B.Sc. Part-II Honours Examination,2020

Sub.-PHSA PAPER-IV B (practical) FULL MARKS-25

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 BLUE/BLACK INK only.

   (b) must attach a scanned copy of her/his registration certificate at the end of the answer script. She/he may attach a scenned copy of the admit card of current examinations, if available.

   (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.

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 BLUE/BLACK INK only.

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Answer ***any one question*** of the following

1.

With the help of a ballistic galvanometer, following are the records of the deflection 'd_1' versus dial reading ϕ for determination of mutual inductance (M) of the given pair of coils , kept at different positions from 0^0 to 90^0 .

V_{IN}=3.0 V R_1=10 Ω ,R_2=2000 Ω (XCDR= 1000 Ω)

T=(1min.30.41Sec)/10 = 9.041 sec. **r = 0.01** Ω

STEADY DEFLECTION (d_2) = (10.5+9.7)/2=10.1 cm.

BALLISTIC THROW (d_1)

ϕ **DEGREES**	**(d_1) cm.**			M
	DIRECT	**REVERSE**	**AVERAGE**	
0	**19**	**18**	**18.5**	
45	**13.5**	**13**	**13.2**	
90	**0.2**	**0.2**	**0.2**	

i) Draw (d_1-ϕ) graph. 8

ii) Write down necessary working formula and Calculate M for ϕ=45^0 and 0^0 5+2

iii) Estimate the percentage error in M for ϕ=45^0 4

iv) Data for finding log decrement at ϕ=0^0 are given below. Calculate log decrement for ϕ=0^0. 6

$where\ \beta_1 = \alpha_1 + \alpha_2;\ \ \beta_{2n+1} = \alpha_{2n+1} + \alpha_{2n+2}$

$\alpha_1 = 19cm$

$\alpha_2 = 14.5cm.\ \ \beta_1 = \alpha_1 + \alpha_2 = 33.5cm$

$\alpha_3 = 12cm.$

$\alpha_4 = 9.3cm.\ \ \beta_3 = \alpha_3 + \alpha_4 = 21.3cm$

$\alpha_5 = 9.5cm.$

$\alpha_6 = 7.5cm.\ \ \beta_5 = \alpha_5 + \alpha_6 = 17.0cm$

2.

Draw the resonance curve of a circuit containing C=0.01 μF ,R=1KΩ and a coil of unknown inductance L in series to an a.c. source . 10

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	
13	**5.0**	**3.10**	**14.06**	**3.10**	
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 4+4

iii) Calculate value of L from the resonant frequency 5

3.

The rotations of the plane of polarization for four different concentrations by volume of the optically active solutions are given below. Draw the calibration curve. Find the unknown concentration of the given solution (rotation of the plane of polarization of the said concentration is given in the table) from the calibration curve. Determine the specific rotation of the solution. Estimate the percentage error in specific rotation. write down the parameters on which specific rotation depends. 10+5+5+2+3

DIRECT READING: TABLE-I

No of observations	Readings of the first vernier				Readings of the second vernier			
	Circular scale reading	Vernier scale reading	Total	Mean (R_0)	Circular scale reading	Vernier reading	total	Mean R_0'
1	357^0	4	$357^0 24'$		177^0	3	$177^0 18'$	
2	357^0	6	$357^0 36'$	$357^0 38'$	177^0	5	$177^0 30'$	$177^0 32'$
3	357^0	9	$357^0 54'$		177^0	8	$177^0 48'$	

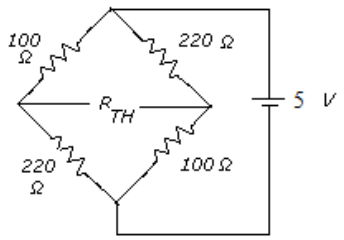
No of observations	%strength of solution (c)	Vernier no	Reading of the vernier				Rotation of the variation (Θ)	Mean rotation (Θ)
			Circular scale (s)in degree	Vernier reading (v.r)	Total reading=s+(v.r*v.s)	Mean reading		
1	C_1=15%	1	16	6	$16^0 36'$	$16^0 44'$		
			16	8	$16^0 48'$			
			16	8	$16^0 48'$			
		2	196	9	$196^0 54'$	$196^0 48'$		
			196	8	$196^0 48'$			
			196	7	$196^0 42'$			
2	C_2=12%	1	12	2	$12^0 12'$	$12^0 18'$		
			12	3	$12^0 18'$			
			12	4	$12^0 24'$			
		2	192	6	$192^0 36'$	$192^0 36'$		
			192	7	$192^0 42'$			
			192	5	$192^0 30'$			
3	C_3=9%	1	8	3	$8^0 18'$	$8^0 24'$		
			8	4	$8^0 24'$			
			8	5	$8^0 30'$			
		2	188	5	$188^0 30'$	$188^0 44'$		
			188	6	$188^0 48'$			
			188	7	$188^0 41'$			
4	C_4=6%	1	4	6	$4^0 36'$	$4^0 36'$		
			4	7	$4^0 42'$			
			4	5	$4^0 30'$			
		2	184	1	$184^0 6'$	$184^0 12'$		
			184	3	$184^0 18'$			
			184	2	$184^0 12'$			

DATA FOR **UNKNOWN** SOLUTION:

°°

Vernier number	Reading of the vernier			Mean reading	Rotation for the vernier	Mean rotation	Percentage strength of the solution from graph
	Circular scale (s)	Vernier reading (v.r)	Total reading = s+(v.r *v.c)				
1	15	2	$15^0 12'$	$15^0 20'$	$17^0 42'$	**$17^0 38'$**	
	15	3	$15^0 18'$				
	15	5	$15^0 30'$				
2	195	0	195^0	$195^0 12'$	$17^0 34'$		
	195	2	$195^0 12'$				
	195	4	$195^0 24'$				

4.

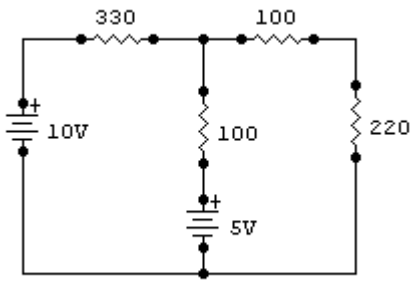


i) Calculate V_{TH} and R_{TH} of the above circuit 2+2

R_L Ω	V_L(VOLT)	I_L(mA)	$P_L(=I_L x V_L)$ mW
1000	1.64	1.7	
500	1.47	3.1	
200	1.11	5.9	
150	0.98	7.0	
130	0.91	7.5	
120	0.87	7.8	
110	0.84	8.0	
90	0.74	8.8	
70	0.63	9.7	
50	0.50	10.7	

ii) Plot a curve of the power (P_L) delivered in the load resistance against R_L from the above data table. Hence, find the value of R_L for which the power delivered is maximum. Compare this with the value of R_{TH} of the above circuit and comment.

6+2+1+2



Verify superposition theorem using the above network. Given voltage across 220 ohm is 2.127 V, when 10 V is short circuited and voltage across 220 ohm is 1.28 V, when 5 V is short circuited. 10

5. In Newton's ring experiment diameters of the dark rings of various orders, varying from p th. ring to (p+10) th. ring are given below.

Ring no.	Obs. Started from	Reading of the microscope for the						Diameter D= R_1-R_2 In cm.	Mean D in cm.
		(a) Left end of the ring			(b) Right end of the ring				
		Scle(S) In cm.	v.r	Total reading In cm. R_1=S+v.rXv.c	Scle(S) In cm.	v.r	Total reading In cm. R_2=S+v.rXv.c		
P+10	Right	41	83	41.083	49	22	49.022		
	left	41	89	41.089	49	20	49.02		
P+8	Right	42	16	42.016	48	84	48.084		
	left	42	14	42.014	48	81	48.081		
P+6	Right	42	38	42.038	48	44	48.044		
	left	42	37	42.037	48	42	48.042		
P+4	Right	42	85	42.085	47	95	47.095		
	left	42	81	42.081	47	93	47.093		
P+2	Right	43	48	43.048	47	64	47.064		
	left	43	43	43.043	47	62	47.062		
P	Right	44	71	44.071	46	72	46.072		
	left	44	70	44.070	46	70	46.070		

i) Plot D^2_{p+n} versus n. 10

ii) Determine the radius of curvature of the curved surface of the lens. 5

iii) Determine the difference of the diameters of D_{21} - D_{16} and D_9 - D_4 from the graph and make a comment on the variation of fringe width with ring number. 5+5