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

Semester: *I*
Course Name & Code: *Section 1: Mathematical Methods and Mechanics PYC 101*
Section 2: Electrical Circuit Theory

Total marks: *80* **Date:**21*/11/2022* **Duration:** *2 Hours* **Total No of pages: 03**

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. **(4x4 = 16)**

(A) If $\mathbf{A} = \begin{pmatrix} 1 & 2 & 5 \\ 2 & 3 & 2 \\ 1 & 4 & -1 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 1 & 3 & 4 \\ 2 & 4 & 6 \\ -1 & 3 & 4 \end{pmatrix}$. Find $2|A| + 2|B|$.

(B) Plot the function $f(x) = \sqrt{1 - x^2}$ and discuss the continuity of when $x = +1$ and $x = -1$.

(C) Write $z = 4(\cos 120° + i \sin 120°)$ in standard form a + bi. Show complex number in a plot of complex plane.

(D) A part of Newton's first law states that a body continues to move uniformly in the absence of an external force appears contradictory. Comment.

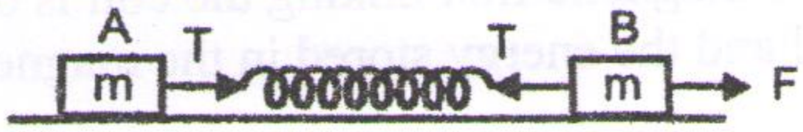
(E) Vehicle stop on applying brakes. Does this phenomenon violet the principle of conservation of momentum? Explain.

(F) A body is projected with a velocity of $25ms^{-1}$. After 3s it crosses a vertical pole of height 10.5 m. Find the angle of projection and horizontal range of projectile. (use $g=9.8m/s^2$)

Q2.(A)

(p) The dot product of two vectors **A** and **B** is zero. The magnitudes of the two vectors are, respectively, A=4 and B=6.What can you say about the cross product of these two vectors? **(3)**

(q) Two bodies A and B each of mass m are fixed together by a massless spring. A force F acts on the mass B as shown in Figure. At the instant shown, the body A has an acceleration a. What is the acceleration of B? **(3)**



OR

Q2.(A)

(x) A hammer weighing 1 kg moving with a speed of 20m/s strikes the head of a nail driving it 10 cm into a wall. Neglecting the mass of the nail, calculate (a) the acceleration during the impact (b) the time interval during the impact (c) the impulse. (3)

(y) Find the limit of the trigonometric function $\lim_{x\to 0} \frac{\cos x - \sin x - 1}{2x}$ (3)

Q2.(B)

Derive an expression for displacement of the particle in motion under a resistive force. (6)

Q3.(A)

(p) Using chain rule evaluate $\mathbf{y = \tan 3x}$ (3)

(q) Evaluate $\int \mathbf{x\, e^{-x} dx}$ (3)

OR

Q3.(A)

(x) Find the integral of $\int 5 \cos 5x \, dx$ (3)

(y) Given $x^2 + y^2 = 25$, find $\frac{dy}{dx}$. (3)

Q3.(B)

Find (a) time of flight, (b) Max. Height (c) Horizontal range of projectile projected with speed 'v' making an angle θ with the horizontal direction from ground. (6)

Section -2

Q4. Answer **any FOUR** of the following questions. **(4x4 = 16)**

(A) Explain the working of a constant voltage source and illustrate with diagram an ideal voltage source.

(B) What do you understand by the term time constant of a given LR circuit and also state its physical significance.

(C) State the principle of non-inductive resistance coil and list different kinds of losses in a transformer coil.

(D) Why a parallel resonant circuit called a rejector circuit, state the condition for natural resonance.

(E) Capacitive reactance in D.C. circuit is infinite. Explain.

(F) Write the balancing condition for Wheatstone A.C. bridge and state few of its applications.

Q5.(A)

(p) A D.C. electromagnet is wound with 960 turns and has resistance of 50Ω when the exciting voltage is 230V, the magnetic flux linking the coil is 0.005Wb. Calculate the self – inductance of the coil and the energy stored in the magnetic field. (3)

(q) State Norton's Theorem and draw a Norton equivalent circuit to demonstrate the same. (3)

OR

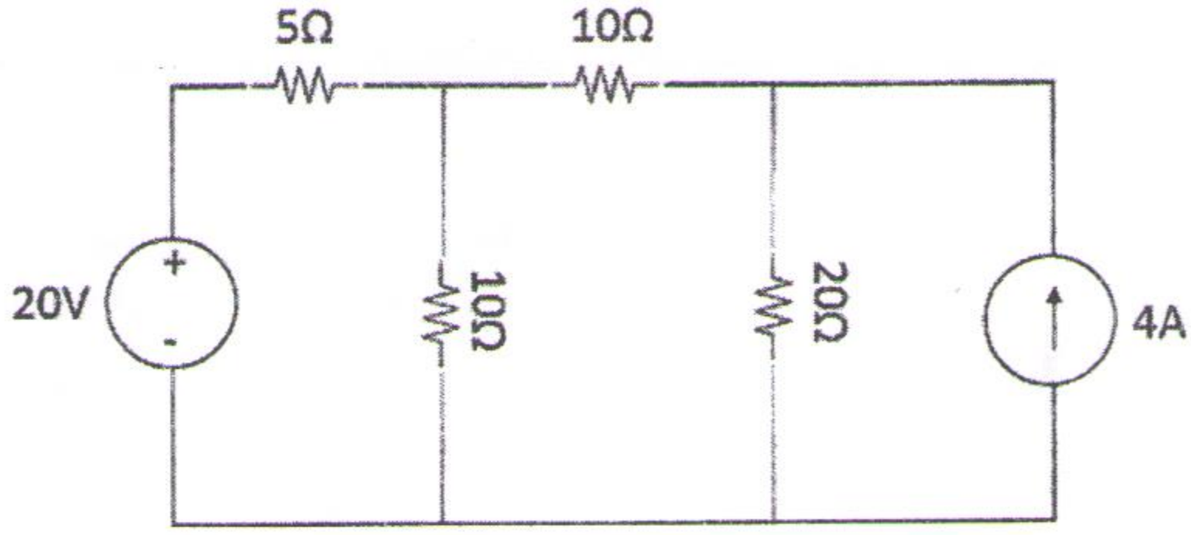
Q5.(A)

(x) State Thevenin's Theorem and draw a Thevenin's equivalent circuit to demonstrate the same. (3)

(y) Draw neat diagram of two coils of self-inductance L1 and L2 are connected in parallel and Derive the expression for the total inductance. (3)

Q5.(B)

Find the current flowing through 20Ω using the superposition theorem. (6)



Q6.(A)

(p) In Wein's bridge R1 = R2 = 800 ohms and C1= C2 = 1μf. Find the frequency at which the bridge balances. (3)

(q) An electric lamp which runs at 80 volt D.C. and consumes 10 A is connected to 100 volt, 50Hz A.C. mains. Calculate the inductance of the choke required. (3)

OR

Q6.(A)

(x) An alternating e.m.f. is applied to a circuit containing an inductor, capacitor and a resistor in series. Obtain an expression for the impedance. (3)

(y) A 50 μ F capacitor is capacitor is connected across a 230 V, 50 Hz supply. Calculate the reactance offered by the capacitor, maximum current and the r.m.s. value of the current drawn by the capacitor. (3)

Q6.(B)

A D.C. source of emf V volts is connected in series with a key, a capacitor of C Farads and a resistor of R Ω. Find the maximum charge on the capacitor and the time taken for the charge to reach half its maximum value. (6)