

**B.Sc. Semester-2 Honours Examination -2020**

**Sub.-PHSA**

**PAPER- CC-3**

**FM-50**

**Modalities**

1. An examinee shall not attend her/his college in person to sit for the examination of a practical paper. Examinee shall
  - (a) write her/his answer with BLACK INK only.
  - (b) must attach a scanned copies of her/his admit card of previous examination and the registration certificate at the end of the answer script.
  - (c) scan the whole answer script in a single .pdf file. If it is instructed to use separate answer scripts for different modules/units, if any, examinee must do accordingly, but she/he shall create a single .pdf file for the answer script. There will be exactly one .pdf file for each examinee.
  - (d) upload her/his answer script through proper web portal to submit.
2. The full marks and duration of examination of a paper shall be in accord with those specified by the University of Calcutta. The examination of a paper shall consist of three parts, viz., Internal Examination, Theory and Practical. **An examinee must use separate answer scripts for the three parts but scan the whole answer script(answers, admit card and registration certificate) in a single .pdf file and upload.**
3. For examinations of a practical paper, examinees need not submit their laboratory work book, neither they have to face any viva. Examinees shall have to answer the questions following the instructions given in the question paper. Examinees shall use her/his own graph-papers to draw graphs(if any) in practical papers and attach them at proper positions of the answer script. Examinees shall draw circuits and graphs with BLACK INK only.

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**Use separate answer scripts for Internal, Theory and Practical examinations.**

INTERNAL ASSESSMENT -10 marks

1. Answer **any two** questions:

5X2=10

- a) A charge of 4 C is moving with a velocity  $\vec{v} = (2\hat{i} + 3\hat{k})$  in a magnetic field

$\vec{B} = (2\hat{j} + 5\hat{k})$  Wb/m<sup>2</sup>. Find the force acting on the charge.

- b) Check whether the following represent electrostatic fields or not:

$$\vec{E}_1 = (4y\hat{i} - 2x\hat{j} - \hat{k}); \vec{E}_2 = (4xy - z^3)\hat{i} + 2x^2\hat{j} - 3xz^2\hat{k}$$

- c) A 1.5 m long solenoid of 0.4 cm. diameter possesses 10 turns per cm length. A current of 5 A flows through it. Find the magnetic field at the axis inside the solenoid.

- d) If the wave form of a current has form factor 1.2 and peak factor 1.7, find the average and *r.m.s* value of the current if maximum current is 100A.

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**THEORY -25**

Answer **question no. 2** and any **two** from the rest in this group.

2. Answer **any five** questions:

5X1=5

- a) What is Gauss's law in electrostatics?
- b) What is Poisson's equation?
- c) What is Laplace's equation?
- d) What is Biot-Savart law?
- e) What is Ampere's circuital law?
- f) What is r.m.s value of alternating current?
- g) What is Lenz's law ?

3. (a) Show that electric field is always perpendicular to a equipotential surface.

(b) A point charge 'q' is placed symmetrically at a distance 'd' from two perpendicularly placed grounded conducting infinite plates. Calculate the net force F on the charge 'q'.

(c) A point charge q is placed at a distance  $r_0$  from the centre of a grounded spherical conductor of radius a ( $a > r_0$ ). Find by method of electrical image the electric field at an external point and total charge induced on the sphere.

2+2+(4+2)

4. (a) What is Lorentz force ? A long straight conductor carries a current I . Determine the force per unit length of the conductor when it is placed in a uniform magnetic field.

(b) State Faraday's law of electromagnetic induction and express it in differential form.

(c) Explain how Maxwell generalized Ampere's circuital law.

(2+2)+(2+2)+2

5. (a) Prove that for parallel LCR circuit at resonance the impedance of the circuit is maximum.

(b) From current response curve for a series LCR circuit, show how Q-factor of the circuit quantifies the sharpness of resonance.

c) A 230 V, 50 Hz voltage is applied to a coil  $L = 5H$  and  $R = 2\Omega$  in series with a capacitance C. What value must C have in order that the voltage across the coil be 400 V?

4+2+4

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**PRACTICAL-15**

Answer *any one* of the following questions:

6.

Draw the resonance curve of a circuit containing  $C=0.01 \mu F$ ,  $R=1K\Omega$  and a coil of unknown inductance  $L$  in series to an a.c. source .

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Calculate Q factor from the graph

2

**DATA FOR RESONANCE CURVE-**

$$V_i=3.5V$$

NO.OF OBS.	FREQ. IN KHZ f	$V_R$ VOLTS (r.m.s)	$V_L$ VOLTS (r.m.s)	$I = \frac{V_R}{R}$ in mA	$Z_L' = \frac{V_L}{I} K\Omega$
1	0.5	0.08	0.02	0.08	
2	1.0	0.17	0.17	0.17	
3	1.5	0.30	0.47	0.30	
4	2.0	0.50	1.03	0.50	
5	2.5	0.70	1.77	0.70	
6	3.0	0.90	2.48	0.90	
7	3.5	1.23	3.90	1.23	
8	4.0	1.83	6.69	1.83	
9	4.5	2.38	9.94	2.38	
10	4.6	2.47	10.21	2.47	
11	4.7	2.80	10.80	2.80	
12	4.8	2.76	11.92	2.76	
<b>13</b>	<b>5.0</b>	<b>3.10</b>	<b>14.06</b>	<b>3.10</b>	
14	5.2	2.70	12.00	2.70	
15	5.5	2.08	10.70	2.08	
16	6.0	1.42	7.90	1.42	
17	6.5	1.13	7.01	1.13	
18	7.0	1.00	6.53	1.00	
19	8.0	0.75	6.00	0.75	
20	9.0	0.50	5.70	0.50	
21	10.0	0.08	5.50	0.08	

ii) Calculate  $Z_L$  and draw  $Z_L$  vs.  $f$  graph

2+2

iii) Calculate value of  $L$  from the resonant frequency

3

7. i) Determine the average resistance per unit length( $\rho$ ) of the metre bridge wire by Carey-Foster's method from the following table.

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No. of obs.	Resistance in ohm.		Null points in cm.			$(l_2 - l_1)$	$\rho$	Mean
	Extreme left gap	Extreme right gap	D.C	R.C	MEAN	In cm.	Per cm.	$\rho$ Per cm.
1a)	0.5	0	42.8	42.6				
b)	0	0.5	69.4	69.6				
2a)	0.8	0	35.4	35.6				
b)	0	0.8	77.2	77.1				
3a)	1.2	0	27.4	27.6				
b)	0	1.2	88.5	88.7				

ii) Hence determine the unknown resistance from the following table

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No. of obs.	Resistance in ohm.		Null points in cm.			$(l_2' - l_1')$	R	Mean
	Extreme left gap	Extreme right gap	D.C	R.C	MEAN	In cm.	Per cm.	R Per cm.
1a)	2.4	0	87.6	87.8				
b)	0	2.4	28.8	29.0				
2 a)	2.2	0	81.0	81.0				
b)	0	2.2	33.5	33.5				
3a)	2.0	0	75.5	75.5				
b)	0	2.0	38.0	38.2				