



বিদ্যাসাগর বিশ্ববিদ্যালয়

**VIDYASAGAR UNIVERSITY**

**B.Sc. (Major) Honours Examination 2021**

**(CBCS)**

**4th Semester**

**AUTOMOBILE MAINTENANCE**

**PAPER—SEC2T**

**ELECTROMAGNETISM AND DIGITAL ELECTRONICS**

*Full Marks : 40*

*Time : 2 Hours*

*The figures in the right-hand margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable.*

**THEORY : SEC2T**

**Group – A**

Answer any *two* questions.

2×15

1. (a) Establish the continuity equation relating the charge density and current density at a point in a medium. Explain the significance of the equation.  
(b) What is Lorentz force?

(c) What is Ampere's circuital law? Show how this law can be applied to find the magnetic field at an interior and exterior point.

(5+2)+2+(2+4)

2. (a) Explain the term (i) Magnetization, (ii) Magnetic induction.  
 (b) Establish the relationship between susceptibility and permeability.  
 (c) State Faraday's law of induction and express it in differential form.  
 (d) What do you understand by 'self' and 'mutual' inductances? Show that the mutual inductance between two coils of self-inductance  $L_1$  and  $L_2$  cannot be exceed  $\sqrt{L_1 L_2}$ . (2+2)+3+(2+1)+(2+3)
3. (a) A circuit with resistance R and inductance L is connected to a steady source of emf  $E_0$  between  $t = 0$  and  $t = t_0$  after which the source is suddenly removed, the circuit being kept closed after the removal of the source. Determine how the current in the circuit varies with time. Assuming  $t_0$  to be large compared with  $L/R$ , sketch the current as a function of time.  
 (b) What is series resonance in an electric circuit? What are the resonant frequency, bandwidth and Q-factor of this circuit? How they are related? (6+2)+(2+3+2)
4. (a) Define universal gate. Mention the universal gates with their truth tables. Write down the De Morgan's theorems.  
 (b) Design a full adder circuit using 2-input NAND gate only. Write down the logical expression for it.  
 (c) What is flip-flop? Draw a JK flip-flop with its truth table. (1+3+2)+(3+2)+(1+3)

### Group - B

Answer any *one* question.

1×10

5. (a) A DC generator (emf = 20 V) delivers a maximum power of 10W to an external load resistance. Calculate the internal resistance of the

source and its short-circuit current. How much power will it dissipate when its terminals are shorted?

- (b) A coil of wire wound closely on a cylinder has  $n$  turns per unit length. The diameter of the cylinder is equal to its length. Calculate the magnetic field at the centre of the cylinder. 6+4

6. (a) In a very large ferromagnetic material exists uniform magnetization  $M$  and a uniform magnetic field  $H$  in the direction of  $M$ . (i) A thin disc-shaped cavity whose axis is parallel to  $M$ , and (ii) a needle-shaped cavity whose length is parallel to  $M$  are scooped in the material. Determine the magnetic induction  $B$  in the two cavities.
- (b) A coil of radius 1.5 cm and 500 turns links with magnetic field of 50 Gauss. If the magnetic field reversed in 0.01s, calculate the average emf induced in the coil. 6+4