VCD/ 1110 22 S.Y.B.Sc SEM III PHY-II__ 100 MARKS 3 HOURS

Note: i) All the questions are compulsory.
ii) Figures to the right indicate full marks.
iii) Use of non programmable calculator is allowed.

Q.1.A] Select the correct option: [12M]

1) A differential amplifier_____.
(a)Rejects commom-mode signals (b) Amplify differential-mode signals
(c)Both (a) & (b) (d) Accept two input signals & amplify them.

2) An amplifier has a power gain of 100.Its dB gain is _____.
(a)20dB (b)40dB (c)10dB (d) none

3) The volume of a sphere of radius 3R is _____.
(a)$\frac{4}{3}\pi R^3$ (b) $2\pi R^3$ (c) $36\pi R^3$ (d) none

4) If the value of the collector current I_C increases in CE configuration , then value of V_{CE}_____.
(a)remains same (b)decreases (c)increases (d) none

5) The value of the line integral $\int grad\ (x+y-z)$dr from (0,1,-1) to (1,2,0) is _____.
(a)-1 (b)3 (c)0 (d) none

6)The work done by the force$\vec{F}$=yz$\hat{\imath}$+zx$\hat{\jmath}$+xy$\hat{k}$ in moving a particle from point (1,1,1) to (3,3,2) along a path is _____.
(a)51 (b)0 (c)17 (d)none

Q.1.B] Answer in one statement: [3M]

1. What happens in case of cutoff region operation.
2. Give unit vector in the direction of $\vec{A} = 2\hat{\imath}+2\hat{\jmath}-\hat{k}$.
3. Which IC is used to study Op-Amp?

Q.1.C] Fill in the blanks: [5M]

1)A necessary & sufficient condition that line integral $\int A.\,dr = 0$ for every close curve C is _____.
2)Volume element in cylindrical system is _____.
3)The stability factor value for the base resistor bias is_____.
4)In sustaining oscillations, the loop gain should be _____.
5)The phase difference between the output & input voltages of CE amplifier is _____

Q.2.A] Attempt any one: - [8M]

1. Evaluate using cylindrical co-ordinates: $\int_0^{2\pi}\int_0^{3}\int_0^{z/3} r^3\,dr\,dz\,d\theta$
2. S is the surface of the plane 2x+y+2z=3 in the first octant. Evaluate $\int A.n\,dS$ if $\vec{A}$=(x^2+y^2)$\hat{\imath}$-2x^2$\hat{\jmath}$+2yz$\hat{k}$.

By using the divergence theorem evaluate $\iint \vec{F}.\vec{n}\overrightarrow{dS}$
where $\vec{F}$ = 3xz$\hat{\imath}$+2y^2$\hat{\jmath}$+yz$\hat{k}$ & S is surface of the cube bounded by x= 0 to 1, y= 0 to 1 & z= 0 to 1

Q.2.B] Attempt any one: - [8M]

1.Evaluate using spherical co-ordinates: $\int_0^{2\pi}\int_0^{\pi}\int_0^{(1-\cos\phi)/2} r^2 \sin\phi dr d\phi d\theta$

2. Check the fundamental theorem for gradients using $T=x^2+4xy+2yz^3$ the points A=(0,0,0),B=(1,1,1) and the three paths,
i) (0,0,0) → (1,0,0) → (1,1,0) → (1,1,1)
ii)(0,0,0) → (1,0,0) → (1,1,0) → (1,1,1)
iii)The parabolic path $z=x^2$, y= x

Q.2.C] Attempt any one: - [4M]

1.State fundamental theorem of Curls with diagram.

2.Show that $\frac{\partial r}{\partial r}\cdot\frac{\partial r}{\partial \theta}=\frac{\partial r}{\partial \phi}\cdot\frac{\partial r}{\partial r}=\frac{\partial r}{\partial \theta}\cdot\frac{\partial r}{\partial \phi}=0$ when x=r sinΘcosΦ,y=r sinΘsinΦ ,z=r cosΘ are the spherical co-ordinates.

Q.3.A] Attempt any one: - [8M]

1. Explain any four advantages of Negative Feedback.

2.Describe dc bias circuit with Emitter resistor for a transistor . Determine its stability factor. State its advantages .

Q.3.B] Attempt any one: - [8M]

1.Describe Voltage divider biasing for a transistor . Determine its stability factor .State its advantages & disadvantages.

2.What is faithful amplification? State and explain any two conditions to be fulfilled to achieve faithful amplification in a transistorized amplifier.

Q.3.C] Attempt any one: - [4M]

1. A power amplifier has an input voltage v_i=12V peak to peak & an output voltage v_o=8V peak to peak across a load resistance of 8Ω.The amplifier input resistance is 500KΩ.Determine its power gain.

2. Define amplifier.An amplifier has an input signal voltage 0.1V & draws 0.1mA from the source.The amplifier delivers 5V to a load at 10mA.Determine the voltage, current and power gain.

Q.4.A] Attempt any one: - [8M]

1.Draw labeled diagram of Colpitts oscillator & using this diagram determine the following parameters:
a)feedback fraction b)min. gain for sustain oscillations c)freq. of oscillation.
Use the foll. Components:C_1=0.014μF , C_2=0.14μF,L=20μH.

2.By means of a neat circuit diagram explain the use of Op-amp as a Inverting amplifier.What is the input resistance of Op-amp used as inverting amplifier when its output is -12V,with input of 120mV. The feedback resistance is 10MΩ.

Q.4.B] Attempt any one: - **[8M]**

1.Explain the basic requirements of Sustained oscillations.Determine the operating frequency & feedback factor for Hartley oscillator,using the following data:L_1=200mH,L_2=2000mF,M=0.002mH,C=20pF

2.Explain the architecture block diagram of a typical Op-amp.Calculate the output voltage of an Op-amp working as a differentiator;A ramp of 3V height drives the circuit and has width of 3msec.If the R_fC time constant is 1 msec. for C=0.1μF

Q.4.C] Attempt any one: - **[4M]**

1.Write a note on Hartley Oscillator.

2.Determine the output voltage of a non-inverting amplifier for R_i=200K ,R_f=2MΩ & input voltage10mV.

Q.5] Answer the following: -[Any four] **[20M]**

1.Explain an oscillator with a simple block diagram.
2.By means of a neat circuit diagram explain the use of Op-amp as a Non-inverting amplifier.
3.Determine the volume integral of the function $T=z^2$ over the tetrahedron with corners at (0,0,0),(1,0,0),(0,1,0) & (0,0,1).
4.A solid of constant density ρ=1 occupies the region S.Find the solids M.I.about z-axis.Given: $r \leq 1$ by the cone $\phi=\pi/3$
5.It is desired to set the operating point at 4V,1.2 mA by biasing silicon transistor with collector feedback resistor R_B.If β = 120, find the value of R_B.
6.Determine the open circuit voltage of the source,v_s to provide an amplifier input voltage v_i of 0.25V when the internal resistance of the source is 50Ω.

-x-x-x-x-x-x-x-x-x-x-x-x-x-x-x-