
This course will continue on the study of quantum systems using advanced mathematical techniques. In this course, we will examine the fundamental phenomena associated with quantum mechanics. In addition, we shall explore how these phenomena relate to atomic physics. Our aim will be to develop a quantitative description of these phenomena. In particular, to learn how to do quantum mechanics, rather than what quantum mechanics means.

Course Contents:-
Degenerate Fermi systems, charged particles in a magnetic field, time-independent perturbation theory, time-dependent perturbation theory, second quantization, Fermi- Golden rule, variational and semi-classical methods, scattering theory, natural units, adiabatic approximation and Berry's phase, quantum computing.

PHY345
Statistical Mechanics
Objectives:-
The objective of the course is to approach the thermodynamic properties of systems from the statistical point of view. Students will be taught to address problems of systems consisting of large number of particles by studying their collective behavior.

Course Contents:-
Review of Thermodynamics: micro and macrostates of a thermodynamic system,
thermodynamic functions and Maxwell’s relations, specific heat; Introduction to probability theory: elementary statistical concepts, random walk problem, calculation of mean values, Gaussian probability distribution, Maxwell velocity distribution; Ensemble Theory: concept of a statistical ensemble, phase space of a classical system, basic postulates of ensemble theory, partition function, microcanonical ensemble, quantum states and phase space; Canonical ensemble: a system in a canonical ensemble, partition function, statistical definition of entropy, classical systems (equipartition and virial theorems), ideal monoatomic gas and Gibb’s paradox, ideal diatomic gas, system of harmonic oscillators, paramagnetism, two-level systems and negative temperatures; Grand canonical ensemble: system in a grand canonical ensemble, physical significance of the statistical quantities, examples; Kinetic theory of gases: Maxwell’s velocity distribution and mean values, examples; Quantum Statistics of ideal gases: Maxwell-Boltzmann statistics, photon statistics and black body radiation, Bose-Einstein statistics, Fermi-Dirac statistics, conduction electrons in metals.

**PHY350**

**Solid State Physics**

**Course Objectives:**
This course deals with crystalline solids and is intended to provide students with basic physical concepts and mathematical tools used to describe solids. The course will provide a valuable theoretical introduction and an overview of the fundamental applications of the physics of solids. This course includes theoretical description of crystal and electronic structure, lattice dynamics, and optical properties of different materials (metals, semiconductors, dielectrics, magnetic materials and superconductors), based on the classical and quantum physics principles. This information is required to tailor modern materials for the high-tech and industrial electronics as well as the efficient daily use devices.

**Course Contents:**

**PHY351**

**Lasers and Fiber Optics**

**Course Objectives:**
After reviewing fundamental concepts in optics, this course provides an introduction to two major fields in optics. A quantitative treatment of optical fibers and waveguides discusses coupling of light into these structures as well as optical properties of various types of fibers and waveguides. This follows by a discussion of fundamental mechanisms that are responsible for the generation of laser radiation. Various types of lasers and their properties are also considered.

**Course contents:**
DEPARTMENT OF PHYSICS


PHY352 Engineering Optics
Course Objectives:-
At the end of the course the student should be able to:

- Understand the utility of physical and thermal characterization techniques in materials science and engineering
- Understand various microscopy techniques like optical, scanning electron and transmission electron microscopy and their applications in materials science
- Understand the phenomenon of diffraction and its utility in materials science
- Have a overview of thermal characterization of materials

Course contents:-
A phenomenological introduction to applied optics, interactions between light and materials, properties of light, lenses and mirrors, simple optical systems, telescopes and microscopes, introductions to optical fibers, lasers, and holography. Experiments designed to illustrate properties of light and optical systems, reflection and refraction, lenses and lens systems, optical instruments, interference and diffraction, polarized light, laser principles.

PHY353 Optics and Laser
Course Objectives:-
After reviewing fundamental concepts in optics, this course provides an introduction to two major fields in optics. A quantitative treatment of optical fibers and waveguides discusses coupling of light into these structures as well as optical properties of various types of fibers and waveguides. This follows by a discussion of fundamental mechanisms that are responsible for the generation of laser radiation. Various types of lasers and their properties are also considered.

Theory Course Outline :
Fiber optic communication system, introduction; Optics review, Ray theory, Lenses, Imaging, Diffraction; Lightwave Fundamentals; Integrated Optic Waveguide; Optic Fiber waveguide; Laser as light sources; Properties of Laser light; Monochromaticity, Gaussian Beams; Polarization, Interference and Coherence; Stimulated Emission, Einstein Coefficients; Threshold and Steady State Conditions; Emission and absorption in a two level system, Three, and Four Level Laser Systems; Laser Examples, Gas Lasers, laser diodes, DFB laser; Measurement Techniques, Detectors; Fiber components, Modulation; Noise and detection.

Lab Course Outline:
- Determine the wavelength of sodium light by spectrometer.
- Determine the wavelength of LASER(He-Ne) used in laboratory purposes by diffraction grating.
- Determine the index of refraction of the glass from which the prism is made at the wavelengths of the visible lines in the mercury spectrum by spectrometer.
- Measuring the index of refraction of glass.
- Measuring the index of refraction of prism
- Measuring the width of single slit by diffraction technique.
- Beam divergence and convergence by lenses.
- Verifying the Snell’s law and measuring the index of refraction of liquid.
- Measuring the critical angle of liquid and verifying the total internal reflection of light.
- Verifying the law of reflection and to prove that \( \theta_i = \theta_r \).
- Measuring the diameter of pinhole by diffraction from small holes.
- Measuring the index of refraction of liquid using diffraction technique.
- Measure the light intensity transmitted through two polarizers and the angle, 0, of the axes of polarizer’s.

**PHY354**  
**Fundamental Properties of Solids**  
**Course Objectives:**  
The objective of this course is to understand structure of materials, defects in materials, and introduction to materials characterization. Structure of materials covers the fundamentals of crystallography and diffraction. Defect in materials include deformation, electrical, magnetic, optical, and chemical properties, as well as the rates of diffusion in solids.  
**Course contents:**  
Periodic structure and symmetry of crystals, diffraction from crystals (X-ray and Neutron), reciprocal lattice, Brilloin zones, types of bonding, chemical bonding, Lattice dynamics, elastic waves, phonons, thermal properties, defects in crystals.

**PHY361**  
**Mathematical Methods of Physics**  
**Course Objectives:**  
The course aims to teach a variety of mathematical methods essential for technical proficiency in advanced undergraduate physics and engineering,. The class will focus on developing both an understanding of basic techniques and skill in their application. Connections will be made with topics covered in other physics courses. Little stress will be placed on proving mathematical theorems.  
**Course contents:**  
Complex numbers, Complex variables, Cauch-Riemann Equations, Residue theorem, group theory, Fourier and Laplace transforms, evaluation of integrals, Special functions: Legendre, Laguarre, Bessel functions, spherical harmonics, summation of series, Asymptotic solutions to initial- and boundary-value problems, eigenvalue problems.

**PHY362**  
**Computational Physics**  
**Course Objectives:**  
The fundamental objective of the Computational Physics course is, to provide an insight to the students in methods of simulation of phenomena and processes. To achieve this objective a prerequisite knowledge of information technology is required. The laws of physics govern many of the sectors of science and technology, and the techniques of modeling and simulation that are applicable to physics have applications in many other scientific and technological fields, e.g. the laws and the computational techniques of dynamics, statistical physics, electromagnetism, and quantum mechanics.  
**Course contents:**  
Computational techniques for scientific problems with emphasis on practical applications and effective programming. Review of computer programming, floating-point numbers, and numerical stability, polynomial interpolations, solutions of non-linear equations, solutions of difference and differential equations, survey of basic numerical algorithms and numerical subroutine libraries and their application to scientific problems, simulations and Monte Carlo. Use of at least one package such as matlab, maple, mathematica.

**PHY363**  
**Theory of Errors and Research Methodology**  
**Course Objectives:**  
There are errors associated to instruments, with human beings and to our mathematical limitations. The error theory tells how to express the magnitude of a measurement; both in term of direct and indirect measurements. The second part of the course is research methodology, which refers to the analysis of principles of methods, rules and techniques. Research methodology involves the collection of theories, concepts or ideas, comparative studies to different approaches and individual methods which are conduced when a research work is performed.
**PHY422**  
**Electromagnetic Theory and Applications**

**Course Objectives:**
To understand the basic ideas about electric and magnetic fields and their propagation. The study of electromagnetic waves. Concept of Energy and potential, Energy theorem and Poynting vector. Time varying fields, Maxwells equations, Boundary conditions in EM fields. EM wave equations. To achieve a broad competence in the subjects covered, and be able to apply it to the solution of problems.

**Course contents:**
Properties of plane e-m waves in free space, the wave equation, Poynting's theorem, electromagnetic waves in non-conducting media, electromagnetic waves in conductors, dispersion, radiation of electromagnetic waves, electric dipole radiation, electric quadruple radiation, magnetic dipole radiation, radio transmission: polarization of em waves, the electric and magnetic dipoles as receiving antennas, dielectric wave guides and optical fibers, transmission line theory and concepts, antennas and equivalent principles.

**PHY425**  
**Microelectronics**

**Course Objectives:**
Microelectronics is the branch of electronics concerned with or applied to the realization of electronic circuits or systems from extremely small electronic parts. It include the design, production and application of any microminiaturization technique to reduce the cost, size and weight of electronic parts, subassemblies and assemblies and to replace vacuum-tube circuits with solid compatible parts. The main objectives of this course is to give an overview of semiconductor manufacturing processes and discuss the physics behind the key processes.

**Course Contents:**
Microfabrication Principles - Materials, devices and fabrication; Basic properties of semiconductor materials - crystal structure, crystal growth and defects, Particle kinetics; Vacuum Technology, Pressure measurement; Epitaxial semiconductor growth - Vapor phase epitaxy of silicon, MBE, MOCVD; Thin film deposition - chemical and physical vapor deposition; Oxidation - silicon oxide structure, thermal oxidation process; Diffusion - Principles of diffusion, diffusion profiles in Si; Ion implantation - Ion-solid interactions, Ion implantation in Si, implantation damage and annealing; Lithography - Resist systems, Optical lithography and Metallization; Etching Chemical etching, process integration.

**PHY433**  
**Nuclear Physics**

**Course Objectives:**
The objective of this course is to provide an overview of the fields of nuclear and particle physics to the level where one should be able to understand how one have arrived at the present description of matter and its interactions and to have a good idea of the basis of current research. Experimental methods and theoretical description of particle and nuclear physics: applied relativistic quantum mechanics, symmetries of fundamental interactions, experimental techniques, structure of the nucleon, electromagnetic and weak interactions, elementary particles and the Standard Model. The components of nucleons, quarks, and the other fundamental components, leptons, are then revealed as the building blocks of all matter.

**Course Contents:**
Properties of nuclei, nuclear forces, models of nuclei, nuclear decays, electromagnetic...
interactions, weak interactions, passage of nuclear radiations through matter and methods of detection, nuclear reactions, nuclear reactions in sun, fission, fusion, nuclear reactors, neutron physics, quarks in nuclei, heavy-ion reactions, introduction to high-energy accelerators.

**PHY441**  
**Electronic Properties of Solids**  
**Course Objectives:**  
To understand basic ideas about band structure, the electrical and magnetic properties of solids. Transport mechanism of electrons in solids. Study of the materials, electronic properties together with practice in problem-solving. Concept of Fermi energy and the Fermi surface. Free electron approximation. To achieve a broad competence in the subjects covered, and be able to apply it to the solution of problems  
**Course Contents:**  

**PHY451**  
**Semiconductor Devices**  
**Course Objectives:**  
The course teaches the physical foundations underlying the operation of modern electronic solid-state devices. Conduction processes going on in the semiconductor will be discussed. Design and device of the modern electronic devices are the subject of interest. Quantum mechanical foundations will be emphasized. As the spatial dimensions of electronic and photonic heterostructure devices shrink, the inclusion of quantum mechanics provides a useful description of many physical processes.  
**Course Contents:**  
General introduction to semiconductor and semiconductor devices, Energy band in solids, charge carriers, Intrinsic and extrinsic material, state and carrier distribution, carrier concentrations and its dependence on temperature, carrier drift, diffusion of carriers, resistance, band bending, recombination and generation of carriers, photo and thermal generation, PN junction electrostatics, the Ideal diode equation, reverse bias break down, Capacitance of semiconductor, Optoelectronics diodes/pn junction, Bipolar junction transistor(BJT) and its static characteristics, Metal semiconductor junctions, Metal oxide semiconductor (MOS) system and its electrostatic-quantitative formulation, MOS capacitance, MOS field effect transistor(MOSFET).

**PHY452**  
**CMOS Technology**  
**Course Objectives:**  
This course will give a state of the art review of principals, concepts and techniques required to produce successful designs of Complementary Metal Oxide Semiconductor CMOS technologies. After completion of course the student would be able to have insight to future challenges in CMOS design.  
**Course Contents:**  
A description of integrated circuit fabrication technology and how it is used to fabricate CMOS devices, MOS capacitor and its application as a varactor), the MOS transistor, sub-micron devices such as: velocity saturation; breakdown; drain-induced barrier lowering; random dopant fluctuations, etc. relationship between device geometry, e.g. length, and fabrication, e.g. doping, and the corresponding circuit performance.
PHY453
Device Design and Simulations
Course Objectives:-
To familiarize students with the behavior of semiconductor electronic devices, including an understanding of how to design, model and simulate the devices to obtain the desired characteristics. Virtual optimization and realization of devices before actual fabrication will be accomplished.
Course contents:-
Review of semiconductor electronics, band model for solids, free carriers statistics, transport in semiconductors, drift mobility, hot electrons, diffusion; Fundamental equations for semiconductor devices: current equations, Poisson equation, study cases, continuity equations; P-N junctions: potential barriers, quasi-neutrality, static properties, reverse biased junctions, avalanche and Zener breakdowns; Current in PN Junctions: Shockley-Hall-Read Model, I-V characteristics, charge storage and transients, numerical simulation of PN Junctions; Bipolar transistors: basic properties, transistor action-Gummel number, amplifications, switching; Bipolar transistors, limitations and models: Early effect, low and high emitter biases, base resistance, base transit time-charge control model and transients ; MOS systems: energy band diagram, accumulations, depletion, inversion, capacitance, MOS electronics, threshold voltage, oxide and surface charges; MOSFET: basic theories and models, MOSFET parameters, Body effects, transconductance, speed of response, channel-length modulation, MOSFET design, control of the threshold voltage, CMOS, technological evolution.

PHY454
Optoelectronics
Course Objectives:-
This course deals with optoelectronic devices and principles. In particular, optical properties of semiconductors are discussed in detail. Optoelectronic devices based on bulk semiconductors as well as heterostructures are also examined.
Course contents:-

PHY 455
Introductions to Biophysics
Course Objectives:-
The aim of this course is to introduce the student to the interdisciplinary field of biophysics. The goal of the course is to obtain a basic understanding of the key concepts of biophysics, especially molecular biophysics, kinetics of biological systems, membrane and cell biophysics, bioelectricity, and biological motors.
Course contents:-
Nature and subject of Biophysics; Molecular structure of biological systems; Energetics and dynamics of biological systems; Physical factors of environment; The kinetics of biological systems; Application of principles of physics to biological problems as well as to single protein molecules. Review of membrane and cell biophysics; theoretical and mathematical bases of bioelectricity, photobiology and biomolecular motors.

PHY457:
Lasers and their Applications
Course Objectives:-
The main objective of the course is to introduce the students to basic principles, characteristics, and some applications of Lasers. This course provides the foundation for further studies at graduate level in the field of Lasers and Applied Photonics.

**Course Contents:**

**PHY461 Industrial Automation**

**Course Objectives:**
- The purpose of this course is to study the elements and methods of control system operations used in the industry to control industrial processes. This course provides the student with a basic foundation in industrial electronics. Students will gain an understanding of common industrial electronics concepts, components, and applications. This course discusses the underlying principles of process control, Programmable logic controllers PLCs, very general selection of components and connection for centralized monitoring and supervisory control. Concepts can be applied to benefit for small commercial operations, large industrial plants and commercial building automation.

This course covers a broad range of electronic devices and components, how they operate, how they are typically used, and how to effectively troubleshoot them. This course especially helps the students a lot, in their final year projects.

Therefore this course must be included in the undergraduate Electronics degree so that the students may get some introduction about what is going on in the industry.

**Course contents:**
- 1. Introduction to process control: Introduction, control systems, process control block diagram, control system evaluation, analog and digital processing, units standards and definitions, sensor time response, significance and statistics.


  - 4. Thermal sensors: Introduction, metal resistance versus temperature devices, thermistors, thermocouples, other thermal sensors, design considerations.

  - 5. Mechanical Sensors: Introduction, displacement, location, or position sensors, strain sensors, motion sensors, pressure sensors, flow sensors.


  - 8. Discrete state process control: Introduction, definition of discrete state process control, characteristics of system, relay controllers and ladder diagrams, programmable logic controllers (PLCs).
9. Controller principles: Introduction, process characteristics, control system parameters, discontinuous controller modes, continuous controller modes, composite control mode.

10. Analog controllers: Introduction, general features, electronic controllers, pneumatic controllers, design considerations.


PHY462
Introduction to Nanoscience and Technology
Course Objectives:-
The main aim of the course is to introduce the basic notions of Nanoscience and Nanotechnology and establish the basics of physical properties of materials at Nanometer scales and their relation to technology of production of Nano devises and Nano materials.

Course Contents:-
Introduction to main principles and concepts of nanotechnology with an exploration of impact of nanotechnology across a vast array of fields including health care, manufacturing, environment, biotechnology, energy and food production, and information technology. Physics of low dimensional materials: density of states, electrical, optical, magnetic properties; Introduction to nanostructured materials, theory of processes to design materials with nanostructure, and properties and behavior of nanostructured materials. Basic techniques and theory of modern characterization methods of nanomaterials. Techniques include: electron microscopy, scanning probe microscopy, diffraction spectroscopy and emission spectroscopy. Review of current nanotechnology applications including societal effects.

PHY463
Introduction to Material Science and Engineering
Course Objectives:-
The main objective of this course is to establish the basic structure/property relationships in materials through studying the bonding, crystalline structure, defects and diffusion phenomena. Hence the ultimate goal of the course is to provide the fundamental knowledge necessary to understand important concepts in materials science and engineering, and how these relate to engineering design and manufacturing.

Course Contents:-
Atomic Structure and Bonding: Electronic structure of atoms, Energy diagram, Electronic structure and chemical reactivity, Primary atomic bonds, ionic, covalent and mixed bonding Crystal Structure and Crystal Geometry: Space lattice, unit cells, Bravais lattice; Solidification: Formation of s table nuclei, grain structure, Solidification of single crystals; Crystalline Imperfection and Diffusion in Solids: Point defects, line defects, grain boundaries, Rate processes in solids, Atomic diffusion and diffusion mechanisms, Effect of temperature, impurity diffusion in Si wafers;Mechanical Properties of Materials: Extrusion, Rolling, Elastic and plastic deformation, Stress-Strain relationship, Recovery and recrystallization. Ductile and brittle fracture; Phase diagrams: Gibbs phase rule, Phase diagram of pure substances, Binary phase diagram;

Type of Materials and Applications: Alloys, Ceramics, Polymers, composites, and their industrial applications.

PHY457
Lasers and Their Applications
Course Objectives:
The main objective of the course is to introduce the students to basic principles, characteristics, and some applications of Lasers. This course provides the foundation for further studies at graduate level in the field of Lasers and Applied Photonics.


PHY468
Introduction to Group Theory
Course Objectives:
After the course the students will be familiar with the concept of symmetry groups and their representations. The student will be able to apply group theory to the physics of molecules, solids and elementary particles.

Course contents: Fundamental concepts in group theory and representation theory, Point groups and the Permutation groups, Rotation groups, Space groups, Applications in spectroscopy, Continuous groups, Lie algebras, SU(N) groups and applications in particle physics, General treatment of Lie groups, Poincaré and Lorentz groups

PHY469
Introduction to Astrophysics and Cosmology
Course Objectives:
- will be familiar with the basic ideas and Stellar formation and evolution
- will have developed an understanding of current cosmological models of the universe.
- will be able to understand the history and evolution of the early universe.


PHY471
High Energy Physics I
Course Objectives: This course is designed to give a broad introduction of elementary particle physics. The material includes discussions of accelerators, particle detectors, the quark model of elementary particles and the Standard Model of the weak, electromagnetic and strong interactions. The course will include the phenomenology and experiments of both the latest advances in particle physics, and some important historical milestones. The quest is not over and many questions remain unanswered---they will be briefly discussed as well.

Course contents: Introduction to HEP, Units in HEP, Brief introduction of particle accelerators and detectors, Principle of particle detection, Class of Particles and their quantum numbers, Leptons, Quarks, Gauge Bosons, Higgs Boson, Hadrons, Particle Representations, Schrödinger, Klein-Gordon, Dirac and Proca equations, Type and range of forces, EM Interaction, Weak Interaction, Strong Interaction, Symmetries and Conservation laws - continuous and discrete transformation Quantum
numbers, P, C, T, Parity violation, CP violation, Brief introduction of SU(N) symmetries, Isospin symmetry, Quark model, Light Mesons, Light Baryons, Baryon mass splitting, Introduction to colour Quantum number, Colour wave functions and Pauli principle.

PHY476
High Energy Physics II
Course Objectives: This one-semester course designed to give a balanced introduction to the elementary particle physics, covering the theoretical concepts and major experimental results. It will provide an excellent opportunity to get acquainted with our current understanding of universe and the way its works.
Course contents: Bound states , Fine structure, Lamb shift, Hyperfine Structure, positronium, Quarkonium, Hydronic Masses and Magnetic Moments, The Feynman Calculus, Life time and Cross Sections, The Golden rule, The Feynman rule for toy theory, higher order Diagrams, Introduction to Quantum electrodynamics (QED), The Feynman rule for QED, Casimir’s trick and trace Theorm, cross-section and decay rates, Electrodynamics of quark and hadrons, Electron quark interaction, Hadron production in electron-positron scattering, Inelastic electron –Proton scattering, elastic electron –Proton scattering, the Parton Model and Bjorken Scaling, Quark Distribution Functions, Weak interactions, Charge weak interactions Of quark, Neutral weak interaction, Introduction to Quantum Chromodynamics (QCD), Brief introduction to Gauge theories.

PHY465
Introduction to Materials Science
Course Objectives:-
To gain an understanding of the relationships between the structures, properties, processing and applications of metallic, ceramic, polymeric and electronic materials. This course also provides the solid knowledge of the fundamental mathematics, natural sciences and materials science and engineering necessary for success in industry or graduate school.
Course Contents:-
Atomic Arrangement in Materials; reciprocal lattice Structural Imperfections, Atomic Movement; Engineering Alloys, Physical and Mechanical Behavior of Materials; Deformation, Phase Diagrams, Cold Working, Work Hardening, Annealing, Hot Working; Solidification, Cast structures; Solid State Transformations; Heat Treatment; Failure of Materials; Types of Materials, (Ceramics, Polymers, Composites etc)

PHY478
Quantum Computing
Course Objectives:-
The main aim of the course is to introduce the basic notions of quantum computing with particular emphasis on quantum algorithms as well as to identify the essential difference between the classical paradigm and the quantum paradigm of computation showing the advantage of quantum computing over the classical one.
Course Contents: -
The field of quantum computing has gained a lot of interest of the people who are working in the areas of Physics, Mathematics, Computer Science and Electrical Engineering. This course therefore provides theoretical understanding about the quantum computing principles and the related issues to the
undergraduate students of the final year who intend to continue graduate studies in this rapidly growing field of interest.

**Outline:** A brief history behind the quantum computing, quantum mechanics and computers, quantization, state vectors and Dirac notation, probability interpretation, eigenstates and eigenvalues, unitary operators, product state and entangled state, Hamiltonian, unitary evolution, operators and observables, from cbits to qubits, some fundamental logic gates, qbits and their physical realization, bell state/EPR pair, quantum circuits, no cloning theorem, quantum teleportation, superdense coding.

**CSC101**  
**Introductions to Computing**  
**Course Objectives:**  
This course is an introduction to a broad class of computer issues. It is designed for students who are not CS majors and who have had little or no previous experience with computers.

**Course Contents:**  
Introduction to Computers and computing; Classification of computers; Elements of computers; Basic Computer Architecture; Control Unit; Arithmetic & Logical Unit (ALU operations); Main Memory (ROM,RAM, Cache);CPU Operation; The Registers; Input & Output Devices; Storage Media; Data Representation; Software Concepts; System Software; Operating Systems; Basic Input Output Software (BIOS); Disk Operating system; Windows 95/98/XP/2000; Application Software; Data base Management Systems; Communication System; Security Issues; Threats to computers & communication systems; Computer Networks; Internets; Artificial Intelligence-Commerce; Computer Labs; Word processing tools & Internet; Databases; Spreadsheet; Presentation tools; User Designed Application Software.

**CSC103**  
**Introduction to Computers and Programming**  
**Course Objectives:**  
This course introduces the basics of computer hardware and software. Purpose of this course is to make the students familiar with the computer and enable the student to develop simple computer programs.

**Course Outline:**  
What is computer; Computer Architecture; Computer components (software, hardware and utility); Components of a microcomputer; CPU structure and function; Types of software; Introduction to languages; Languages history; Language types and level; IDE; Basic data types; Keywords, pseudo code and flowcharts; Operations; Expression; Assignment sequence; Program control if and else statements; For, while and do while loops; Switch statements; Compound statements; Functions and Parameters; Arrays declaration; Array passing to functions; String; Strings manipulating; pointers; Recursion; Introduction to abstract data type; Structure declaration and initialization; Accessing members of Structure; File processing reading, writing, randomly accessing data structures.

**CSC141**  
**Object Oriented Programming**  
**Course Objectives:**  
Introduction to Computer and Programming aims to familiarize students with the fundamental concepts of computer, computer programming and program execution and to enable the student to develop simple computer programs.

**Course Outline:**  
The need of this course is to develop fundamental skill and techniques of problem analysis and solution synthesis using a computer; Introduction (computer & language); Computer components
(software, hardware and utility); Types of software; Languages history; Language types and level; IDE; Basic data types; Key words pseudocode and flowcharts; Operations; Expression; Assignment sequence; Program control if and else statements; For, while and do while loops; Switch statements; Compound statements; Functions and Parameters; Arrays declaration; Array passing to functions; String; Strings manipulating; Pointers; Recursion; Introduction to abstract data type; Structures declaration and initialization; Accessing members; File processing reading, writing, randomly accessing data structures; Introduction to OOP reading, writing, randomly accessing data structures; Introduction to OOP.

CSC241
Object Oriented Programming

Course Objectives:-
To develop familiarity with Object Oriented Concepts, Classes and their usability in languages and to let them implement those concepts in the lab keeping in mind the real-world problems.

Course Outline:-
Object-oriented programming basics; identifying class objects; differences between procedural languages and OOP languages; function identification/attribute identification; class declaration/scope and access modifiers; Class and data abstraction; constant functions; friends functions; operator overloading; restriction on overloading; overloading unary and binary operator; base class and derive class; protected members; method overriding; public, protected and private inheritance; constructors and destructors in derived classes; virtual functions and polymorphism; abstract classes and concrete classes; dynamic binding using new and delete operators; virtual destructors; template classes/functions; overloading template functions; template stacks and template queues; exception handling using throw, catch and try.

HUM100
English Comprehension and Composition

Course contents:-
The course will help students in developing the competencies to understand English and express themselves effectively in the same language both in writing and speaking. This course is designed to improve students' abilities to paraphrase, summarize, and synthesize and to correctly and effectively express them. Students learn to write more effectively through a variety of assignments that highlight the writing and revision process, effective sentence formation, paragraph development, and the format of essays. This course will emphasize the use of correct grammar, spelling, punctuation, and mechanics. Students will be required to apply these skills to all writing assignments.

HUM102
Report Writing Skills

Course contents:-
This course has been specifically designed to meet the writing needs of students aiming for a specialization in areas of Management. The aims and objectives of this particular course are to introduce course participants the importance, needs, varieties, and technicalities of business reports. Aspects of written business reports such as organization, contents, impact, and style will be highlighted. Students will aim for proficiency in writing letters, memos, messages, resumes and applications etc. Students will learn basic writing techniques such as: how to use an active voice, how to apply the 7 C's of writing, how to avoid using jargon or offensive phrases and how to write with a YOU attitude. They will also learn about the proper formats for letters, memos and proposals. By the end of this course, students will be able to write clear, concise business correspondence with style and confidence.

HUM103
Communication Skills

Course contents:-
This course is designed to develop student’s reading, writing, listening and speaking skills at an advanced level through language experience, free writing, drafting, peer response, revising and editing. This course will enable the students to organize messages that are appropriate to the audience and situation. Students improve oral communication skills for professional and social interaction through extensive pronunciation and conversational practice. Individual pronunciation assessments help students refine their language skills. Practice includes forming and communicating opinions on contemporary issues, developing formal and informal oral presentations and reports, giving and following directions. Through readings and written exercises, students learn how to form, communicate, and support their opinions and ideas in academic and professional settings. Students strengthen their reading skills and expand their vocabularies by reading and discussing a variety of adapted and authentic texts. They also may present findings in research reports.

HUM110
Islamic Studies
Course contents:-
The subject introduces Islamic thought in comparison with other major world religions. The topics included are beliefs and actions: Islam and other world religions, basic sources of teaching, obligations towards God, self and others, and Islamic teachings of collectivism.

HUM111
Pakistan Studies
Course contents:-
The course seeks to provide an appreciation and understanding of the cultural, historical and socio-political heritage of Pakistan and instills in the students a sense of sacrifices which have been made by many to establish Pakistan as an independent country. At the same time, students are encouraged to develop analytical and interpretative skills, and are challenged to evaluate and analyze points arising from the course contents in a balanced and logical manner.

EEE121
Electric Circuits Analysis I
Course Objectives:
This is the very first undergraduate course which is aimed to build an understanding of the concepts and ideas explicitly involved in the introductory electric circuit theory. The course is designed to emphasize the relationship between conceptual understandings and practical problem-solving techniques involved in the circuit theory. In short, the course will provide students with a strong foundation of electric circuit knowledge and practices.

Course Outline:

EEE222
Electric Circuits Analysis II
Course Objectives:
EEE 222 is a continuation of EEE 121, in which we study DC circuits, but in EEE 222 we mainly deal with AC circuits. The main objective of this course is to inculcate in students the abilities to

- analyze AC circuits
- understand and analyze poly-phase circuits, manipulate ac power measurements
- understand transfer function and frequency response of a circuit, sketch Bode plots
- design frequency selective circuits using passive circuit elements
- analyze two port circuits

Course Outline:

EEE223
Signals and Systems
Course Objectives:
The purpose of this course is to equip students with fundamental theory of systems and signal for application in communication, control, computing and power engineering. Basic concepts of continuous and discrete LTI signals and systems and Fourier transform are discussed. Determine whether a signal has the following properties: Discrete time, continuous time, power, energy, periodic, aperiodic, even, odd. Evaluate the convolution sum and integral given an input and the impulse response. Determine whether the DTFS, FS, DTFT, or FT representation is appropriate for a give signal.

Course Outline:

EEE231
Electronics I
Course Objectives:
This is a fundamental level course in electronic devices and circuit theory. The main objective of this course is to make students understand the construction, operation and modeling of semiconductor devices and to inculcate in them the ability to analyze and design various electronic circuits.

Theory Course Outline:

**Lab Course Outline**
1. Introduction to laboratory equipment i.e oscilloscope, power supply e.t.c
2. Op-amp based circuits
   - Inverting non-inverting integrator differentiator peak detector
3. Half Wave and Full Wave rectifier
   - Rectifiers with filters
4. Zener diode as a regulator
5. Clippers and clammers
6. Implementation of logic GATES using diodes
7. Introduction to Transistor components, Transistor as switch
8. $V_{BE}$ versus $I_C$ Calculation
9. Implementation of logic GATES using transistors
10. DC Biasing of Transistors
11. Transistors as an Amplifier
12. 100 mV AC to 5 V DC Conversion
13. FET operations
14. Power supply

**Software:**
A brief introduction to one of the following simulation software is also required

- Electronics work bench
- Orcad
- Multisim

### EEE232
**Electronics II**

**Course Objectives:**
This is course is a continuation of EEE231 Electronics-I. The main objective of this course is to inculcate in students the ability to analyze and design basic analog electronic circuits that will be used as building blocks in the design of larger systems.

**Theory Course Outline:**

Lab Course Outline

<table>
<thead>
<tr>
<th>Experiment#</th>
<th>List of Experiments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment#1</td>
<td>Low Pass Filter in Frequency Domain</td>
</tr>
<tr>
<td>Experiment#2</td>
<td>Hi Pass Filter in Frequency Domain</td>
</tr>
<tr>
<td>Experiment#3</td>
<td>Signal Output Analysis; Square wave with different duty cycles, sine wave with voltage and frequency variations</td>
</tr>
<tr>
<td>Experiment#4</td>
<td>Reading a Resistor, Capacitor; and Understanding Lab Apparatus</td>
</tr>
<tr>
<td>Experiment#5</td>
<td>Transistor Amplifier; Small Signal Model</td>
</tr>
<tr>
<td>Experiment#6</td>
<td>Transistor Amplifier; Large Signal Model</td>
</tr>
<tr>
<td>Experiment#7</td>
<td>Charging and Discharging of Capacitor in RC Circuit Charging</td>
</tr>
<tr>
<td>Experiment#8</td>
<td>Charging and Discharging of Capacitor in CR Circuit Charging</td>
</tr>
<tr>
<td>Experiment#9</td>
<td>Voltage Gain of Cascaded Amplifier</td>
</tr>
</tbody>
</table>

Projects

Semester Projects using different ICs, BJTs and MOSFETS.
Course Objectives:
This is a basic course which concentrates on the basic methods of digital hardware designing. The students will learn different techniques to design simple to moderate level hardware. The course contains extensive lab work, in which students will learn to design at IC level. Students will also learn designing using VHDL.

Theory Course Outline:

Lab Course Outline
Week 1: Introduction to MATLAB:
To get familiar with the MATLAB working environment. Use the help system to study basic MATLAB commands and syntax. Declare and process matrices. Simple plot commands.

Week 2: Signal plotting of continuous & discrete time signals
To declare Continuous and discrete signals on MATLAB and plot various continuous and discrete signals.

Week 3: Discrete Time Signal & Systems
To provide an overview of discrete time signals and systems on MATLAB. To analyze various properties of discrete signals and verify them on MATLAB.

Week 4: Z–Transform

Week 5: Discrete Time Fourier Transform
To form a routine of discrete time Fourier transform on Matlab and find discrete time Fourier transform of various signals on Matlab. Also analyze different application of discrete time Fourier transforms.

Week 6: Image Processing

Week 7: Speech Processing

Week 8: Fast Fourier Transform
To analyze fast Fourier algorithms and see how it can efficiently be used to calculate discrete Fourier transform.

Week 9: Digital Filter Design
To design and simulate Infinite Impulse Response (IIR) Filters and Finite Impulse Response (FIR) filters and analyzes their responses on Matlab.

Week 10: Introduction to SIMULINK
To get familiar with SIMULINK working environment. Construction of different models in SIMULINK. Simulate and observe the responses.

Week 11: Applications to SIMULINK
To see how different tool boxes can be used and to find various transforms on simulink by using
EEE324
Digital Signal Processing
Course Objectives:
The course would cover all the aspects concerning the signal and systems, their mathematical description and representation, transformations and analytical framework in discrete domain. It will also provide thorough information about the design of multirate systems and filter design techniques. The implementation of systems in discrete domain using FFT is emphasized. This course covers the techniques of modern digital signal processing that are fundamental to a wide variety of application areas. Review of the mathematical basis of discrete-time signal analysis, discussion of the theory and implementation of fast Fourier transform algorithms, and discussion of the design and implementation of digital filters is covered.

Course Outline:

EEE325
Control Systems
Course Objectives:
This course lays emphasis on mathematical modeling and analysis of various physical systems and then the design of a controller to improve the performance of the system according to the desired/given specifications. The objective of the course is to develop a critical thinking within the students to investigate the real world systems and then they should be able to design a strategy for better performance of the particular system.

Theory Course Outline:

Lab Course Outline

CONTROL SYSTEM LAB REPORT

1. Revision of C++ basics.
2. Introduction to MATLAB
3. Mathematical operations, and polynomials in MATLAB.
4. Different matrix operations in MATLAB.

5. Intro. To different types of plots in MATLAB

6. How to initialize and solve transfer functions.

7. Use of ACSYS to solve the problems stated in book.


10. Some System design using simulink.

11. Filter designing using Simulink.

12. Intro. to GUI

**EEE342**

**Microprocessor Systems and Interfacing**

**Course Objectives:**

This is course is a continuation of EEE241 Digital Logic Design. The main objective of this course is to develop the logical thinking of students towards the hardware implementation of logic using microprocessor or microcontroller interfaced with some other components via electric circuits. Objective of this course is to enable a student to use the microcomputer for variety of purposes as control, telemetry, digital systems etc. Course focuses on Memory and I/O interface design and programming, study of microprocessor and its basic support components including CPU architecture, memory interfaces, bus concepts, serial I/O devices, and interrupt control devices. Laboratories directly related to microprocessor functions and its interfaces.

**Course Outline:**


**EEE351**

**Principles of Communication Systems**

**Course Objectives:**

The course objective is to familiarize students with the fundamental principles of communication theory. The fundamental components of a analog and digital communication system will be outlined and the concept of modulation will be explained. Concepts e.g. analog amplitude modulation, frequency modulation, analog to digital conversion, digital modulation schemes, multiplexing and multiple access will be studied, including their performance in the presence of noise.

**Course Outline:**

EEE371
Electrical Machines

Course Objectives:
The objective of the course is to familiarize the students with the fundamental concepts of electric machines relating there construction working and applications.

Theory Course Outline:
Magnetic Circuits, Review of Induction Laws, Transformers, Ideal Transformer, Equivalent Circuit of a Transformer, Types and Construction of Transformers, Voltage Regulation and Efficiency, Parallel Operation & Load Sharing, Autotransformers, Instrument Transformers, 3-phase Transformers, Fundamentals Theory of DC Machines, DC Generators and their Equivalent Circuits, Shunt and Series DC Generators, DC Motors and their Equivalent Circuits, Separately Excited, Shunt and Series DC Motors, DC Machines Efficiency Calculations, Starter Circuits, Torque-Speed Curves, Speed Control Methods, Fundamentals Theory of AC Machines, Rotating Magnetic Field, Synchronous Generators & Motors, Three Phase Induction Motors, Torque-Speed Curves, Starting Methods, Power Factor Control, Single-Phase Induction Motors, Operation, Principles, Starting Methods, Torque Equations, Universal Motors, Hysteresis Motors, Reluctance Motors, Special Purpose Motors, Stepper Motors, Disk Motors.

Lab Course Outline
1) Low pass RL filter
2) Making a Step Down Transformer (10 turns per volt)
3) Making a Step Up Transformer (10 turns per volt)
4) Making a Current Transformer
5) Electromagnet design
6) DC motor basics
7) DC motor winding
8) Open Air DC motor with moveable Electromagnet
9) Pole calculations of Induction motor

EEE463
Antennas and Radio Waves Propagation

Course Objectives:
This course follows Electromagnetic Theory which deals with basics of Antennas and Wave Propagation. Effort has been made to balance the course. Nearly equal emphasis has been given to antennas and wave propagation. Textbooks on the subject are either too much mathematical or written for the technicians. Effort has been made to balance the two approaches. Students will benefit most from the class lectures and notes. After completing the course, the students will have a good understanding of the fundamentals, and a broad exposure to antennas and wave propagation. They will have some idea of the practical factors involved in antenna layout.

**Theory Course Outline:**

**Lab Course Outline**
1. Introduction to HFSS
2. 3D Modeling, Properties, Commands & Attributes
3. Wave Port Excitation, Radiation Setup and Analysis
4. Ultra High Frequency Probe
5. Monopole and Dipole Antennas
6. Micro strip Patch Antenna
7. Different Types of Antennas Modeling
8. Introduction to AWR
9. Project
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