

Answer all the questions sequentially, Section II and Section III should be answered separately

Section-II

Total marks in this section 64

Question Q1.

[2 x 8]

- a) How rancidity of oils can be prevented using green tea
- b) Does the use of milk in tea minimizes its health benefits?
- c) What are the major benefits of taking green tea?
- d) What is point mutation?
- e) What are the lifestyle factors that can cause cancer?
- f) How does DNA photolyse help prevent skin cancer?
- g) Define Millard reaction with its utility
- h) What is the chemical formulation for sunscreen? Name some of the components and their mechanism of action.

Question Q2.

[2 x 8]

- a) How perfumes are extracted from plant sources, describe two methods
- b) What is an opaque formulation for sunscreen and its mechanism of action?
- c) What is SPF? How it is different from Boot Star?
- d) What are the most common dental bleaching agents? Explain their bleaching action
- e) Why does the use of light enhance the whitening process of a hydrogen peroxide-based dental bleach?
- f) Why does the tooth whitening process lead to sensitive teeth?
- g) Explain the workings of hemotoxic venom and neurotoxic venom.
- h) What are antivenins, how are they obtained and how do they work?

Question Q3.

[2 x 8]

- a) What is catgut suture and how do proteolytic enzymes help break the sutures
- b) How and why kidney stones are formed
- c) What are the factors that contribute to food fraud
- d) Why rosemary is so popular as a natural food preservative
- e) What are the steps that need to be taken to prevent food adulteration
- f) Suggest a few methods for the detection of food adulteration
- g) What is a film former in nail polish? What is its role
- h) What is plasticizer in nail polish? What is its role



Question Q4.

[2 x 8]

- ✓ a. What are the traditional methods of food preservation?
- b. What is thixotrophy property, and where does it find its application?
- ✓ c. What are the health benefits of catechins?
- ✓ d. What are the benefits of using hair conditioner?
- ✓ e. What is Glass ionomer cement (GIC) and what are its major uses?
- f. What are the advantages of Resin-modified glass ionomers (RMGI)?
- g. How does an optical brightener work?
- ✓ h. What is a bleach activator? How it works?

Section-III

Total marks in this section 50

- ✓ 1. What is the photoconductivity principle? Provide an example of photoconducting polymer and list four main applications. [6]
- ✓ 2. Draw and discuss the "Nobel Prize" winning synthesis of polyacetylene. Compare the structures and conditions to obtain all-cis and all-trans polyacetylene. [6]
- ✓ 3. Describe the chemical synthesis of polyaniline. Represent different structures and salts of polyaniline, with their band gaps. [6]
- ✓ 4. What is *Gravure* printing? Represent the structures of both PVK and Ir(ppy)<sub>3</sub>, their HOMO-LUMO energy diagram, the light emitting diode device constructed and four related properties. [6]
- ✗ 5. From "Sand to Silicon to Wafers": Schematically represent the industrial production of silicon wafers? [8]
- ✓ 6. Schematically describe the preparation of PEDOT:PSS and its four applications. [6]
- ✓ 7. An n-type OFET having 100 nm PVA as an organic polymer dielectric (K=10), has threshold voltage of 1 V, gate to source voltage of 3 V and W/L ratio 20. [6]

Calculate and provide answers corrected to 02 decimal places.

- (i) the  $C_i$  (Oxide capacitance per unit area) in  $F/cm^2$
  - (ii)  $\mu$  of the OFET when  $V_{DS}$  applied is 1V, and  $I_{DS}$  is 10 nA
  - (iii)  $\mu$  of the OFET when  $V_{DS}$  applied is 5V, and  $I_{DS}$  is 20 nA
- ✓ 18. A solar cell shows a power conversion efficiency of 17.5%, fill factor of 76.2% and short circuit current density of 22.25 mA/cm<sup>2</sup> when illuminated with a 100 mW/cm<sup>2</sup> light ( $P_{in}$ ). [6]
- (a) If the short circuit current is 3.56 mA, what is the area of device in mm<sup>2</sup>?
  - (b) Calculate open circuit voltage of the device in mV (Correct to one decimal place).

$$\begin{array}{r} 22.25 \\ \times 4 \\ \hline 89.00 \end{array}$$

$$\begin{array}{r} 22.25 \\ \times 35 \\ \hline 11125 \\ 66750 \\ \hline 77875 \end{array}$$

$$C_i = \frac{\epsilon_0 \epsilon_r}{d}$$

$$V_{DS} = \frac{1.507 W C_i}{L} (V_{GGS} - V_{Th})^2$$

$$FF = \frac{P_{max}}{P_{in}} = \frac{J \times I}{P_{in}}$$

$$\begin{array}{r} 356 \\ \times 6 \\ \hline 2136 \end{array}$$

$$\begin{array}{r} 1780 \\ \times 15 \\ \hline 1780 \end{array}$$

$$\begin{array}{r} 356 \\ \times 2 \\ \hline 712 \end{array}$$

$$\begin{array}{r} 356 \overline{) 2225} \\ 2126 \\ \hline 0990 \\ 712 \\ \hline 1780 \end{array}$$