

**B.E. Computer Science and Engineering, 1<sup>st</sup> YEAR 1<sup>st</sup> SEM**  
**SUPPLEMENTARY EXAMINATION, 2018**

**PHYSICS I**

Time : Three hours

Full Marks : 100

Answer *any five questions*. All questions carry equal marks

1. (a) Convert a vector from Cartesian co-ordinate system to Cylindrical Polar co-ordinate system.

(b) Show that the Coulomb field is conservative.

(c) Find  $\nabla\phi$  if (a)  $\phi = \ln \left| \frac{\vec{r}}{r} \right|$ , (b)  $\phi = \left| \frac{1}{r} \right|$  [11+3+6]

2. Write down and solve the differential equation for forced vibration explaining how it is obtained. Derive the condition for amplitude resonance in case of forced vibration. Explain the term 'sharpness of resonance'. [20]

3. (a) Derive the relation between torque and angular momentum.

(b) Explain parallel and perpendicular axis theorem.

(c) Obtain an expression for the moment of inertia of a cylinder about (i) its own axis (ii) an axis passing through its centre and perpendicular to its own axis (iii) diameter of one of its faces. [4+5+11]

4. (a) Distinguish the streamline flow and turbulent flow of a liquid.

(b) From Bernoulli's principle obtain the equation of pressure in hydrostatics.

(c) Derive the Poiseuille's equation for the flow of incompressible fluid. What are the assumptions made? [4+6+10]

5. (a) State the basic assumptions of Kinetic Theory of gases.

(b) Deduce Kinetic pressure for an ideal gas and show that at a particular temperature this pressure is directly proportional to the average density of the gas.

[ Turn over

(c) Air is mainly composed with nitrogen and oxygen. Why hydrogen is absent in the air-explain. [8+8+4]

6. (a) Define  $C_p$  and  $C_v$ . Show that for an ideal gas  $C_p - C_v = R$  i.e. universal gas constant.

(b) What are the two corrections made by Van der Waals to deduce the equation of state for real gas from that of ideal gas? Explain your answer.

(c) What are the units of Van der Waals constants 'a' and 'b'? [8+10+2]

7. (a) State and explain the 1<sup>st</sup> law of Thermodynamics. What is the state function that you get from this law?

(b) Distinguish between isothermal and adiabatic processes.

(c) One quantity of perfect gas ( $\gamma = 1.4$ ) at 283K is adiabatically compressed to  $\frac{1}{4}$ <sup>th</sup> its volume. Calculate the final temperature.

(d) One mole of ideal gas expands from volume  $v_i$  to volume  $v_f$  at constant pressure  $P_0$ . Find out its work done with P-V diagram. [6+6+4+4]

8. (a) Describe Carnot's reversible cycle. Show that the efficiency of Carnot's engine working between a source (temperature  $T_1$ ) and a sink (temperature  $T_2$ ) is  $1 - T_2/T_1$ .

(b) A Carnot's reversible engine operates between 100 °C and 0 °C. Find out its efficiency. To get 40% efficiency what will be the source temperature?

(c) What do you mean by 'entropy' of a system? [10+6+4]