

End Semester Examinations - Nov-Dec 2015 Exams

14PH1001 Applied Physics

Set A

Time : 3 hrs
Total Marks: 100

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1. a. What are matter waves? Explain the duality of matter waves from Davisson-Germer Experiment with a neat diagram. (17 marks)
b. Calculate the de-Broglie wavelength of electrons accelerated by a potential difference of 54 V. (3 marks)
- OR**
2. a. Derive the Schrödinger time independent wave equation. (17 marks)
b. State Heisenberg's uncertainty principle. (3 marks)
3. a. Explain the construction and working of He-Ne laser with relevant diagrams. Mention the role of helium in this laser (20 marks)
- OR**
4. a. What are the different Vibrational modes of a CO₂ molecule? Explain the construction and working of CO₂ laser with a neat sketch (20 marks)
5. a. Define and derive the expression for Numerical aperture of an optical fiber cable (17 marks)
b. Find the numerical aperture of an optical fiber having a core refractive index of 1.55 and cladding refractive index of 1.50. (3 marks)
- OR**
6. a. Classify optical fibers based on materials, modes and refractive index profile with neat diagrams (17 marks)
b. Sketch the block diagram for the fiber optical communication system (3 marks)
7. a. Discuss factors affecting acoustics of buildings with their remedies. (17 marks)
b. How sound waves are classified based on frequency range. (3 marks)
- OR**
8. a. What is Magnetostriction effect? Explain the construction of Magnetostriction generator with a neat circuit diagram and explain its working principle. (17 marks)
b. How ultrasonic waves are used in Non-Destructive Testing (NDT) (3marks)
9. a. Classify diamagnetic, paramagnetic and ferromagnetic materials based on their properties. (17 marks)
b. What is meant by meissner effect? (3 marks)
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End Semester Examinations - Nov-Dec 2015 Exams

14PH2006 Mechanics and Properties of Matter

Set A

Time : 3 hrs
Total Marks: 100

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1. a) Distinguish between the following: -
i) mass and weight
ii) gravity and gravitation
iii) inertial mass and gravitational mass (6 marks)
b) Obtain the expressions for gravitational potential and field due to a uniform solid sphere at a point (i) inside the sphere and (ii) outside the sphere. (14 marks)
- OR**
2. a) State Kepler's laws of planetary motion. Give the dimensions and S.I units of gravitational constant. (5 marks)
b) Describe Cavendish method for determining the gravitational constant. Mention the drawbacks. (15 marks)
3. a) State Newton's second law of motion. (2 marks)
b) Calculate the general equation for the motion of a projectile. Derive the expressions for (i) maximum height and (ii) maximum range. (15 marks)
c) Two tall buildings are 75 m apart. With what velocity must a ball be thrown, horizontally from a window 70 m above the ground in one building so that it enters a window 25.9 m above the ground in other building (3 marks)
- OR**
4. a) Distinguish between elastic and inelastic collision. (5 marks)
b) Describe in detail about the collision between two elastic bodies (15 marks)
5. Define the elastic constants. Establish the relations between all the three types of modulus of elasticity (20 marks)
- OR**
6. Derive an expression for the bending moment of a horizontal beam clamped at one end and loaded at the other end and hence derive an expression for the depression of a beam supported at the ends and loaded at the centre, neglecting the weight of the beam. (20 marks)
7. A thin uniform bar of rectangular cross section is supported at its ends on two knife edges and loaded in the middle. Derive an expression for the depression of the mid-point of the beam for a load W. Neglect the mass of the beam. (20 marks)
- OR**
8. A rectangular beam is kept over two knife edges equal distances apart. Derive an expression for the depression when masses are loaded at their ends. (20 marks)
9. Explain the Rotation viscometer for finding the coefficient of viscosity of liquids.
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End Semester Examinations - Nov-Dec 2015 Exams

14PH2007 Heat and Thermodynamics

Set B

Time : 3 hrs
Total Marks: 100

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1. a. State and explain zeroth law of thermodynamics. What is its importance. On the basis of this law introduce the concept of temperature. (10 marks)
- b. Write a detailed note on I and II law of thermodynamics. (10 marks)

OR

2. a. What is entropy? Give the expression for entropy and give its unit. Explain how entropy leads to II law of thermodynamics. (10 marks)
- Explain change in entropy in adiabatic process and reversible cycle. (10 marks)
3. a. Write note on probability and give examples based on (i) throwing a coin and (ii) throwing a die (10 marks)
- b. Write note on (i) probability and frequency (ii) Permutations and combinations. (10 marks)

OR

4. Explain Macrostate and Microstate in detail using four distinguishable particles. (20 marks)
5. Write the difference between classical and quantum statistics. Write a detailed note on different types of classical and quantum statistics with examples. (10 marks)
- Write note on III law of thermodynamics and their consequences. (10 marks)

OR

6. Explain the application of one dimensional harmonic oscillator using statistical mechanics. (20 marks)
7. Explain statistical ensemble and explain different types of ensembles with a neat diagram. (10 marks)
- Explain basic theories of Phase transitions in statistical mechanics. (10 marks)

OR

8. Derive Bose Einstein distribution law (20 marks)
9. Derive Fermi-Dirac distribution law (20 marks)

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End Semester Examinations - Nov-Dec 2015 Exams

14PH2008 Electricity and Magnetism

Set B

Time : 3 hrs
Total Marks: 100

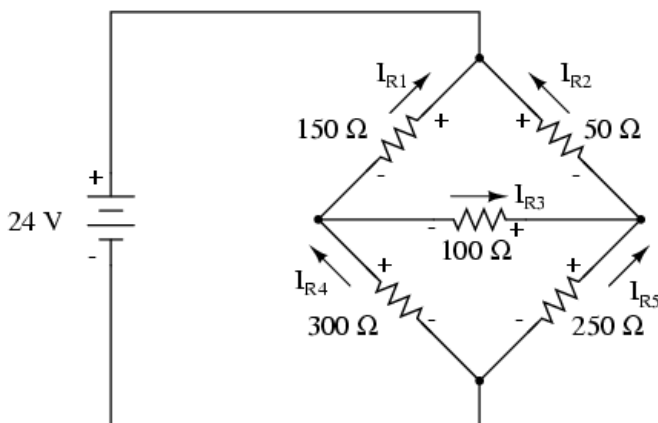
1. (i) Deduce Coulomb's Law from Gauss Law
(6)
- (ii) What is the force between two small charged sphere having charges $2 \times 10^{-7} \text{ C}$ and $3 \times 10^{-7} \text{ C}$ placed 30cm apart in air. (4)
- (iii) State and prove Gauss Law in electrostatics
(10)

OR

2. (i) Apply the Gauss Law to explain : (3 x 5)
 - (a) the electric field Intensity due to a uniformly charged spherical shell.
 - (b) the electric field Intensity due to non- conducting charged sphere.
 - (c) the electric field Intensity due to thin infinite plain sheet of charge.
 - (ii) A uniformly charged conducting sphere of 2.4 m diameter has a surface charge density of $100 \mu \text{ C/m}^2$, Find (i) the charge on the sphere (ii) the total electric flux leaving the sphere. (5)
3. (i) Draw series circuit, parallel circuit and series- parallel circuit to derive an expression for its resistance. (10)
 - (ii) Derive an expression for electric field due to an electric dipole. (10)

OR

4. (i) State Kirchoff's rules
(4)
- (ii) Applying kirchoff's loop rule and junction rule in the wheatstone bridge circuit, Find the current in each resistor and equivalent resistance of the below network. (16)



5. Derive and explain maxwell's equations in differential form using:

(a) Biot- savart law and Gauss divergence theoreem. (20)

(b) Faraday's law and stoke's theorem

OR

6. (i) State and explain Biot-Savart Law (6)

(ii) Find the force on a current carrying conductor in a magnetic field also find the force between two parallel current carrying conductor (14)

7. (i) State and explain Faraday's law and Lenz law of electromagnetic induction (6)

(ii) Define self induction and mutual induction (4)

(iii) Derive an expression for the self induction and mutual induction of a solenoid (10)

OR

8. (i) Derive Maxwell's electromagnetic wave equations for free space in differential form and in integral form (12)

(ii) Define: (a) Magnetic field intensity

(b) Magnetic field permeability (3 x 2)

(c) Magnetic field susceptibility

(iii) Derive the relation between relative permeability and susceptibility. (2)

9. Explain the principle of transformer, Describe the theory of transformer and its types with necessary diagram (20)

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End Semester Examinations - Nov-Dec 2015 Exams

14PH2017 Astro Physics

Set B

Time : 3 hrs
Total Marks: 100

1. (a) What was the celestial noise proposed by Pythagoras? State and explain how his theory was inconsistent with the observations. (12)
(b) Calculate the flux received by each square meter of the earth's surface if the energy released by the Sun is 3.83×10^{26} watts. The distance between the earth and the sun is 149 million km. (5)
(c) Write short notes on Pluto dwarf planetary system. (3)

OR
2. (a) What are the laws propounded by Johannes Kepler? Explain the same with necessary diagrams. (12)
(b) What is the frequency of an electromagnetic wave (gamma ray) that has a wavelength $\lambda = 8 \times 10^{-12}$ m? Find its energy also. (5)
(c) What are meant by comets? (3)
3. (a) Explain the steps in the formation of a black hole with diagrams. (12)
(b) Calculate the flux received by each square meter of the Mar's surface if the energy released by the Sun is 3.83×10^{26} watts. The distance between the Mars and the sun is 227.9 million km. (5)
(c) State the differences between apparent and absolute magnitudes. (3)

OR
4. (a) Explain the process of a star's life cycle with necessary diagrams. (12)
(b) The parallax of a nearby star A is 1 arc seconds. Calculate the distance of the star in light years. The parallax of another star B is 0.5 arc seconds. Calculate its distance also in light years. Which star is far away from our planet? (5)
(c) Define 1 Parsec. (3)
5. (a) How are ultraviolet telescopes operated? Explain in detail. (12)
(b) Calculate the magnifying power of a telescope where the focal length of the objective lens (f_o) is 4 m and the focal length of eye piece(f_e) is 2 m. What do you mean by magnifying power? (5)
(c) State the principle used in radio astronomy. (3)

OR
6. (a) Explain the terms Light Gathering power, Resolution power and Magnifying power of a telescope. (12)
(b) Calculate the light gathering power of the 5-m (Diameter) Palomar telescope. Calculate the light gathering power of a 0.2 m (Diameter) telescope. Compare and tell how many times the Palomar telescope is having more light gathering capacity. (5)
(c) Explain the problem found in refracting telescope. (3)
7. (a) With neat sketches, explain the formation of Milky Way galaxy. (12)
(b) The orbital speed of sun around the center of Milky Way Galaxy is 220 km/s. How many years it will take the sun to cover one parsec distance? (5)

(c) Write short notes on Andromeda Galaxy. (3)

OR

8. (a) Explain in detail how galaxies are classified based on their shape and sizes. (12)

(b) Find the mass inside the orbit of our Sun's rotation in Milky Way galaxy if sun's rotation speed is 220 km/s and sun is away from the center with a distance of 8.5 kpc. [Given $G = 6.67 \times 10^{-11} \text{ m}^3/\text{s}^2\text{kg}$]. (5)

(c) What are flocculent galaxies? (3)

9. (a) Explain in detail homogeneity, isotropy and universality concepts. (12)

(b) If the Hubble's constant is having a value of 70 km/s/Mpc, find the age of the universe in seconds. (5)

(c) State Hubble's Law. (3)

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End Semester Examinations - Nov-Dec 2015 Exams

15PH3005 Semiconductor Physics

Set A

Time : 3 hrs
Total Marks: 100

1.
 - a. Give the basic construction and working of N-Channel FET and draw the common source drain characteristics of the N-Channel FET. (10marks)
 - b. With suitable diagrams and characteristics, distinguish the Enhancement MOSFET and the Depletion MOSFET. (10marks)
- OR**
2.
 - a. Explain the working of Tunnel Diode with energy band diagrams of open circuit condition to progressively increasing the forward bias. (15)
 - b. Define the intrinsic stand-off ratio for a UJT (5 marks)
3. Describe the basic process involved in monolithic IC Fabrication Technology. (20 marks)
- OR**
4. With suitable diagrams, explain how can be constructed in a monolithic integrated circuit. (20 marks)
 - a. a diode
 - b. a transistor
 - c. a resistor
 - d. a capacitor
5.
 - a. Give the schematic representation of Basic operational amplifier and explain its characteristics. (10 marks)
 - b. With suitable summing amplifier diagram and virtual ground equivalent circuit, calculate the output voltage of an op-amp for the voltages and resistors as
 $V_1 = 1V, V_2 = 2V, V_3 = 3V, R_1 = 500 \text{ k}\Omega, R_2 = 1 \text{ M}\Omega, R_3 = 1 \text{ M}\Omega$. The voltage shunt feedback resistance $R_f = 1 \text{ M}\Omega$ (10 marks)
- OR**
6.
 - a. With the virtual ground equivalent circuit, explain how the op-amp will act as an Integrator. (10 marks)
 - b. Explain how op-amp can be modified as monostable multivibrator. (10 marks)
7. Describe the internal architecture of 8085 microprocessor and explain the functional parts of the Execution unit. (20 marks)
- OR**
8.
 - a. Explain the addressing modes of 8085 microprocessor. (10 marks)
 - b. What are status registers and segment registers in 8085 (10 marks)
9.
 - a. Design half and full subtractor circuits using gates. (12 marks)
 - b. Draw the logic diagram of 2176 EPROM memory and explain the salient features. (8 marks)

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End Semester Examinations - Nov-Dec 2015 Exams

15PH3002 Classical Mechanics

Set B

Time : 3 hrs
Total Marks: 100

1. (a). State and derive D'Alembert's principle (10 marks)
(b). Obtain Lagrange's equation of motion for a holonomic conservative system using D'Alembert's principle (10 marks)

OR

2. (a). Find the kinetic energy for a single particle in spherical polar coordinates from Lagrange's equation (10 marks)
(b). A particle of mass 'm' moves in one dimension such that it has the Lagrangian

$$L = \frac{m^2 \dot{x}^2}{l^2} + mx^2 V(\dot{x}) - V^2 x$$

Find the equation of motion for x(t) describe the physical nature of the system (10 marks)

3. (a). Define inverse square law of force (5 marks)
(b). Define and derive Kepler's laws from inverse square law of force (15 marks)

OR

4. What is differential scattering cross section and discuss the problem of scattering of charged particles by a Coulomb field and obtained Rutherford formula for differential scattering cross section (20 marks)
5. (a). Describe the triatomic molecule with suitable schematic diagram (4 marks)
(b). Find the Eigen vector and Eigen value for the linear triatomic molecules (12 marks)
(c). Explain the different types of vibration for triatomic molecules (4 marks)

OR

6. Discuss the vibrations of small oscillations of particles on string (20 marks)
7. Describe the Hamilton-Jacobi theory and Apply Hamilton-Jacobi method to determine the motion of a particle falling vertically in a uniform gravitational field (20 marks)
- OR**
8. What are action-angle variables? Solve Kepler's problem in Action-Angle variables (20 marks)
9. (a). Derive Hamilton's canonical equation of motion and write about physical significance of H (12 marks)
(b). Derive Hamiltonian equation from variational principles (8 marks)

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End Semester Examinations - Nov-Dec 2015 Exams

15PH3003 Statistical Mechanics and Thermodynamics

Set A

Time : 3 hrs
Total Marks: 100

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1. (a) Derive any two Maxwell Equations. (17 marks)
(b) Write a note on thermodynamic potentials. (3 marks)

OR
 2. (a) What are different laws of thermodynamics? Explain I law of thermodynamics in case of different processes like cyclic, isothermal, free expansion and adiabatic, with suitable diagrams. (17 marks)
(b) Write note on Gibbs Phase rule. (3 marks)
 3. (a) Derive Maxwell Boltzmann (M-B) energy distribution law for the particles of an ideal gas. (17 marks)
(b) Give examples for particles which will obey M-B statistics. (3 marks)

OR
 4. Derive Fermi Dirac distribution law for an assembly for fermions. (20 marks)
 5. (a) What do you meant by an Ensemble? Classify different types of ensembles with neat sketch (17 marks)
(b) What is phase space? (3 marks)

OR
 6. (a) What is meant by Partition function? Derive its relation with any two thermodynamic quantities. (17marks)
(b) What is meant by Equal A priori probability theorem? (3 marks)
 7. Explain Equilibrium between two systems in thermal contact.

OR
 8. State and prove Equipartition theorem of energy.
 9. (a) Prove the Liouville thoerem using Hamilton's equations. (17 marks)
(b) State Liouville theorem (3 marks)
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1.

(a). If $F = y\vec{i} + (x - 2yz)\vec{j} - xy\vec{k}$, evaluate $\iint_S (\nabla \times F) \cdot n ds$, where S is the surface of the Sphere $x^2 + y^2 + z^2 = a^2$ (10 marks)

(b). If $r = a \cos \omega t + b \sin \omega t$, show that (10 marks)

i) $\frac{d^2 r}{dt^2} = -\omega^2 r$ (ii) $r \times \frac{dr}{dt} = \omega(a \times b)$

OR

2.

(a). Verify Green's theorem in the plane for $\oint_C (xy + y)^2 dx + x^2 dy$ where C is the closed curve of the region bounded by $y = x^2$ and $y = x$ (10 marks)

(b). Compute $\oint \{(xy - x^2)dx + x^2 y dy\}$ over the triangle bounded by lines $y = 0$, $x = 1$, $y = x$ and verify the Green's theorem (10 marks)

3.

(a). Compute the ad joint of $\begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$ (10 marks)

(b). Find the inverse of matrix $\begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ (10 marks)

OR

4.

(a). Find the Eigen values and normalized Eigen vectors of matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 1 & 1 \end{bmatrix}$ (10 marks)

(b). Solve by Cramer's rule the system of equations
 $x + 2y + 3z = 10$, $2x - 3y + z = 1$, $3x + y - 2z = 9$ (10 marks)

5.

(a). Prove that, if $A^\lambda B_{\mu\nu}$ is a tensor for all Contravariant tensors A_λ then $B_{\mu\nu}$ is also a tensor. (10 marks)

(b). Show that tensors as Classification of Transformation laws. (10 marks)

OR

6.

(a). Write the laws of transformation for the tensors

i) $A_{\mu\nu}^{\sigma}$ ii) $A_{\sigma}^{\mu\nu}$ iii) $B_{\mu\nu\sigma}^{\alpha\beta}$ iv) $B_{\alpha\beta}^{\mu\nu\sigma}$ v) $C_{\mu\nu}$ vi) $C^{\mu\nu}$ (12 marks)

(b). What is a tensor? Explain the rank of tensors (8 marks)

7.

(a). Prove that $\cosh\left(z + \frac{1}{z}\right) = a_0 + \sum_1^{\infty} a_n \left(z^n + \frac{1}{z^n}\right)$ where

$$a_n = \frac{1}{2\pi} \int_0^{2\pi} \cos n\theta \cosh(2\cos\theta) d\theta \quad (10 \text{ marks})$$

(b). Explain about Residue and contour integration (10 marks)

OR

8. Derive the Cauchy's residue theorem (20 marks)

9.

(a). Find the finite Fourier sine and cosine transform of $\frac{\partial^2 U}{\partial x^2}$ where U is a function of x and t for $0 < x < l, t > 0$. (10 marks)

(b). Use finite Fourier transformation to solve $\frac{\partial U}{\partial t} = \frac{\partial^2 U}{\partial x^2}$,

$U(0, t) = 0, U(\pi, t) = 0, U(x, 0) = 2x$, Where $0 < x < \pi, t > 0$. (10 marks)

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End Semester Examinations - Nov-Dec 2015 Exams

15PH3007 Physical Optics

Set A

Time : 3 hrs
Total Marks: 100

1. a) Deduce the expression for the focal length of a thin lens in terms of the refractive indices of the material of the lens and the surrounding medium and the radii of curvature of the two faces. (15 marks)
b) The two surfaces of a double concave lens are of radii of curvature 10 and 30 cm. Find its focal length in water, μ for water is $4/3$ and for glass is $3/2$. (5 marks)

OR
2. a) Explain reflection, refraction, translation and system matrix for various combination of lenses. (15 marks)
b) The radii of curvature of a convex lens are 8 cm and 12 cm. Identify the position of the focal points and the principal points and find its focal length if the thickness of convex lens is 6 cm and refractive index of material is $\mu = 1.5$ (5 marks)
3. a) Write a short note on group velocity. (5 marks)
b) Explain the phenomenon of interference, its types in relation to the law of conservation of energy. (15 marks)

OR
4. Explain the concept of interference with addition of waves of same frequency and with different frequencies. (20 marks)
5. a) What is plane polarised light? Describe any two methods of producing and detecting plane-polarised light. (12 marks)
b) State Malus's law. Explain elliptically and circularly polarised light. (8 marks)

OR
6. a) Define Brewster's law. Give an account of full wave, half wave and quarter wave plates. (15 marks)
b) Calculate the thickness of double refracting crystal required to introduce a path difference of $\lambda/2$ between the Ordinary and Extraordinary rays when $\lambda = 6000\text{\AA}$, $\mu_o = 1.65$ and $\mu_e = 1.48$ (5 marks)
7. Describe the construction of Michelson's interferometer and explain its working. Discuss the important applications of the interferometer. (20 marks)

OR
8. Describe the formation of fringes by Fabry-perot interferometer. (20 marks)
9. a) Find the fourier transform of the function given as $f(x) = e^{-|x|}$ (10 marks)
b) Explain the dirac delta function with respect to sine and cosine functions (10 marks)

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End Semester Examinations - Nov-Dec 2015 Exams

15PH3018 Thin Film Technology

Set B

Time : 3 hrs
Total Marks: 100

1. a) Explain with suitable diagram the instrumentation, working principle, advantages and drawbacks of turbo molecular pump. (16)
b) What are the advantages and drawbacks of diffusion pump? (4)

OR
2. a) With a neat sketch explain in detail the construction and working of pirani gauge. (16)
b) What is the use of magnetic field in penning gauge? (4)
3. a) With suitable diagram explain the construction and working of RF sputtering. Mention its advantages. (16)
b) Write short notes on spray pyrolysis. (4)

OR
4. a) Explain DC sputtering method with necessary diagram. Is it possible to deposit insulating materials by DC sputtering? Explain with appropriate reason. (16)
b) Differentiate Magnetron DC sputtering and DC sputtering? (4)
5. a) Define interface. Discuss in detail, the different types of interfaces. (16)
b) Differentiate physisorption and chemisorption. (4)

OR
6. a) What is thin film? With a neat sketch, explain in details the following processes in the growth of thin film.
i) adsorption ii) surface diffusion iii) nucleation (16)
b) Briefly discuss the steps in fabrication of a thin film solar cell. (4)
7. a) With suitable diagram, discuss in detail, the four probe method to determine the sheet resistance of thin films. (16)
b) Briefly discuss the various steps in fabrication of a thin film transistor. (4)

OR
8. a) Describe how the structure of a material and the particle size are determined by X- ray diffraction studies. (16)
b) What is a thin film diode? Mention its types with suitable sketch. (4)
9. a) Explain in detail, the design rules for fabrication of thin film resistors. (12)
b) Write short notes on magnetic thin films for MEMS application. (8)

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