Micro-Syllabus of CSIT Physics

Text Book **(A):** Garcia Narciso, Damask Arthur, ***Physics for Computer Science Students***, Springer-Verlag

Reference Books:

(B): Heliday David, Resnick Robert and Walker Gearl, ***Fundamentals of Physics***, 9th ed., John-Wiley and Sons, Inc.

(C): Francis W. Sears, Hugh D. Young, Roger Freedman, Mark Zemansky, ***University Physics***, Volume 1 & 2, 14th ed., Pearson Publication

(D): Knight Randall D., ***Physics for Scientists and Engineers: A Strategic Approach***, 3rd ed., Pearson Publication

Unit	Content	Teaching Methodology			Teaching Hours
		Modes	Text Book (A)	Reference Books	
UNIT 1: Rotational Dynamics and Oscillatory Motion (5 hrs)					
1	Moment of inertia and torque	Multimedia	p98-p99	Ref. B, D	1 hour
1	Rotational kinetic energy	Multimedia	p101-p104	Ref. B, D	1 hour
1	Conservation of angular momentum	Board & Marker	p106-p109	Ref. B, D	1 hour
1	Oscillation of spring: frequency, period, amplitude, phase angle and energy	Board & Marker	p132-p141	Ref. B, D	2 hours
1	***Numerical (12)***	Board & Marker ***(a few problem can be discussed)***	**Text Book (A):** **Example:** 8.1, 8.2, 8.4, 10.2, 10.3 **Problems:** 8.1, 8.2, 8.7, 8.18, 10.5, 10.13, 10.18 **Note:** *Reference C is preferred for additional numerical.*		*(Tutorial: 2 hours)*
UNIT 2: Electric and Magnetic Field (5 hrs)					
2	Electric field and potential	Multimedia	p188-p195	Ref. B, D	2 hours
2	Magnetic field & Force on current carrying wire *(should be extended up to torque)*	Board & Marker	p228-p232	Ref. B, D	1 hour
2	Magnetic dipole moment, Force on a moving charge	Board & Marker	p232-p234	Ref. B, D	1 hour
2	Hall effect, Electromagnetic waves	Multimedia	p235-p239	Ref. B, D	1 hour
2	***Numerical (12)***	Board & Marker ***(a few problem can be discussed)***	**Text Book (A):** **Example:** 14.1, 14.2, 14.3, 16.1, 16.2 **Problems:** 14.6, 14.8, 14.21, 16.1, 16.2, 16.12, 16.13 **Note:** *Reference B. C is preferred for additional numerical.*		*(Tutorial: 2 hours)*
UNIT 3: Fundamentals of Atomic Theory (8 hrs)					
3	Blackbody radiation	Board & Marker	p244-p247	Ref. C, D	1 hour
3	Bohr atom, Spectrum of Hydrogen	Board & Marker	p269-p274	Ref. C, D	2 hours
3	Franck-Hertz experiment	Multimedia	p274-p277	Ref. B, D	1 hour
3	de Broglie's hypothesis and its experimental verification	Multimedia	p280-p282	Ref. B, D	1 hour

3	Uncertainty principle and its origin	Board & Marker	p285-p289	Ref. B, C	1 hour
3	matter waves and the uncertainty principle	Board & Marker	p289-p290	Ref. B, C	1 hour
3	group velocity	Multimedia	p292-p293	Ref. B, C	1 hour
3	***Numerical (11)***	Board & Marker ***(a few problem can be discussed)***	**Text Book (A):** **Example:** 18.2, 19.1 **Problems:** 18.1, 18.2, 18.3, 18.19, 19.2, 19.7, 19.11, 19.16, 19.19 **Note:** *Reference C is preferred for additional numerical.*		*(Tutorial: 2 hours)*
UNIT 4: Methods of Quantum Mechanics (5 hrs)					
4	Schrodinger theory of quantum mechanics and its application	Board & Marker	p298-p303	Ref. C, D	1 hour
4	Outline of the solution of Schrodinger equation for H-atom	Board & Marker	p323-p326	Ref. C, D	2 hours
4	space quantization and spin	Multimedia	p326-p332	Ref. C, D	1 hour
4	Atomic wave functions	Multimedia	p333-p336	Ref. C, D	1 hour
4	***Numerical (8)***	Board & Marker ***(a few problem can be discussed)***	**Text Book (A):** **Example:** 20.2, 21.2 **Problems:** 20.1, 20.2, 20.3, 20.12, 21.3, 21.6 **Note:** *Reference C is preferred for additional numerical.*		*(Tutorial: 2 hours)*
UNIT 5: Fundamentals of Solid State Physics (6 hrs)					
5	Crystal structure, Crystal bonding	Board & Marker	p348-p358	Ref. C & D	1 hour
5	Classical and quantum mechanical free electron model	Board & Marker	p362-p367 p370-p375	Ref. C & D	2 hour
5	Bloch theorem, Kronig-Penny model, Tight-binding approximation	Board & Marker	p396-p415	Ref. C & D	2 hour
5	conductors, insulators and semiconductors	Multimedia	p415-p417	Ref. C & D	30 minutes
5	effective mass and holes	Multimedia	p417-p420 p422-p423	Ref. C & D	30 minutes
5	***Numerical (9)***	Board & Marker ***(a few problem can be discussed)***	**Text Book (A):** **Example:** 23.1, 23.2 **Problems:** 22.1, 22.3, 22.4, 22,5, 22.9, 24.6, 24.8 **Note:** *Reference C is preferred for additional numerical.*		*(Tutorial: 2 hours)*
UNIT 6: Semiconductor and Semiconductor devices (8 hrs)					
6	Intrinsic and extrinsic semiconductors (1)	Board & Marker	p430-p444	Ref. B, C & D	2 hours
6	Electrical conductivity of semiconductors (1)	Board & Marker	p446-p448	Ref. B, C & D	1 hour
6	Photoconductivity (1)	Multimedia	p448-p449	Ref. C	1 hour

6	Metal-metal junction: The contact potential, The semiconductor diode (2)	Board & Marker	p454-p465	Ref. C	2 hours
6	Bipolar junction transistor (BJT), Field effect transistor (FET) (2)	Board & Marker	p465-p477	Ref. C	2 hours
6	Numerical (11)	Board & Marker ***(a few problem can be discussed)***	**Text Book (A):** **Example:** 25.2 **Problems:** 25.1, 25.2, 25.3, 25.13, 25.16, 26.1. 26.2. 26.3. 26.4, 26.5 **Note:** *Reference C is preferred for additional numerical.*		*(Tutorial: 2 hours)*
UNIT 7: Universal Gates and Physics of Integrated Circuits (8 hrs)					
7	Universal gates		p488-p494	Ref. C	1 hour
7	RTL and TTL gates		p494-p496	Ref. C	1 hour
7	Memory circuits, Clock circuits		p497-p500	Ref. C & D	2 hours
7	Semiconductor purification: Zone refining, Single crystal growth		p504-p508	Ref. D	2 hours
7	Processes of IC production		p508-p511	Ref. D	1 hour
7	Electronic component fabrication on a chip		p511-p515	Ref. C & D	1 hour
7	Numerical (4)	Board & Marker ***(a few problem can be discussed)***	**Text Book (A):** **Problems:** 27.1, 27.6, 27.9, 27.10 **Note:** *Reference C is preferred for additional numerical.*		*(Tutorial: 1 hour)*
Total Lecture and Tutorial Hours					**45 lectures *(+13 Tutorial Hours)***

CSIT FIRST SEMESTER PHYSICS EXPERIMENTS

Students should perform at least 5 experiments (at least one from each groups) in a group of 2 students. They should submit report of the experiment individually. Students should write their lab report of each experiment in this format:

Name of the Experiment:
Apparatus Required:
Theory/Working Formula
Observation
Calculation
Result
Error Analysis
Discussion

The list the experiments are as follows:

(1) Determine the moment of inertia and angular acceleration of a flywheel.

OR

Study Bar Pendulum and find moment of inertia and angular acceleration about various fix points.

OR

Study Torsional pendulum and find moment of inertia and angular acceleration.

(2) Determine the capacitance of a capacitor by ac bridge (de-Sauty's method).

OR

Study the characteristics of Zener diode its use as voltage regulation

OR

Design and study the parallel LCR circuits for finding the quality factor of the elements.

(3) Study the temperature dependence of resistance of a given semiconductor.

OR

Study and determine the band gap in metals and semiconductors using appropriate method.

(4) Study the drain and transfer characteristics of junction field effect transistor (JFET).

OR

Study RS-Flip-flop using breadboard.

(5) Design and Study the LOGIC Gates: NOT, AND, OR, NOR & NAND Using TTL. Also Study the Power Loss in NOT Gate.

OR

Study NAND/NOR gates as Universal logic gates.

Evaluation: The duration of practical examination will be 3 hours. Students should perform one experiment, took own observational data, calculate the result and interpret it using suitable error analysis. The internal and external examiner (appointed by the Dean Office) will evaluate the performance in this format:

(1) Experiment: 40%
(2) Write-up: 30%
(3) VIVA Examination: 30%

Model Question

Course Title: Physics (PHY113) **Full Marks: 60**
Semester: I **Pass Marks: 24**
Duration: 3 Hours **Credit Hour: 3**

Attempt any TWO questions. [10 x 2 = 20]

1. What do you mean by the equilibrium current across the *pn* junction? Use Fermi-Dirac statistics and Maxwell-Boltzmann distribution to show the flow of electrons from *n* to *p* is equal to the flow from *p* to *n*. How electron current from *p* to *n* (that is, associated with minority carriers) is not affected by the height of the potential energy barrier? Explain. [10]

2. Set up differential equation for an oscillation of a spring using Hooke's and Newton's second law. Find the general solution of this equation and hence the expressions for period, velocity and acceleration of oscillation. [10]

3. Set up Schrodinger equation for Hydrogen atom using spherical polar coordinates and separate radial and angular part of this equation. Without solving radial and angular equations, discuss the quantum numbers associated with these. [10]

Attempt any EIGHT questions. [5 x 8 = 40]

4. Explain Hall effect and discuss the importance of Hall voltage while manufacturing electronic devices. [5]

5. What do you mean by Bloch theorem? Discuss its use in Kronig-Penny model and hence in band theory. [5]
6. Describe the following process of IC production: (a) Oxidation, (b) Pattern definition, and (c) Doping. [5]
7. A given spring stretches 0.1 m when a force of 20 N pulls on it. A 2-kg block attached to it on a frictionless surface is pulled to the right 0.2 m and released. (a) What is the frequency of oscillation of the block? (b) What is its velocity at the midpoint? (c) What is its acceleration at either end? (d) What are the velocity and acceleration when x = 0.12 m, on the block's first passing this point? [5]

8. Two large parallel plates are separated by a distance of 5 cm. The plates have equal but opposite charges that create an electric field in the region between the plates. An a particle (q = 3.2 x 10^{-19} C, m = 6.68 x 10^{-27} kg) is released from the positively charged plate, and it strikes the negatively charged plate 2 x 10^{-6} sec later. Assuming that the electric field between the plates is uniform and perpendicular to the plates, what is the strength of the electric field? [5]

9. What are (a) the energy, (b) the momentum, and (c) the wavelength of the photon that is emitted when a hydrogen atom undergoes a transition from the state n = 3 to n = 1? [5]

10. For a free quantum particle show that the wavefunction, $\psi(x,t) = Acoskx\, e^{-i\omega t}$ satisfies the time dependent Schrodinger equation. [5]

11. Copper has a face-centered cubic structure with a one-atom basis. The density of copper is 8.96 g/cm^3 and its atomic weight is 63.5 g/mole. What is the length of the unit cube of the structure? [5]

12. The output of a digital circuit (y) is given by this expression:
$$y = (\bar{A}B + \bar{C}A)(\overline{B + C})$$
Where A, B and C represent inputs. Draw a circuit of above equation using OR, AND and NOT gate and hence find its truth table. [5]