Course Synopsis

<table>
<tr><td>Course Code</td><td colspan="2">PHU5318</td><td>Level</td><td colspan="3">5</td></tr>
<tr><td>Course Title</td><td colspan="6">Electronics for Biology Students</td></tr>
<tr><td>Credit value</td><td colspan="6">3</td></tr>
<tr><td>Core/Optional</td><td colspan="6">Optional</td></tr>
<tr><td>Prerequisites</td><td colspan="6">Non – Physics students</td></tr>
<tr><td rowspan="2">Hourly breakdown</td><td colspan="2">Theory</td><td>Practical hours</td><td>Independent Learning</td><td>Assessments</td><td>Total hrs</td></tr>
<tr><td>Sessions X 2
= 15 x 2hrs
=30 hrs</td><td>DS hrs
= 4 x 3 hrs
= 12 hrs</td><td>Lab hrs
= 5 x 6 hrs
= 30 hrs</td><td>• Recommended readings Sessions (Online /Audio-visual materials and other learning resources) = (15 x 3hrs) = 45 hrs
▪ Lab report preparation = (10 x 2) = 20 hrs
▪ Group Learning = 9 hrs</td><td>▪ Continuous Assessments (CA) = 2 hrs
▪ Practical assessments (PA) = 2 hrs</td><td>150 hrs</td></tr>
<tr><td>Course Aim/s.</td><td colspan="6">The aim of this course is to encourage biology students to get involved in understanding the analytical instruments and to use them with more confidence .</td></tr>
<tr><td>PLOs addressed by course</td><td colspan="6">PLO1: Knowledge - Explain the fundamental, principles and broader knowledge pertaining to the chosen science disciplines offered for the BSc degree.
PLO2 Practical Knowledge and Application - Acquire competency in practical skills and the necessary knowledge to appropriately use these skills.
PLO3: Communication - Communicate reliably, efficiently and effectively to present information, ideas and concepts to the scientific community as well as to the wider society.
PLO4: Individual Work, Team Work and Leadership - Function effectively as an individual, and as a team member, sharing work and experiences, leading and managing assigned tasks to completion on time, demonstrating leadership to address situations in diverse and multi-disciplinary environments in day to day life.
PLO5: Creativity and Problem Solving - Identify problems and argue out and analyze such problems using qualitative and/or quantitative practical approaches in scientific methodology to provide valid conclusions.
PLO6: Adaptability and Flexibility - Develop appropriate strategies to adapt to changing environments.
PLO7: Information and Communication Technology Literate: Effectively use ICT skills for numerical and statistical analysis keeping up to date with knowledge and skills.
PLO8: Vision for Life: Identify where one wants to be and develop long term goals maintaining competency to conduct scientific investigations and proceed to undertake further studies.
PLO9: Lifelong Learning: Foresee new trends and recognize their impact, and update knowledge and develop new skills to meet future changes and challenges.</td></tr>
<tr><td>Course Learning Outcomes (CLO)</td><td colspan="6">After completing this course the students should be able to:
CLO01 : describe the basic analogue and digital electronics components (PLO01)
CLO02 : understand the working principle of different electronic circuits (PLO01,PLO02)
CLO03 :solve questions on dc circuits, ac circuits, diode and transistor circuits, op-amps, low voltage power supply, combinational logic circuits, sequential logic circuits.(PLO02 , PLO03)
CLO04 : assemble a given electronic circuit at the laboratory practical sessions (PLO02, PLO03, PLO04 , PLO05, PLO06)
CLO05 : prepare a report on practicals while analysing and criticizing the findings(PLO 03)</td></tr>
<tr><td>Content
(Main topics, sub topics)</td><td colspan="6">• Simple electronics circuits – Electric current, voltage , The relationship between voltage and current , Resistors used in electronics circuits , Value represented by the resistor- colour code, Variable resistors , Power in resistors , Maximum power transfer theorem, Equivalent circuit , Resistors in series and parallel, Thevenin's equivalent circuit, Kirchoff's law , Application of Resistors , Capacitors in dc circuits , Equivalent capacitor , Charging a capacitor , Discharging a capacitor
• Alternating current circuit – Resistors in AC circuits , Capacitors in AC circuits , RC circuits , Inductors in AC circuits , RL circuits , LCR series circuits
• Application of LCR circuits – RC filters , Low – pass RC filters , High pass RC filters , Band pass RC filters , Resonance circuits and active filters , wave shaping circuits , RC differentiator circuit , Integrator circuits
• Semiconductor diodes – Semiconductors , Atomic structure of Silicon , N- type and P- type semiconductors , P-N junction diodes , Current through a diode , Application of PN junction diode, Rectifier diodes , diode switch , Clipping circuits , Zener diodes , Light Emitting diodes , Photo diodes
• Bipolar junction transistors – current flow in a transistor , transistor configurations, Biasing a transistor , Input output characteristics of a transistor , Signal amplification by a transistor , Single stage transistor amplifier
• Operational amplifiers – open loop and closed loop amplifiers , Ideal op-amp approximations , op-amp applications, Inverting amplifiers , summing amplifiers , Non inverting amplifiers , Differential amplifiers , Logerithemic amplifiers , Integrators , Differentiators , Details of op-amp Ic – CA741
• Low voltage power supplies-Battery , Primary cells , Secondary cells , AC to DC convertors , Voltage reduction of an AC signal , Rectification , Half wave rectification , full wave rectification , Smoothing , voltage regulation , three terminal fixed regulators , Three terminal adjustable regulators
• Introduction to Digital electronics – Digital electronics and binary number system , Basic logic gates , AND gate , OR gates , NOT gates , NAND gates , Exclusive OR gate , Boolean algebra , Digital logic families , Logic IC parameters , TTL gates , CMOS gates ,
• Combinational Logic gates – De Morgan's theorem , Designing of combinational logic circuits using truth tables , Mathematical operations using combinational logic gates , Half adder and full adder circuits
• Sequential Logic circuits – Flip flops , clocked RS flip flop , D – type flip flop , JK - flip flop , registers , Data</td></tr>
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<tr><td></td><td colspan="2">registers , Shift registers , Counters
• Colorimeters – Beer – Lambert's law , Concept of a colorimeter , Electronics circuits of a colorimeter
• Spectrophotometer - Basic principles of physics for Spectrophotometer , Components of Spectrophotometer , Wavelength selecting mechanism and related electronics , Detection of transmitted radiation , analyzing data
• Other analytical instruments -pH meter , conductivity meter, ECG , etc..</td></tr>
<tr><td>Teaching Learning methods (TL)</td><td colspan="2">• Self-Learning/Independent learning
  • Instructional Material (IL)
  • Online Activities (OL)
  • Reference Work (RE)
• Compulsory contact sessions
  • Practical Sessions (PR)
  • Assessments (AS) and Feedback – MCQs (MCQ);Structured Essay (SEQ); Presentations (PS); Viva voce (VV); Reports (RE);
• Non-compulsory contact sessions
  • Day Schools (DS)
  • Group Learning (GL)</td></tr>
<tr><td rowspan="2">Assessment strategy</td><td>Overall Continuous Assessment Mark (OCAM): 40 %</td><td>Final Assessment: 60 %</td></tr>
<tr><td>Details: Continuous Assessment (CA):
36% of Best NBT + 24% of other NBT % (2 hrs)
Practical Assessment (PA) : (2 hrs)
40% of PM%
(Participation for the practical session is compulsory)</td><td>Final Evaluation
Theory: 100 % (2 hrs)</td></tr>
<tr><td>Recommended Readings:</td><td colspan="2">[1] Pau; Horowitz, DThe Art of Electronics . Cambridge: Cambridge University Press.
[2] Thomas C. Hayes, Students Manual for The Art of Electronics , Cambridge: Cambridge University Press</td></tr>
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