

- P.T.O

- 10) The continuity equation for traffic flow in one dimension is: 2
- a) $\frac{\partial \rho}{\partial t} + \frac{\partial(\rho u)}{\partial x} = 0$ b) $\frac{\partial \rho}{\partial t} + u \frac{\partial \rho}{\partial x} = 0$
- c) $\frac{\partial \rho}{\partial t} - \frac{\partial(\rho u)}{\partial x} = 0$ d) $\frac{\partial \rho}{\partial t} + \rho \frac{\partial u}{\partial x} = 0$
- 11) When traffic density is zero, the velocity of cars is: 2
- a) Maximum b) Zero
- c) Equal to the speed limit d) Unpredictable
- 12) The gravitational potential at a point due to a mass m at distance r is given by: 2
- a) $V = m/r$ b) $V = -m/r$
- c) $V = m/r^2$ d) $V = -m/r^2$

2. Solve the following questions any five.

- 1) Define mathematical modeling and give two examples, where mathematics is used to study the situations. 4
- 2) The angle of elevation of the top of a tower from a point O on the ground, which is 450m away from the foot of the tower, is 40° . Find the height of the tower. 4
- 3) List the principles and steps involved in mathematical modeling? 4
- 4) A manufacturer of medicines is preparing a production plan of medicines M_1 and M_2 . There are sufficient raw materials available to make 20000 bottles of M_1 and 40000 bottles of M_2 but there are only 45000 bottles into which either of the medicines can be put. Further, it takes 3 hours to prepare enough material to fill 1000 bottles of M_1 , it takes 1 hour to prepare enough material to fill 1000 bottles of M_2 and there are 66 hours available for this operation. The profit is Rs. 8 per bottle of M_1 and Rs. 7 per bottle for M_2 . How should the manufacturer schedule his/her production in order to maximise profit? 4
- 5) State the Hooke's Law and discuss the role of Hooke's Law in deriving the equation for a vibrating mass-spring system. 4
- 6) What is resonance in a mechanical system? Derive the condition for resonance in a damped harmonic oscillator. 4
- 7) Define- 4
- i) Traffic flux ii) Traffic density
- iii) Gravitational intensity iv) Gravitational potential
- 8) Define gravitational potential and derive the potential equation. 4
