FIRST SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2023
(Regular/Improvement/Supplementary)

PHYSICS
FPHY1C04- ELECTRONICS

Time: 3 Hours   **Maximum Weightage: 30**

Part A: Short answer questions. Answer *all* questions. Each carries *one* weightage.

1.   Sketch a two-input NAND gate and verify that it satisfies the Boolean NAND equation.

2.   What is population inversion? Explain with example.

3.   Describe about tunnel diode.

4.   Explain briefly the advantages of the differential input and output amplifier.

5.   Elaborate on voltage followers.

6.   Explain R - 2R ladder D/A converter.

7.   How shift register can be used as counter?

8.   What is a flip – flop?

$(8 \times 1 = 8$ **weightage)**

Part B: Essay questions. Answer any *two* questions. Each carries *five* weightage.

9.   Discuss the principles of operation of photodetectors and explain the different types of photodetectors. Describe the different factors that affect the performance of photodetectors.

10. What are the characteristics of an ideal Op-Amp? Define the electrical parameters: input offset voltage, input resistance, CMMR and slew rate.

11. Explain the difference between the integrator and differentiator. Give applications of each.

12. What is a microprocessor? Explain the internal architecture of intel 8085.

$(2 \times 5 = 10$ **weightage)**

Part C: Problems. Answer any *four* questions. Each carries *three* weightage.

13. Calculate the voltage gain of a device as a single stage, and then as the first transistor in a cascaded amplifier consisting of two identical stages. The MOSFET parameters are $g_m = 1.5$ mA/V, $r_d = 47$ K, $C_{gs} = 2$ pF, $C_{ds} = 1$ pF and $C_{gd} = 3$ pF.

(P.T.O.)

14. The amplifier of figure utilizes an n-channel FET for which VP= -2 V and I_{DSS}= 1.55 mA. It desired to bias the circuit at I_D= 0.85 mA, using V_{DD} = 24 V. Assume rd >> Rd, find V_{GS}, g_m and R_s.
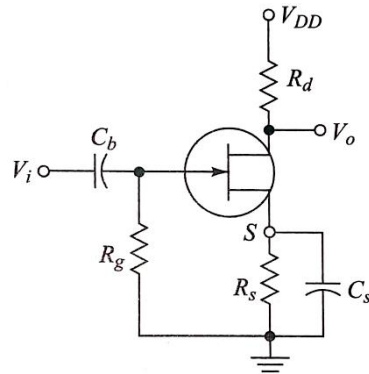
15. Find the threshold current for a laser diode using following data: Front and mirror reflective are 0.44 and 0.99 respectively. The cavity length and width are 300 μm and 5 μm, respectively, $\alpha = 100$ cm^{-1}, $\beta = 0.1$ cm^{-3}A^{-1}. $g_0 = 100$ cm^{-1} and $\Gamma = 0.9$.

16. For the inverting amplifier shown in the figure, determine the maximum possible output offset voltage due to input offset voltage V_{io} and input bias current I_B. the op – amp is a type of 741.
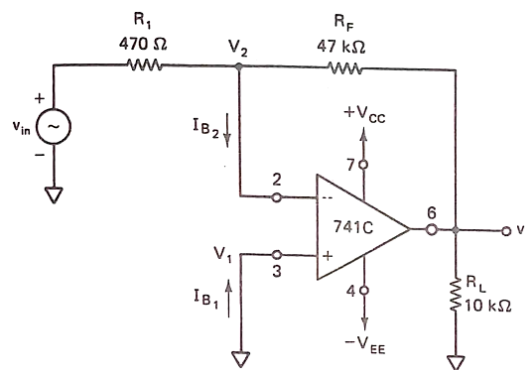
17. A certain Wien bridge oscillator uses R = 4.7 kΩ, C = 0.01 μF and $R_F = 2R_1$. What is the frequency of oscillation?

18. What is the maximum modulus of a counter with each of the following number of flip –flops?   a) 2,   b) 5,   c) 10.

19. Convert J-K flip – flop into: a) SR flip – flop and b) D flip – flop.

(4 × 3 = 12 weightage)