Khyber Pakhtoon Khwa, Public Service Commission, Peshawar

Competitive Examination for the Posts of Provincial Management Service (BPS-17)

PHYSICS PAPER I

2013

Time Allowed: 03 hours

Max. Marks: 100

Attempt any FIVE questions

Q1:

a) State and Prove divergence theorem. 10

b) What is the physical meaning of divergence? 4

c) If $\vec{F} = x\hat{\imath} + 2y\hat{\jmath} + 3z\hat{k}$ 6

  Show that $\iint_s \vec{F} \cdot d\vec{S} = 6V$, where S is a closed surface enclosing a volume V.

Q2:

a) Distinguish between inertial and non-inertial reference frames. 5

b) On the basis of Lorentz transformation, derive an expression for length contraction. 9

c) In inertial frame S, a red light and a blue light are separated by a distance $\Delta x = 2.45\ km$, 6
  with the red light at the larger value of x. The blue light flashes, and 5.35 µs later red light
  flashes. Frame S' is moving in the direction of increasing x with a speed of u=0.855c.
  What is the distance between the two flashes and time between them as measured in S'?

Q3:

a) What are general characteristics of fluid flow? 4

b) Define the surface tension, viscosity and elasticity. 7

c) State and Prove Bernoulli's equations. 9

Q4:

a) Define Simple harmonic motion. Derive a general differential equation of motion of a 2, 4,
  simple harmonic oscillator and also obtain a solution of the equation. 4

b) Find an expression for the periodic time and frequency of a simple harmonic oscillator. 4

c) When a spring attached with mass M = 1.65 kg hangs vertically, its length increases by 6
  7.33 cm. The spring is then mounted horizontally with a block of mass m=2.43 kg. The
  bock is free to slide along the frictionless horizontal surface. (i) What is the force constant
  k of the spring? (ii) How much horizontal force is required to stretch the spring by a
  distance of 11.6 cm? (iii) When the block is displaced a distance of 11.6 cm and released,

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with what period will it oscillate?

Q5:

a) Describe the principle, construction and working of Michelson's interferometer.   2,4,4

c) How white light fringes are produced in Michelson's interferometer.   4

e) A Michelson interferometer is set for the white light straight fringes. When a mica sheet   6
of thickness 0.005 cm is put in front of fixed mirror, then in order to bring back the
colored fringes to their original position, the movable mirror is moved by 0.0025 cm.
Calculate refractive index of mica.

Q6:

a) Differentiate between spontaneous and stimulated emission.   4

c) Describe Laser and explain the working principle of Lasers.   4,6

e) How can we achieve higher probability of stimulated emission as compared to that of   6
spontaneous emission?

Q7:

a) Treating the ideal gas as a system governed by classical statistics, derive the Maxwell-   10
Boltzmann law of distribution of molecular species.

b) Find i) the mean energy and ii) the most probable energy of gas in thermal equilibrium at   10
temperature T.

Q8:

a) Discuss the law of increase of entropy. Also discuss the applications of this law.   5,5

c) Show that an increase of entropy is always followed by the loss of available energy.   5

e) State and explain third law of thermodynamics.   5