B.SC. 4th Semester (Honours) Examination, 2019 (CBCS)

Subject : Physics

Paper : SEC-2

(Electrical Circuits and Network Skills)

Time: 2 Hours
Full Marks: 40

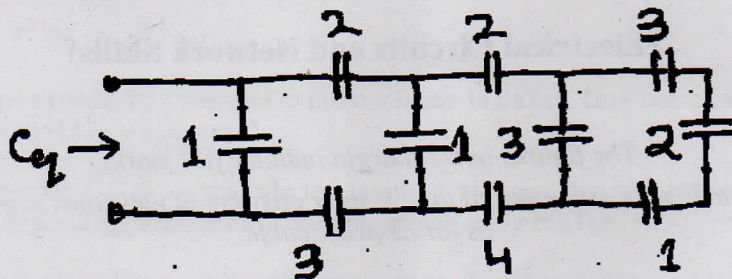*The figures in the margin indicate full marks.*
Candidates are required to give their answers in their own words
as far as practicable.

1. Answer *any five* of the following questions: 2×5=10

   (a) A current of 5A exists in a 10Ω resistance for 4 minutes. How many coulombs and how many electrons pass through any section of the resistor in this time?

   (b) Why don't birds sitting on a powerline get electrocuted?

   (c) Explain 'reactance' and 'impedance'.

   (d) What is the difference between neutral, ground and earth?

   (e) Explain the working of an ammeter.

   (f) What do you mean by circuit breaker?

   (g) Briefly mention two differences between 'single phase' and 'three phase' in a motor?

   (h) Why power transmission cables and lines are loose on electric poles and transmission lines?

2. Answer *any two* of the following questions: 5×2=10

   (a) Two bulbs of 80W and 100W are first connected in series and later in parallel circuit. In each case, which bulb will glow brighter? Explain.

   (b) An electric lift is required to raise a load of 5 tonne through a height of 30m. One quarter of electrical energy supplied to the lift is lost in the motor and gearing. Calculate the energy in kWhr supplied. If the time required to raise the load is 27 minutes, find the kW rating of the motor and the current taken by the motor. The supply voltage is 230V d.c. Assume the efficiency of the motor is 90%.

   (c) What is an isolated ground? Discuss how it is implemented.

   (d) (i) A platinum coil has a resistance of 3·146Ω at 40°C and 3·767Ω at 100°C. Find the resistance at 0°C and the temp coefficient of resistance at 40°C.

   (ii) What is power factor for a LCR series circuit. 3+2=5

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3. Answer *any two* of the following questions: $10×2=20$

   (a)   (i) Briefly discuss about the $p-n$ junction diode explaining its principle of operation.

        (ii) What do you mean by capacitance? Find the capacitance of the circuit shown in figure 1. All capacitances are in μF. $5+2+3=10$

   (b)   (i) Draw the circuit diagram and explain the operation of a full wave rectifier.

        (ii) The resistivity of a ferric-chromium-aluminium alloy is $51 × 10^{-8} \Omega$m. A sheet of the material is 15cm long, 6cm wide and 0·014cm thick. Determine the resistance between the opposite ends and the opposite sides.

        (iii) Two capacitors of 4μF and 12μF capacitances and each of working voltage rating of 24V are connected in series across a 24V battery. Calculate the charge and voltage across each of them. $3+3+4=10$

   (c)   (i) What is a transformer? Discuss its principle of operation.

        (ii) Briefly discuss the components and working principle of AC generator.

        (iii) What is Ohm's law? $4+4+2=10$

   (d)   (i) Draw the various electrical symbols for wire, switch and relay, ground, resistor, capacitor, inductor, power supply, meter, lamp, diode, motor and transformer.

        (ii) What is ladder diagram? Why are they used? Explain giving example. $6+4=10$

B.SC. 4th Semester (Honours) Examination, 2019 (CBCS)

Subject : Physics

Paper : SEC-2 (OR)

(Computational Physics Skill)

Time: 2 Hours   **Full Marks: 40**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words
as far as practicable.

1. Answer *any five* of the following questions: 2×5=10

   (a) Write the flowchart for conversion from Cartesian to spherical polar co-ordinates.

   (b) Draw and mention the purpose of any four flowchart symbols.

   (c) Explain the difference between 'stop' and 'end' statements in FORTRAN?

   (d) What is the difference between GOTO and assigned GOTO statements in FORTRAN?

   (e) How do you change the font size using LaTex command?

   (f) What are the codes used in LaTex to produce coloured text.

   (g) Write down the basic GNU plot commands for plotting data from a file.

   (h) What is subprogram statement in FORTRAN?

2. Answer *any two* of the following questions: 5×2=10

   (a) Write down the algorithm to find the trajectory of a projectile thrown at an angle with horizontal.

   (b) Discuss how variables and constants are used in FORTRAN. How are the relational operator expressed in FORTRAN?   3+2=5

   (c) Write code in LaTex to produce the following table:

X	Y	X.Y
0	0	0
0	0	0
1	0	0
1	1	1

   (d) Write the GNU plot commands to plot the $\sin x$ curve. Also write the command to plot the data by solid line and dashed curve for two different values of x. How to fill an area between two curves: $f(x) = \sin x$ and $g(x) = x$, using GNU plot.   2+2+1=5

3. Answer *any two* of the following questions: 10×2=20

(a) Write LaTex codes to produce the following equations:

(i) $\frac{y}{\frac{3}{x}+b} = 5$

(ii) $\int_a^b x^2 \, dx = \frac{1}{3}(b^3 - a^3)$

Write and explain the command to insert a figure in LaTex. How one can scale the size of the figure in the LaTex document?

4+4+2=10

(b) What are the LaTex commands for inserting bibliography and citing references? Hence discuss in detail the management of bibliography using BibTex. (2+3)+5=10

(c) What is sorting? What are the different sorting algorithms? Write a FORTRAN program to rearrange the 10 elements in ascending order.

2+3+5=10

(d) Write a program to evaluate sum of finite series: $1 + 3 + 5 + \cdots + 19$. Write a program to calculate the Euler number using exp(x) series evaluated at $x = 1$.

5+5=10

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