Q.P. Code – 42631

Sixth Semester B.Sc. Degree Examination, September 2020

(CBCS Scheme)

Physics

Paper VII – EMBEDDED SYSTEM : INTRODUCTION TO MICROCONTROLLERS, OP-AMP AND QUANTUM MECHANICS

Time : 3 Hours] *[Max. Marks : 90*

Instructions to Candidates : Answers should be written completely in English.

PART – A

I. Answer any **FIVE** of the following questions. Each question carries **8** marks : **(5 × 8 = 40)**

1. (a) Explain the concept of virtual ground.

   (b) Explain with circuit how an Op-Amp function as an inverting amplifier and derive an expression for its gain. **(2 + 6)**

2. (a) Write the characteristics of an Ideal Op-Amp.

   (b) Explain with circuit diagram, how an Op-Amp can be used as Integrator and hence derive expression for output voltage. **(3 + 5)**

3. (a) State Barkhausen criterion for maintaining steady oscillations.

   (b) With a neat circuit diagram explain the working of a Wien bridge oscillator. **(2 + 6)**

4. Explain the internal architecture of 8051 microcontroller with a schematic diagram. **(8)**

5. (a) What are assembly directives? Explain any two directives.

   (b) Explain Long Call (L CALL) and Absolute Call (A CALL) instructions. **(8)**

6. Explain the pin diagram of 8051 microcontroller. **(8)**

7. (a) Give the physical interpretation of wave function.

   (b) Derive Schrödinger time dependent equation for free particle. **(2 + 6)**

8. (a) Write the expectation value equation for position and momentum.

   (b) Derive Schrödinger time independent equation. **(2 + 6)**

PART – B

II. Answer any **SIX** of the following questions. Each question carries **5** marks :

(6 × 5 = 30)

9. Calculate the output voltage and the voltage gain of a non-inverting amplifier. Given input voltage V_i = 30 mV, feedback resistance R_f = 10 KΩ and input resistance R_i = 1 KΩ.

10. Voltages of 1 V, 2 V and 3 V are applied to the input of an Op-Amp inverting adder through resistors of 10 KΩ, 5 KΩ and 30 KΩ respectively. Calculate the output voltage of the adder, the feedback resistor is of 30 KΩ.

11. In a phase shift oscillator each resistor in the R.C. network is 10 KΩ and each capacitor has a value of 0.01 μF. Find the operating frequency of the circuit.

12. Show the status of the CY, AC and P flags after the addition of 38 H and 2 FH in the following instruction :

    MOV A, # 38 H

    ADD A, # 2 FH

13. Write a program to multiply two 8 bit numbers stored at locations 70 H and 71 H store the result at memory locations 52 H and 53 H.

14. Find the probability that a particle in one dimensional box of length L can be found between 0.4 L to 0.6 L for the ground state.

    Given $\psi = \sqrt{\frac{2}{L}} \sin \frac{n\pi x}{L}$

15. A particle limited to the x-axis has the wave function $\psi = ax$ between $x = 0$ and $x = 1$, $\psi = 0$ elsewhere. Find the expectation value of the particle position.

16. The position and momentum of 1 keV electron are simultaneously determined. If the position is located within 1 A°, what is the percentage uncertainty in its momentum?

PART – C

III. Answer any **TEN** of the following questions. Each question carries **2** marks : **(10 × 2 = 20)**

17. (a) Why IC's are so cheap?

(b) Mention any two advantages of IC's over discrete component circuits.

(c) What is the condition for C.M.R.R. to be infinite? Explain.

(d) Phase shift oscillators are not suitable for variable frequency work. Explain.

(e) Why microprocessor is faster than microcontroller?

(f) What is the width of DATA bus and Address bus?

(g) What is the largest Hexa value that can be moved into a 8 bit register? What is the decimal equivalent of that value?

(h) How many bytes are used by the following directives?

(i) DATA-1 DB "INDIA"

(ii) DATA-1 DB "1234"

(i) Write the Quantum mechanical operator for momentum and energy.

(j) What is Gaussian wave packet?

(k) What is Hamiltonian?

(l) How quantum mechanics is different from classical mechanics?