BRAINWARE UNIVERSITY

Term End Examination 2018 - 19

Programme – B.Tech. in Computer Science & Engineering

Course Name – Engineering Physics II

Course Code – PH201

(Semester – 2)

Time allotted: 3 Hours **Full Marks : 70**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group –A

(Multiple Choice Type Question) 10 x 1 = 10

1. *Choose the correct alternative from the following*

(i) For small value of damping constant, the quality factor

a. small b. large

c. remains constant d. none of these

(ii) FET is a

a. voltage controlled device b. current controlled device

c. impedance controlled device d. resistance controlled device

(iii) To get a circular Lissajous figure, the phase difference (φ) and the amplitudes (a and b) of two superimposing, mutually perpendicular simple harmonic motions are as follows

a. $\varphi = 0, a = b$ b. $\varphi = \pi/2, a = b$

c. $\varphi = \pi/2, a \neq b$ d. $\varphi = 0, a \neq b$

(iv) For the function $e^{\alpha x}$, the eigen value of the operator $\frac{d^2}{dx^2}$ is given by

a. α b. α^2

c. $2\alpha^2$ d. $\frac{\alpha}{2}$

(v) Transconductance of a FET is proportional to

a. $\sqrt{V_{DS}}$ b. I_{DS}

c. $\sqrt{I_{DS}}$ d. none of these

(vi) The feedback element in an integrator is a

a. capacitor b. inductor

c. diode d. resistance

(vii) The open loop voltage gain of an ideal OPAMP is

a. small b. infinity

c. can be anything d. unity

(viii) The feedback element in a differentiator is a

a. capacitor b. inductor

c. diode d. resistance

(ix) An ideal OP AMP has

a. infinite input impedance b. zero output impedance

c. infinite voltage gain d. all of these

(x) The voltage gain of an OP AMP used as non-inverting amplifier is

a. less than unity b. greater than unity

c. equal to unity d. none of these

Group – B

(Short Answer Type Questions) 3 x 5 = 15

Answer any *three* from the following

2. Establish the relation $\mu = r_d g_m$ in case of FET, where the notations have their usual meanings. 5

3. What do you mean by CMRR of an Op-Amp? Calculate the common mode gain of an operational amplifier from the following parameters: The differential voltage gain A_d=104 and CMRR=2000. 2+3

4. Describe the action of an OPAMP as inverting amplifier. 5

5. Show that the momentum operator in 1D is represented by $\hat{p}_x = -i\hbar\frac{\partial}{\partial x}$ 5

6. Write short note on He-Ne Laser. 5

Group – C

(Long Answer Type Questions) 3 x 15 = 45

Answer any *three* from the following

7. (a) What do you mean by feedback in amplifier? Explain with the help of block diagram, the working principle of feedback amplifier. Find the expressions for voltage gain with both positive and negative feedback. Hence find Barkhausen criterion for sustained oscillation in each case. 2+3+5+2

   (b) Write down the effects of negative feedback. 3

8. (a) What is slew rate? Explain virtual ground concept of an Op-Amp. 2+3

   (b) Elucidate the action of OPAMP as Low pass filter. 5

   (c) Calculate the output voltage for the summing amplifier circuit using OPAMP. Given V_1=1.2V,V_2=3V,V_3=2V and R_1=10KΩ, R_2=20KΩ, R_3=50KΩ and R_f=30KΩ, where notations carry the usual meanings. 5

9. (a) Draw the circuit diagram of a common source n-channel JFET amplifier. Develop the theoretical formulation for small signal voltage equivalent circuit. Hence, calculate the small signal voltage gain of the amplifier. 2+4+2

   (b) The transconductance and the ac drain resistance of a FET are 0.2 mA/V and 150 KΩ respectively. This device is used in the common source configuration with a load resistance of 150 KΩ. Determine the small signal voltage gain. 5

10. (a) Write down the time-independent Schrodinger wave equation. 2

    (b) A particle is placed inside one dimensional box having rigid wall and length a. Derive the wave function and normalise it. 8

    (c) Normalize the wave function N(a-x) appropriate for a particle in one dimensional box of length a, having rigid wall. 5

11. (a) Write down the distribution in tabular forms to show the various microstates and macro-states of a system of two particles, arranged in two compartments assuming that the particles are i) Boltzons ii) Bosons and iii) Fermions. 3+3+2

    (b) Define numerical aperture of an optical fiber and derive its expression. 7
