

2nd In Course Exam., 2014
 PHY-1122: Physics
 Dept. of CSE, DU

Time: 50 minutes

Answer any four:

Total Marks: 20

1. What is thermodynamics? Define thermodynamics equilibrium, and process and also PdV work. 5
2. Consider a cylinder, the pressure in the cylinder varies in the manner with volume, $p = C/V^2$. If the initial pressure is 500 kPa, the initial volume is 0.05 m^3 , and the final pressure is 200 kPa, find the work done by the system. 5
3. Prove that $Q_{1,2} = U_2 - U_1 + W_{1,2}$. 5
4. Derive the expression of first law of thermodynamics for control volume system. 5
5. In a tank similar to Joule's experiment there are 10 kg of water. The total work input is 20 N.m (a) Find the change in specific and total internal energy (assume the system is adiabatic). (b) If a heat leak of 0.1 J/kg is noted, what is the internal energy change? 5
6. A steam turbine receives steam with a flow rate of 15 kg/s and experiences a heat loss of 14 kW. Using the steam inlet and exit properties listed below, find the power production. 5

	Inlet	Exit
Pressure	6205 kPa	9.859 kPa
Temperature	811.1 K	318.8 K
Velocity	30.48 m/s	274.3 m/s
Specific internal energy	3150.3 kJ/kg	2211.8 kJ/kg
Specific volume	0.05789 m^3/kg	13.36 m^3/kg
Height change		3 m

University of Dhaka
 Department of Computer Science and Engineering
 First Year First Semester B.Sc. Final Examination, 2012
 PHY-1122: Physics

Total Marks: 60

Time: 2.5 Hours

(Answer any Four (4) of the following Questions)
 (In the following questions all symbols bear usual meaning)

1. a) State the postulates of special theory of relativity. Show that the concept of simultaneity is not absolute. 2+3
 - b) Define proper time and proper length. Derive the rule for relativistic velocity transformation using Lorentz transformation. 2+3
 - c) Explain how the existence of massless particle is consistent in special theory of relativity. 2
 - d) Find the mass of an electron whose velocity is $0.99c$. 3
2. a) Show, using planetary model of atom, that the energy of an electron inside a hydrogen atom is given by 3+2

$$E = -\frac{e^2}{8\pi\epsilon_0 R} \quad (1)$$

What is the significance of the negative sign in Eq-1?

- b) State the postulates of Bohr model for atom. Explain the condition for orbital stability by incorporating de Broglie wavelength in Bohr model. 3+2
- c) What is the origin of atomic line spectrum? Show that for hydrogen atom the spectral lines obey the following relation 5

$$\frac{1}{\lambda} = \frac{E_1}{ch} \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right) \quad (2)$$

3. a) Show that for a double slit interference, the intensity of light on the screen obeys the following relation 5

$$I = 4I_0 \cos^2 \left(\frac{ay\pi}{s\lambda} \right) \quad (3)$$

- b) State the Huygens-Fresnel principle. 2
- c) Show that for single slit Fraunhofer diffraction the intensity pattern follows the following relation 6+2

$$I = I_0 \frac{\sin^2 \beta}{\beta^2} \quad (4)$$

Draw the intensity pattern for this relation.

4. a) Define electric flux density ϕ_E . Derive the Gauss's law of electrostatics. 2+4
- b) State the Faraday's law of electromagnetic induction. Show that 2+3

$$\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$$

- c) How Maxwell proposed the correction for Ampere's law for magneto-statics. 4

- 5.
- a) State and explain the second law of thermodynamics. 3
 - b) Describe Carnot's cycle and deduce the efficiency of an ideal heat engine. 6
 - c) Define Entropy. Mention its physical significance. Show that the entropy of a perfect gas remains constant in a reversible process but increase in an irreversible process. 6
6. Write short notes on any three of the following: 3×5
- i) Circular polarization
 - ii) Time dilation
 - iii) Charging-discharging phase in RC transient
 - iv) Atomic excitation

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~~b)~~ Define proper time and proper length. Derive the rule for relativistic velocity transformation using Lorentz transformation. আলোকিক সময় ও দূরত্ব 2+3

~~c)~~ Explain how the existence of massless particle is consistent in special theory of relativity. 2

~~d)~~ Find the mass of an electron whose velocity is $0.99c$. 3

~~e)~~ Show, using planetary model of atom, that the energy of an electron inside a hydrogen atom is given by. 3+2

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Biplab

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~~h)~~ Define electric flux density ϕ_E . Derive the Gauss's law of electrostatics. 2+4

~~i)~~ State the Faraday's law of electromagnetic induction. Show that 2+3

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~~j)~~ How Maxwell proposed the correction for Ampere's law for magneto-statics. 4

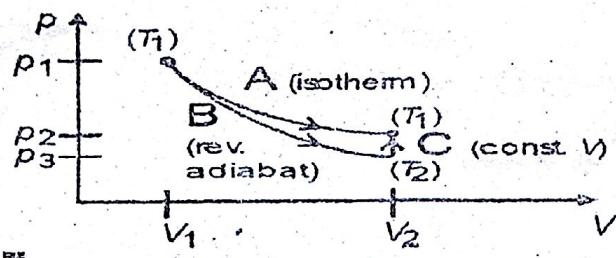
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(Answer any Four (4) of the following Questions)

1. a) Define intensive and extensive thermodynamic variables. 2
- b) Define entropy in terms of Boltzmann relation. State third law of thermodynamics. 2+2
- c) Show that for Ideal gas $U = C_v dT$. 4
- d) Calculate $\oint \frac{dq}{T}$ for the path A - B - C and A - C. 5



2. a) Write down the postulates of Bohr model of atom. ✓ 4
- b) State Wilson-Sommerfeld quantization rule. Show that the condition for the orbital stability is $L = nh$ using this rule. ✓ 3+4
- c) What is De Broglie matter wave? What is the relation between this wave and the wave function Ψ ? 2+2

3. a) Write down the postulates of special theory of relativity. ✓ 2
- b) Derive the relativistic velocity addition formula using Lorentz transformation. ✓ 5
- c) Show that a moving clock ticks slower than a clock at rest. ✓ 4
- d) Suppose a train is moving with a uniform velocity $\frac{3}{4}c$ with respect to an observer at S frame of reference. An observer in the moving train measures the speed of light at vacuum c . What will be the velocity of that light in free space for an observer at S. 4

4. a) Distinguish between Fraunhofer and Fresnel diffraction. 4
- b) Explain 'missing order' in Fraunhofer double slit diffraction pattern. 5
- c) Deduce radius of the n th order bright ring formed in Newton's ring experiment. 6

5. a) Write down the four Maxwell's equations of classical electrodynamics. 4
- b) Derive the continuity equation given by $\frac{\partial \rho}{\partial t} + \nabla \cdot J = 0$. 4
- c) Find out the expression for electric field E at distance r from a midpoint of a wire of length $2L$ with charge density λ . 4
- d) Explain the inconsistency in Ampere's law. 3

6. Write short notes on the following topics: 3x5
 - i. Simple harmonic motion
 - ii. Defects in solid
 - iii. Nicol Prism.