**B.Sc. Sem-4 Honours Examination, 2020**

**Sub. - PHSA Paper – CC8 FM – 50 Duration – 2 hrs.**

**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, 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) 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 Intenal, Theory and Practical examinations.**

**Internal - 10 : Answer any five questions. Each question carry 2 marks.**

1. (a) Write down the formula for n th root of unity.

   (b) Explain primary criterion of Taylor series expansion.

   (c) Find a series expansion of f(z) =sin(z) about the origin, using taylor series expansion.

   (d) Write down the Convolution theorem.

   (e) Write down the normal distribution with proper interpretation of the symbols.

   (f) Write down the Lorentz transformation of coordinates.

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**Theory – 25 : Answer any five questions. Each question carry 5 marks.**

2. (a) Calculate $\oint \frac{z^2}{z^2-1}dz$ around a circle of radius 1 with centered at $z=\frac{1}{2}$ 3

   (b) Find out three cube roots of unity. 2

3. (a) Name a multivalued function in complex number. And mention the cause of being called so. 1+2

   (b) Evaluate the integral $\oint \frac{\cos(z)}{z^3}dz$ around the circle mod(z)=2. 2

4. Let C be a simply closed contour enclosing a regiom R in which f(z) is analytic . Show that $\oint f(z)dz=0$ 5

5. (a) Write down Fourier integral theorem. 2

   (b) Evaluate the Fourier transform of the function f(x) where f(x) is $e^{-\alpha x}$ for x>0 and $-e^{\alpha x}$ for x<0 . 3

6. (a) Evaluate the mean and variance of a random variable following the Poisson distribution. 3

   (b) Briefly explain how does Michenson-Morley experiment discards the notion of existence of the ‘ether’. 2

7. (a) Write down the conditions under which the Minkowski interval between two events are space-like or time-like. 2

   (c) A body of mass $m$ suddenly breaks into two parts with masses $m_1$ and $m_2$ with respective speeds $v_1$ and $v_2$ . Show that $m>m_1+m_2$ . 3

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**Practical – 15 : Answer any one question.**

8. (a) Write a python script to verify the following relation. 5

$$x P'_n(x) = P'_{n+1}(x) - (n+1) P_n(x)$$

(b) Write a python script to compute the Fourier coefficients of the following function

f(x) = 0 if $\pi <= x <= 0$
= 1 if $0 < x <= \pi$ 10

9. (a) Write a python script to verify the following relation. 5

$$(2n+1) x P_n(x) - n P_{n-1}(x) = (n+1) P_{n+1}(x)$$

(b) Write a python script to solve the following equation by Runge-Kutta fourth order method. 10

$$\frac{dy(x)}{dx} = x$$

10. (a) Write a python script to compute the Fourier transform of $\exp(-bx^2)$ with b=2. 7

(b) Write a python script to compute $\sqrt[4]{1}$ with x=1. 4

(c) Write a python script to compute $\sqrt{2+3i}$ 4