Welcome to

PH101: Physics-I

[2–1–0–6]

(July –Nov 2012)

Instructor: Dr. Dipak K. Goswami

Room# 002, Dept. of Physics

Tel: 2722

Email: dkg@iitg.ernet.in

http://www.iitg.ernet.in/physics/fac/dkg/

Lecture Schedule

For Div-I: ME, CE, ECE, EEE, BT+ Back loggers

Wednesday: 9:00 - 9:55 am

Thursday: 10:00 - 10:55 am

For Div-II: CSE, CL, EPH, CST, MC, DD+Back loggers

Wednesday: 4:00 - 4:55 pm

Thursday: 3:00 - 3:55 pm

Venue: Lecture Hall-L3

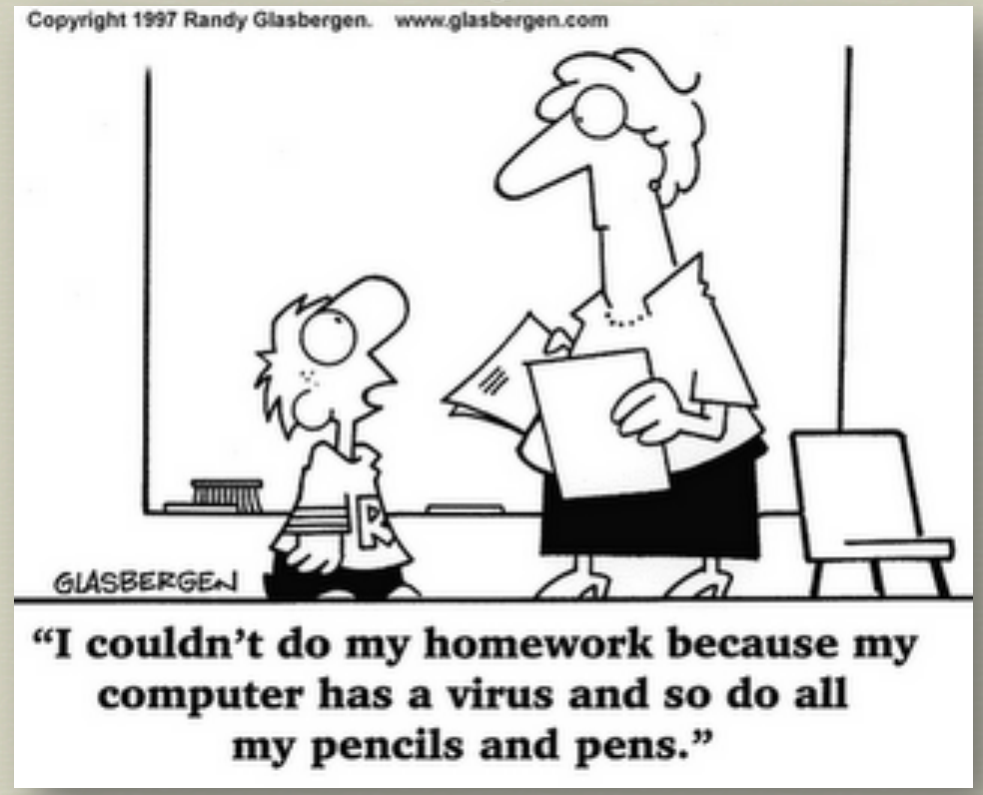
Tutorials

Tuesday: 8-8.55 am (for All)

- ✓ **A set of problems will be given to you at the end of every week. You need to solve the problems at home. Solution will be due on next Tuesday.**
- ✓ **Tutorials will be posted on the website every Friday in the afternoon. Hard copy will be available in the Xerox shop at Core – IV.**
- ✓ **Attendance is MUST and you need to arrive in your tutorial room at 8:00 am SHARP. You will not be allowed to attend afterwards.**
- ✓ **Come prepare with all the solutions and solve in the black board. Your EXPART tutors will guide you in case you need help and discuss the critical points.**
- ✓ **You MUST try to solve the problems at home. You might be asked to show the evidences that you have tried to solve at home.**

Tutorials

Tuesday: 8-8.55 am (for All)



No Excuses!

Tutorials Groups

Group	Roll No	Room No	Tutors
T1	120102001 – 120102047	L1	Dr. S. Basu
T2	120102048 – 120103022	L2	Dr. P. Agarwal
T3	120103023 – 120103069	L3	Dr. T. N. Dey
T4	120103070 – 120104035	L4	Dr. S. Ghosh
T5	120104036 – 120106003	1006	Dr. D. Pal
T6	120106004 – 120106050	1G1	Dr. D. K. Goswami
T7	120106052 – 120106056 120108001 - 120108042	1G2	Dr. P. K. Padmanavan
T8	120101001 – 120101047	1207	Dr. P. Poulose
T9	120101048 – 120101080 120107001 – 120107014	2101	Dr. S. B. Das
T10	120107015 – 120107061	2102	Dr. G. S. Setlur
T11	120107062 – 120107069 120121001 – 120121039	3202	Dr. B. R. Barua
T12	120121040 - 120122042	4001	Dr. A. Sil
T13	120122043 - 120123044	4G3	Dr. S. Thota
T14	120123045 – 120205047 + BL	4G4	Dr. D. Pamu

Exam Schedule

Exam	Date & Time	Marks
Quiz – I	**Aug 21 @ 8:00-8:55 am**	10 %
Mid Sem	Sep 21 @ 10:00-12:00 noon	30 %
Quiz – II	**Oct 16 @ 8:00 -8:55 am**	10 %
End Sem	Nov 23 @ 9:00-12:00 noon	50 %

Quiz Venue: Your Tutorial Room

Mid-Sem/End-Sem Exam details see institute timetable:

http://shilloi.iitg.ernet.in/~acad/intranet/tt/ett.htm

Grading Scheme

Grade	Marks
AA	≥ 85
AB	≥ 75
BB	≥ 70
BC	≥ 60
CC	≥ 50
CD	≥ 45
DD	≥ 35
F	< 35
I	< 75% attendance

Important Instructions

- **Students MUST attend all classes regularly. At least 75% attendance will be needed to be allowed to appear in the End Semester examination. Attendance in the tutorials is a must for all the students.**

- **Tutorials will be posted on the website every Friday in the afternoon.**
  http://www.iitg.ernet.in/physics/fac/dkg/

- **Hard copy of the tutorials will be available from the Xerox shop in Core-IV**

Course Materials

http://www.iitg.ernet.in/physics/fac/dkg/

SURFACES, INTERFACES & NANOSCALE SCIENCE

DR. DIPAK K GOSWAMI
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Research Areas

- Nanoscale Science
- Surface and Interface Science
- Organic Semiconducting Thin Films and Nanostructures
- X-ray Physics
- Ion-Solid Interactions

Current Research Topics

- Growth of Organic Thin Films by Thermal Evaporation Technique for the Application in Organic Thin Film Transistors (OTFTs) and Organic Light Emitting Diode (OLEDs)
- Growth of Nanostructures and Their Characterizations
- Understanding the Growth Mechanisms for the Growth of Inorganic and Organic Thin Films.

Recently Attended Conferences

International Conference for Young Researchers on Advanced Materials (ICYRAM 2010)
July 1 -6, 2012, Singapore

- **International Conference on Fundamental and Applications of Nanotechnology (ICFANT 2010)**
Dec 9 -11, 2010, Jadavpur Univeristy, India
- **Theme Meetings on Quantum Structures**

Recent Activities

Past Event:

Second International Conference on Advanced Nanomaterials and Nanotechnology (ICANN-2011), Dec 8-10, 2011 jointly organized by Department of Physics and Center for Nanotechnology, IIT Guwahati.
Chairman: P. K. Giri
Co-Chairman: D. K. Goswami

Edited Volumes as Guest Editor:

Course Materials

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SURFACES, INTERFACES & NANOSCALE SCIENCE

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PH101: Physics I (July-Nov 2012)

General Instructions

Calender [pdf]

Lecture Time Table:

Wednesday	Thursday
9:00 - 9:55 (for DIV-I) 16:00 - 16:55 (for DIV-II)	10:00 - 10:55 (for DIV-I) 15:00 - 15:55 (for DIV-II)

Tutorial Time Table:
Tuesday: 8:00 - 8:55 (For All Students)

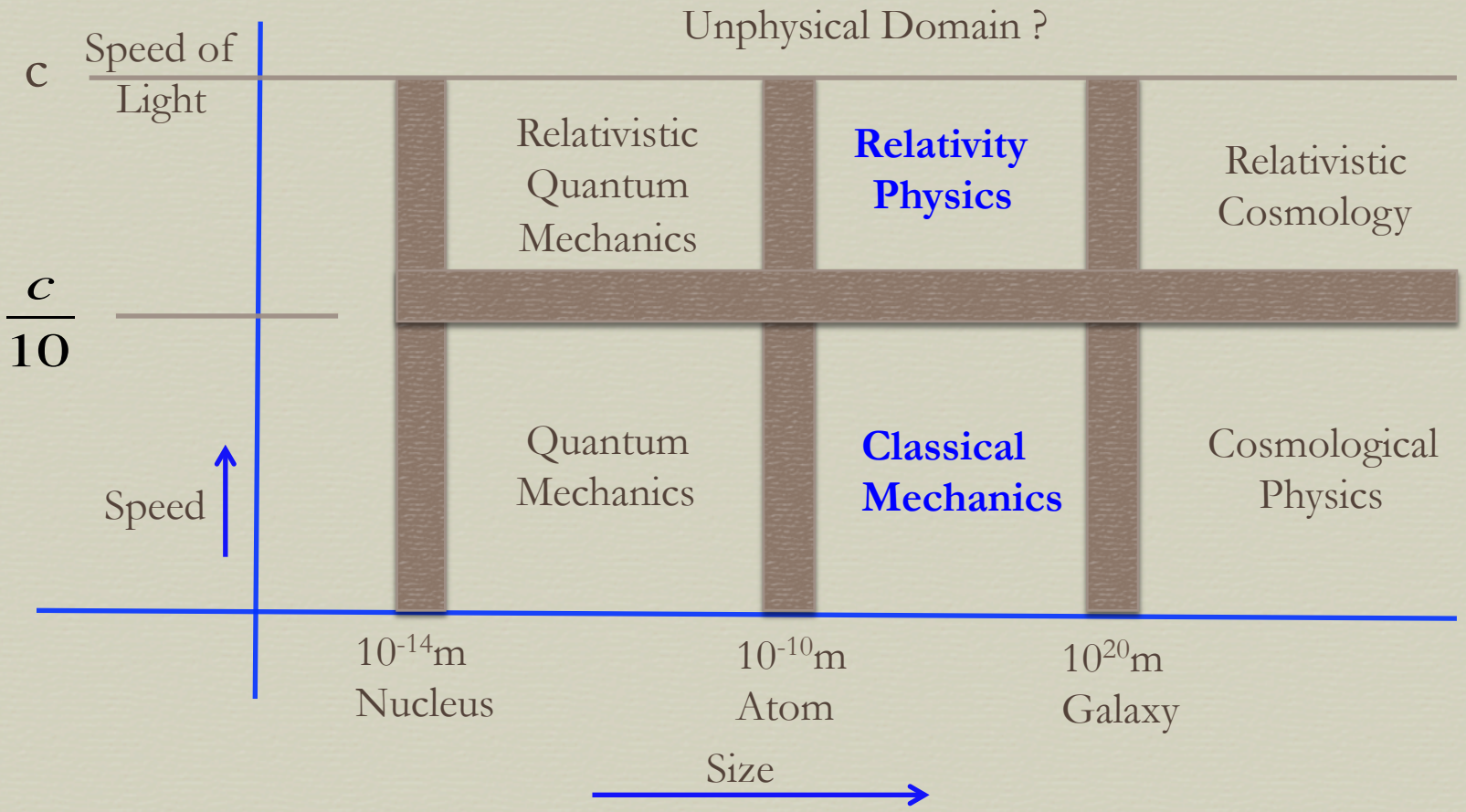
Lecture Notes [check for updates after every class]

Week #	Lec #	Date	Topics	Tutorials
01	01	24/07/2012	Introduction [pdf]	Tut: 01 [pdf]
	02	25/07/2012		

Syllabus

Classical Mechanics: Review of Newtonian Mechanics in rectilinear coordinate system. Motion in plane polar coordinates. Conservation principles. Collision problem in laboratory and centre of mass frame. Rotation about fixed axis. Non-inertial frames and pseudo forces. Rigid body dynamics.

Overview of PH101



Syllabus

Classical Mechanics: Review of Newtonian Mechanics in rectilinear coordinate system. Motion in plane polar coordinates. Conservation principles. Collision problem in laboratory and centre of mass frame. Rotation about fixed axis. Non-inertial frames and pseudo forces. Rigid body dynamics.

Special Theory of Relativity: Postulates of STR. Galilean transformation. Lorentz transformation. Simultaneity. Length Contraction. Time dilation. Relativistic addition of velocities. Energy-momentum relationships.

TEXT (KK): D. Kleppner and R. J. Kolenkow, An Introduction to Mechanics, Tata McGraw-Hill

Quantum Mechanics: Two-slit experiment. De Broglie's hypothesis. Uncertainty Principle, wave function and wave packets, phase and group velocities. Schrödinger Equation. Probabilities and Normalization. Expectation values. Eigenvalues and Eigen functions. Applications in one dimension: Particle in a box, Finite Potential well, Harmonic oscillator.

TEXT (ER): Quantum Physics of Atoms, Molecules, Solids, Nuclei & Particles, Eisenberg & Resnick, 2nd Ed. John-Wiley.

Not Allowed

Questions ?

PH 101 : Physics I (L1) July-Nov, 2012

Note Title 7/19/2012

Reading Assignments !

"CALCULUS"

Revise

→ Vector Algebra !

Vector representation in terms of basic vectors $\hat{i}$, $\hat{j}$ and $\hat{k}$

→ Vector Addition

→ Dot product & Cross product

→ Differentiation of a vector

→ Gradient, Divergence and Curl

Ref: CHAPTER-1, Kleppner & Kolenkow

"Kinematics"

"Kinema" — means movement

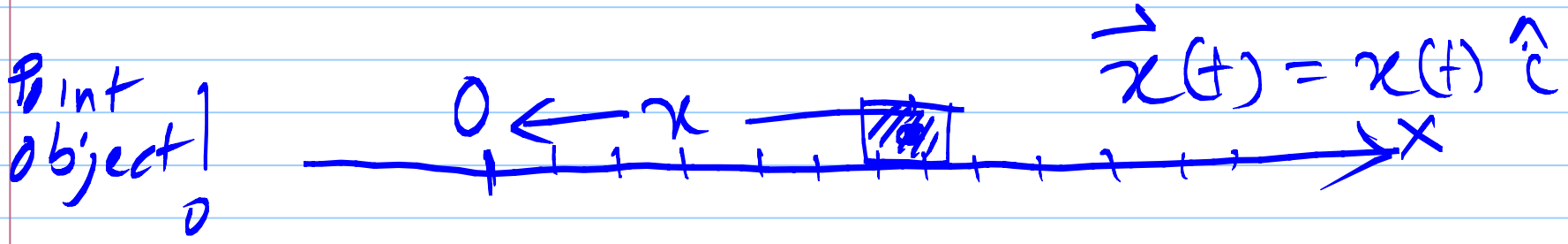
complete description of the problem

or mathematical description of motion

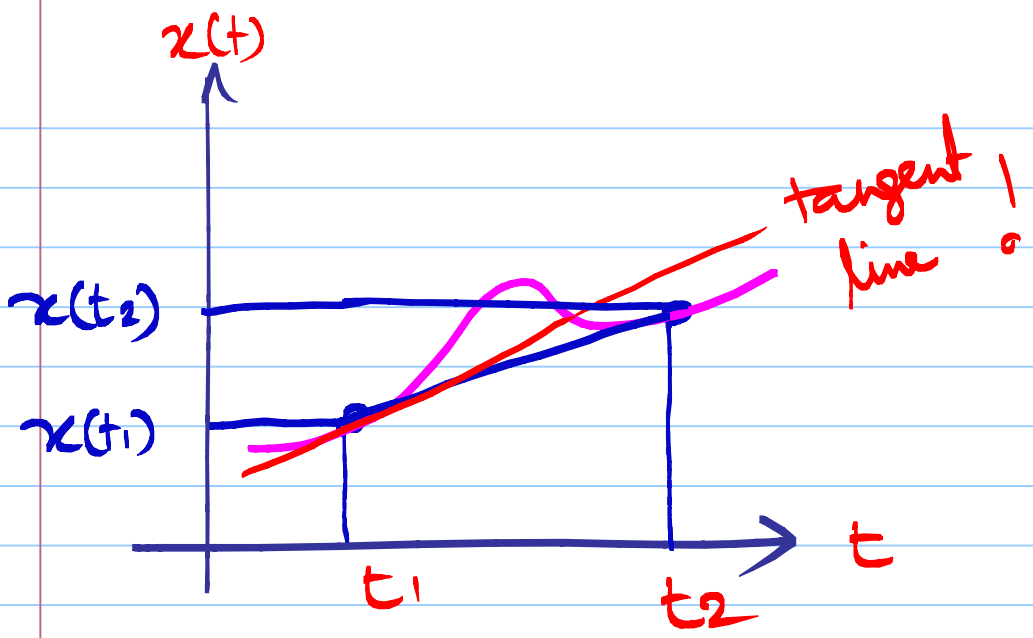
"Dynamics" — ask reqion

- # Position
- # Displacement
- # Velocity
- # Acceleration

* Direction
* Choice of Origin
* coordinate system



Kinematics in 1-dimension



Average velocity

$$\bar{v} = \frac{x(t_2) - x(t_1)}{t_2 - t_1}.$$

Instantaneous velocity

$$v = \lim_{\Delta t \to 0} \frac{x(t + \Delta t) - x(t)}{\Delta t}.$$

$\Delta t = t_2 - t_1$ very small

at the limit $\Delta t \to 0$

$$v = \frac{dx}{dt}.$$

Instantaneous accelaration

$$a = \lim_{\Delta t \to 0} \frac{v(t + \Delta t) - v(t)}{\Delta t}$$

$$a = \frac{dv}{dt}.$$

Kinematics in 1- Dimension

Usually $x(t)$ is not known

$a(t)$ or $v(t)$ at a given time t_0] you can measure!

$$v(t) = v(t_0) + \int_{t_0}^{t} a(t')\,dt'$$

$$x(t) = x(t_0) + \int_{t_0}^{t} v(t')\,dt'$$

If

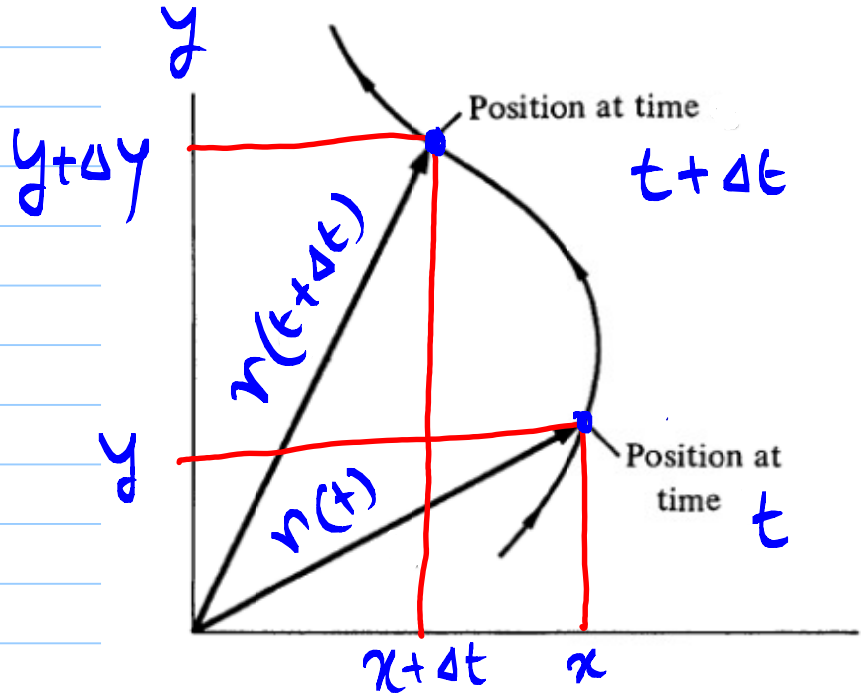
a_0 — constant initial velocity v_0

$$v(t) = v_0 + \int_0^t a_0\,dt = v_0 + a_0 t$$

$$x(t) = x_0 + v_0 t + \frac{1}{2} a_0 t^2$$

Kinematics in 2 Dimensions

$$\vec{x}(t) = x(t)\,\hat{i} \quad \text{— 1D}$$



$$\vec{r}(t) = x(t)\,\hat{i} + y(t)\,\hat{j}$$

Instantaneous velocity

$$\vec{v}(t) = \frac{d}{dt}\vec{r}(t)$$

$$= \lim_{\Delta t \to 0} \frac{\vec{r}(t+\Delta t) - \vec{r}(t)}{\Delta t}$$

$$= \lim_{\Delta t \to 0} \frac{x(t+\Delta t) - x(t)}{\Delta t}\hat{i} + \lim_{\Delta t \to 0} \frac{y(t+\Delta t) - y(t)}{\Delta t}$$

$$\vec{v}(t) = \frac{dx}{dt}\hat{i} + \frac{dy}{dt}\hat{j} = v_x(t)\,\hat{i} + v_y(t)\,\hat{j}$$

Instantaneous acceleration

$$\vec{a}(t) = \frac{d}{dt}\vec{v}(t) = \lim_{\Delta t \to 0} \frac{\vec{v}(t+\Delta t) - \vec{v}(t)}{\Delta t}$$

$$\vec{a}(t) = \frac{d^2x(t)}{dt^2}\hat{i} + \frac{d^2y(t)}{dt}\hat{j}$$

$$a_x(t) = \frac{d^2x(t)}{dt^2} \quad \& \quad a_y(t) = \frac{d^2y(t)}{dt^2}$$

$$x(t) = x_0 + v_0 t + \frac{1}{2}at^2$$

$$v(t) = v_0 + at \quad \Rightarrow \quad t = \frac{v(t) - v_0}{a}$$

$$v^2 = v_0^2 + 2a(x - x_0)$$