WEST BENGAL STATE UNIVERSITY
B.Sc. Honours PART-III Examinations, 2018

ELECTRONICS-HONOURS

PAPER- ELTA-V

Time Allotted: 4 Hours　　　　　　　　　　　　　　　　　　Full Marks: 100

The figures in the margin indicate full marks.
Candidates should answer in their own words and adhere to the word limit as practicable.
All symbols are of usual significance.

GROUP-A

1. Answer any *ten* questions from the following:　　　　　　　$2 \times 10 = 20$

   (a) Flux Φ (in Weber) in a closed circuit of resistance 12 Ω varies with time (in second) according to the equation $\Phi = 6t^2 - 5t + 1$.
   Find the induced current at $t = 0.50$ sec.

   (b) Given that $\vec{E} = \hat{i}\, E_0 \cos \omega \left(\dfrac{z}{c} - t \right) + \hat{j}\, E_0 \sin \omega \left(\dfrac{z}{c} - t \right)$

   determine the magnetic field $\vec{B}$.

   (c) What is the difference between conduction current and the displacement current?

   (d) Define skin effect and skin depth.

   (e) Define characteristic impedance of a transmission line.

   (f) Why is TEM mode of propagation not possible in rectangular waveguide?

   (g) What are the advantages of a reflex Klystron over a two-cavity Klystrol amplifier?

   (h) Write two applications of tunnel diode.

   (i) What is back heating of magnetron?

   (j) What do you mean by voltage standing wave ratio (VSWR)? What is its significance?

   (k) Calculate the radiation resistance of a $\dfrac{\lambda}{2}$ wire dipole in free space.

   (l) What are the conditions for obtaining sustained interference pattern?

   (m) What are Ghost lines?

   (n) What is a metastable state? Give an example.

(o) What is signal attenuation in optical fibre?

GROUP-B

(ELECTROMAGNETIC FIELDS AND WAVES)

Answer any *four* questions from the following $10\times4 = 40$

2. (a) Write Maxwell's equations for vacuum, and derive the wave equation for the electric and magnetic fields in vacuum.   6

   (b) For a plane monochromatic electromagnetic wave propagating in a homogeneous dielectric, show that the time averaged electric and magnetic energy densities are equal.   4

3. (a) Show that (i) $\vec{\nabla}\times\vec{E} = -\dfrac{\partial\vec{B}}{\partial t}$, and   3+3

   (ii) $\vec{\nabla}\times\vec{H} = \vec{J} + \dfrac{\partial\vec{D}}{\partial t}$.

   where symbols have their usual meanings.

   (b) Prove that the rate of flow of energy outward of a closed surface (S) is $\vec{P} = \vec{E}\times\vec{H}$.   4

4. (a) From the theory of dispersion prove that in case of transparent gaseous medium in the region remote from the natural frequencies, the refractive index (*n*) is given by $n^2 = A + \dfrac{B}{\lambda^2} + \dfrac{C}{\lambda^4} + \cdots$,   6

   where *A*, *B*, *C* are constants and λ is the wavelength of the incident beam.

   (b) What is anomalous dispersion ? Plot complex refractive index as a function of frequency and explain the nature of the graph.   4

5. (a) Discuss the possible reasons for distortion in a transmission line.   3

   (b) A distortionless transmission line has an inductance 1.2 mH/km, and a capacitance of 0.05 µF/km. Calculate the characteristic impedance of the line.   2

   (c) Obtain the expression for the input impedance of a transmission line of length *l* and propagation constant γ. Show that $z_0 = \sqrt{z_{sc}\times z_{oc}}$ where the symbols have their usual meanings.   5

6. (a) Define guide wavelength, cut-off frequency and free space wavelength.   3

   (b) Derive expressions for cut-off frequency and guide wavelength when electromagnetic wave is propagating in a rectangular waveguide of dimensions $a\times b$ under TM-mode.   5

(c) Compare the waveguides and transmission lines from the point of view of frequency limitation, attenuation and power handling capacity.

2

7. (a) Show that the time rate of change of dipole moment of an oscillating dipole is equal to a current element.

4

(b) Find the expression of radiation resistance of a short electric dipole with uniform current distribution.

6

GROUP-C

(MICROWAVE ELECTRONICS AND PHOTONICS)

Answer any *four* questions from the following $10 \times 4 = 40$

8. (a) Why the elemental semiconductors Ge, Si are not suitable for fabrication of Gunn diode?

3

(b) How does the tunnel diode differ from the rectifier diode?

3

(c) State the differences between transferred electron devices and avalanche transit time devices.

4

9. (a) How does the reflex Klystron differ from the amplifier Klystron?

2

(b) With the help of a suitable diagram, explain how the π-mode oscillations are sustained in a 8-cavity magnetron.

8

10.(a) Discuss Fraunhofer diffraction pattern by a double slit. Find the position of maxima and minima.

3+4

(b) In Newton's ring experiment, the diameters of the 4th and the 12th ring are 0.4 cm and 0.7 cm respectively. Find the diameter of the 20th ring.

3

11.(a) Show, by Brewster's law, the light incident on a transparent substance at polarising angle gives reflected and refracted rays at right angles to each other.

4

(b) Discuss the action of a Nicol prism as an analyser.

4

(c) An unpolarised light is incident on a glass at an angle of 60°. After reflection from the glass medium, the light is found to be plane polarized. Calculate the refractive index of the glass.

2

12.(a) Obtain a relation between Einstein's *A* and *B* coefficients. What are their physical significance?

5

(b) Briefly discuss three methods of pumping to create a population inversion.

3

(c) What is an optical resonator?

2

13.(a) What is pulse dispersion is a fibre optic system? What should be the minimum time interval between two pulses at the input of a step index optical fibre so that the pulses are resolvable at the output.

    5

  (b) A single clad optical fibre has an index of 1.62 for the core and 1.52 for the clad. Find its numerical aperture. When immersed in air, what is its acceptance angle? What is the maximum acceptance angle?

    5

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GROUP-A

1. Answer any *ten* questions from the following: 2×10 = 20

    (a) What is a Carry Look Ahead Adder?

    (b) Why the use of AM are reducing now?

    (c) What is SNR?

    (d) How many flip-flops are required to construct a 'MOD-80' counter?

    (e) What are the difference between 'stack' and 'queue'?

    (f) Add $(19B9)_{16}$ with $(C7E6)_{16}$.

    (g) Why the modulation is needed for communication?

    (h) Name two protocols that handle e-mails in TCP/IP protocol stack.

    (i) Derive the Gray Code of $(2B)_{16}$.

    (j) The IC is numbered '74LS02' what are the digits stands for?

    (k) Why the sky wave reception is better at night than day?

    (l) What is the significance of "Modulation Index"?

    (m) Name the interrupts at the top and bottom of the priority list for 8085 A'.

    (n) How the PWM differ for PAM?

GROUP-B

[Digital Electronics]

Answer any *two* questions from the following   5×2 = 10

2. (a) Convert to POS form.   2+3
$$x\bar{y} + yz + \bar{x}y\bar{z} + y = 0.$$

   (b) Construct a four input NAND gate using two input NAND gates.

3.   Draw and explain the logic circuit diagram of a 2 to 4 line decoder with only   5
      NOR gates. Include the enable line also.

4.   Design and explain the circuit of transistor inverter.   5

GROUP-C
[Microprocessor]

Answer any *one* question from the following   5×1 = 5

5.   What are the different addressing modes of 8085 microprocessor?   5

6. (a) Why the use of '8255' is must for 8085 kit?   2+3

   (b) Explain the operation of 'program counter' in microprocessor program
        execution.

GROUP-D
[Communication]

Answer any *two* questions from the following   5×2 =10

7. (a) Define Noise factor.   2+3

   (b) What are the difference between ESDF and PSDF?

8. (a) State 'Nyquist Criterion'.   1+4

   (b) Draw and explain in brief the waveforms of PAM and PWM for a given
        message signal.

9.   Explain and prove the time shifting property of Fourier transform.   5

GROUP-E
[Computer Science]

Answer any *one* question from the following   5×1 = 5

10.   Write a short note on network topologies.

11.   Explain the working principle of hub and router. Mention their application
      in telephony system.

GROUP-F

[Digital Electronics]

Answer any *two* questions from the following $10 \times 2 = 20$

12.(a) Convert the number to binary, hexadecimal, octal number system. $(39.21)_{10}$.   4

(b) Design a circuit to have subtraction using 2's compliment method.   6

13.(a) Design a 3 bit up-down counter.   5

(b) Explain the operation of successive approximation type digital voltmeter.   5

14.(a) Define the following terms considering Digital Logic Families. 2×3
(i) Figure of merit (ii) Noise immunity (iii) Fan-out.

(b) Convert a D-flip-flop to a T flip-flop.   4

GROUP-G

[Microprocessor]

Answer any *one* question from the following $10 \times 1 = 10$

15.(a) Define the followings: 4+4+2

(i) T States and (ii) Machine Cycle.

(b) Explain the significance of the nomenclature of the interrupts RST 7.5, RST 6.5 and RST 5.5.

(c) What does the instruction XCHG do?

16.(a) Write a short note on IC 8255's operating modes.   5

(b) Write a program to find out the square of number using look-up-table.   5

GROUP-H

[Communication]

Answer any *one* question from the following $10 \times 1 = 10$

17.(a) What do you mean by a pilot carrier SSB?   4+6

(b) Describe the operation of a AM demodulator circuit.

18.(a) What are the difference between Fourier transform and Fourier Series?   4

(b) Find the Fourier transform of   6
(i) Unit step (ii) $\cos(w_0 t)$.

GROUP-I

[Computer Science]

Answer any *one* question from the following   10×1 = 10

19.(a) Describe an error that can occur for each of the seven layers of the OSI model.   5

(b) Compare token-ring and token-bus architecture.   5

20.(a) Compare between bubble sorting and quick sorting.   5

(b) Write short note on any *two* of the following: 2.5×2

    (i)   router

    (ii) RAM cell

    (iii) Packet switching

    (iv) link-list.