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CARMEL COLLEGE OF ARTS, SCIENCE & COMMERCE FOR WOMEN, NUVEM-GOA
SEMESTER END EXAMINATION, JANUARY 2022

Semester: *III* **Course name & Code:** *Section 1: Waves and Oscillations; Section 2: Electronics & PYC 103*

Total marks: *80* **Date:** */01/2022* **Duration:** *2 Hours* **Total No of pages: 4**

Instructions:

1) *Answer Section-1 and Section-2 on separate answer book.*
2) *All questions are compulsory, however internal choice is available.*
3) *Figures to the right indicate maximum marks to the question.*
4) *Symbols have their usual meanings unless otherwise stated.*
5) *Draw neat diagram wherever necessary.*
6) *Use of non-programmable calculator is permitted.*

Section -1

Q1. Answer **any FOUR** of the following questions. ***(4 x 4 = 16)***

(A) Define the following terms:
Periodic motion, Oscillation, Time period and Frequency.

(B) Show mathematically that Compound pendulum undergoes a simple harmonic motion.

(C) What is wave motion? Mention the types of wave motion with a definition and an example.

(D) Explain free vibrations, forced and resonant vibrations. Give examples.

(E) What is Quality factor for a forced damped harmonic oscillator. Explain using a plot of Amplitude of a forced damped harmonic oscillator as a function of the angular frequency of the driving force.

(F) What do you mean by degrees of freedom? What is the degree of freedom for a particle moving on a thin wire and on a plane respectively?

Q2.(A)

(2 x 3 = 6)

(p) Write a short note on bifilar pendulum.

(q) At a construction site, a bucket full of concrete hangs from a crane. You observe that the bucket slowly swings back and forth, *8.0 times per minute*. What is the length of the cable from which the bucket hangs?

OR

Q2.(A)

(2 x 3 = 6)

(x) A Helmholtz resonator has a volume of *1 litre*. The radius of the neck is *1 cm* and the length of the neck is *0.2 cm*. Calculate the frequency at resonance. (Velocity of sound at room temperature is *350 m/s²*).

(y) A simple harmonic motion is given by $x = Acos(\omega t)$. Draw a neat graph of displacement, velocity and acceleration v/s time (Scale of all the plots should be same).

Q2. (B)

(1 x 6 = 6)

Obtain an expression for the resultant of two simple harmonic motions, moving in same direction and having same frequency but different phase angles. Also obtain the expression for the resultant amplitude.

Q3. (A)

(2 x 3 = 6)

(p) Explain interference with a help of superposition two simple harmonic motions.

(q) An ocean wave has a wavelength of *120 m* and a period of *8.77 s*. Calculate the frequency, angular frequency, wave number, and speed of this wave.

OR

Q3.(A)

(2 x 3 = 6)

(x) A horizontal spring of constant k is attached to a mass m that slides on a slightly frictional floor. After the mass is displaced a distance A from equilibrium and released, the amplitude of oscillation decreases to $0.95A$ after 10 cycles. What is the Q of this system?

(y) Write the equation of motion for a damped harmonic oscillator. Name the three situation/cases that arise for this oscillator and write the respective relation of ω_0 and Γ.

Q3.(B) *(1 x 6 = 6)*

Derive the equation of motion for a forced underdamped oscillator for any system. Also find the expression for it's amplitude and explain sharpness of resonance.

Section-2

Q.1. Answer **any Five** of the following. *(2 x 5 = 10)*

(A) What are the advantages of a bridge rectifier over a half wave rectifier.

(B) What are the biasing conditions for the two transistor junctions when the transistor is biased in active region?

(C) What is bandwidth of an amplifier? State the bandwidth required for a good audio amplifier

(D) What is the ratio of voltage gain before feedback to the gain with feedback?

(E) What is meant by Buffer Amplifier?

(F) Define the three stability factors.

(G) Draw the ideal voltage transfer curve of an op-amp.

Q.2(A) **(p)** Why is zener diode used as a d.c. regulator? Can thermistor be used for d.c. regulation. *2*

(q) In a transistor, $I_B = 68\ \mu A$, $I_E = 30$ mA and $\beta = 40$. Find the value of α and the collector current I_C. *3*

OR

Q.2(A) **(x)** What is the thermistor sensitive to when operated in the self heated mode? What are some of the applications in this region of operation? *2*

(y) The ripple factor of power supply is 5 %. Its output voltage is 100 volts. Determine the r.m.s. value of its ripple voltage and Vr (peak) assuming ripple to be sinusoidal in nature. *3*

Q.2(B) Derive an expression for the ripple factor of a full wave rectifier without filter. *5*

Q.3 (A) **(p)** What is conversion efficiency of an amplifier? What is the maximum theoretical efficiency of class A and class C amplifier? *2*

(q) An amplifier has a power gain of 30 dB. If the output power is 8 watts, determine the input power. *3*

OR

Q.3(A) **(x)** What does a d.c. load line represent? *2*

(y) Obtain the stability factor S for a fixed bias circuit. *3*

Q.3(B) Show that the maximum theoretical efficiency of a directly coupled Class A amplifier is 25 %. *5*

Q.4.(A) **(p)** State any four advantages of negative feedback. *2*

(q) Find the value of collector current Ic for potential divider method of biasing if Vcc = 9V, Re = 1KΩ, R1= 39KΩ, R2 = 10KΩ, Rc = 2.7 KΩ, Vbe = 0.15 V and β = 90. *3*

OR

Q.4.(A) **(x)** Draw the circuit diagram of op-amp as noninverting amplifier and obtain the expression for the voltage gain. *2*

(y) An amplifier has the following characteristics Ri = 2K, Ro = 40K and voltage gain Av = 100, If 5% negative feedback in series with the input is used, determine the input and output resistance with feed back. *3*

Q.4.(B) Explain with the help of a neat diagram the working of RC phase shift oscillator. Write the expression for feedback factor B and for its frequency of operation. *5*