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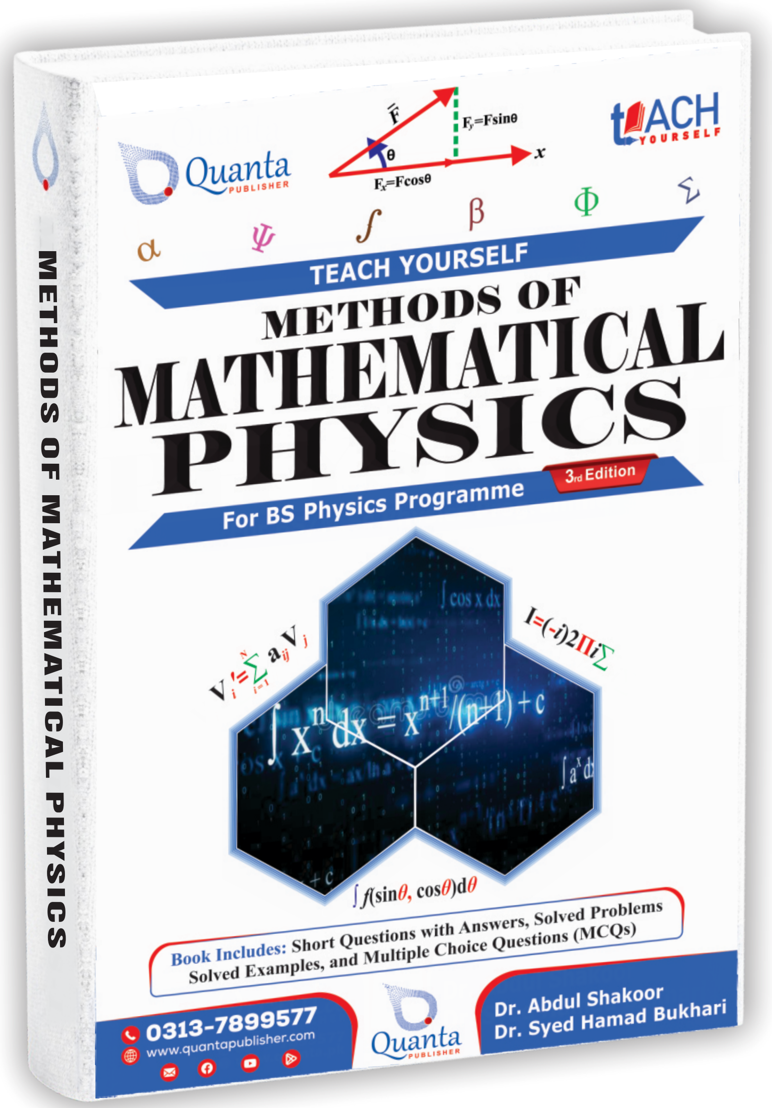
BS Physics

PAST PAPERS



UNIVERSITY OF THE PUNJAB

Roll No. ....

Fifth Semester 2018

Examination: B.S. 4 Years Programme

PAPER: Mathematical Methods of Physics-I
Course Code: PHY-302

TIME ALLOWED: 30 mins.
MAX. MARKS: 10

Attempt this Paper on this Question Sheet only.

Instructions. Attempt all questions

Section-I (Objective)

Marks=10

Fill in the blank or answer true/false.

1. An arbitrary tensor of is neither symmetric nor antisymmetric but can always be written as the sum of a symmetric tensor and an antisymmetric tensor. (True/False)
2. $\oint_C (P(x,y)dx + Q(x,y)dy) = \iint_R \left(\frac{\partial Q}{\partial y} - \frac{\partial P}{\partial x}\right) dxdy$ (True/False)
3. $f(z) = z^2 + z$ is an analytic function. (True/False)
4. The function $f(z) = \frac{z}{e^z - 1}$ has a removable singularity at $z = 0$ (True/False)
5. The function $f(z) = z(e^z - 1)$ possesses a zero of order 2 at $z = 0$ (True/False)
6. If $z = 10 + 8i$, then Re $\left(\frac{z}{\bar{z}}\right) =$ ....
7. $\nabla.(\nabla\phi \times \nabla\psi) =$ ....
8. If $e^z = 2i$, then $z =$ ....
9. $g^{ij}\mathbf{e}_j =$ ....
10. The process of contraction of an Nth-order tensor produces another tensor of rank..........................

PAPER: Mathematical Methods of Physics-I
Course Code: PHY-302

TIME ALLOWED: 2 hrs. & 30 mins.
MAX. MARKS: 50

Attempt this Paper on Separate Answer Sheet provided.

SUBJECTIVE TYPE

Section-II (Short Questions)

Marks=20

1. Show that $\{\mathbf{e}_i\}$ and $\{\epsilon_i\}$ are reciprocal systems of vectors.
2. Expand $f(z) = e^{3/z}$in a Laurent series valid for $0 < |z|$.
3. Show that $z = 0$ is an essential singularity of $f(z) = z^3 \sin(1/z)$.
4. Show that $\mathbf{r} = \rho\hat{\mathbf{e}}_\rho + z\hat{\mathbf{e}}_z$, also prove that $\nabla.\mathbf{r} = 3$ and $\nabla \times \mathbf{r} = 0$. (Note: $x = \rho\cos\phi$, $y = \rho\sin\phi$, $z = z$)
5. Using the calculus of residues, show that $\int_0^\pi \cos^{2n}\theta d\theta = \pi\frac{(2n)!}{2^{2n}(n!)^2}$, $n = 0, 1, 2....$

Section-III

Marks=30

1. Evaluate
$$\int_0^{2\pi} \frac{\cos(3\theta)d\theta}{5 - 4\cos\theta}.$$
2. Evaluate
$$\oint_{|z-2i|=4} \frac{z}{z^2+9}dz,$$
by using Cauchy's integral formula.
3. By considering the derivative of the second-order tensor $\mathbf{T}$ with respect to the coordinate u^k, find an expression for the covariant derivative $T_{ij;k}$ of its contravariant components.
4. The electric field $\mathbf{E} = -\nabla\varphi$; this is derived from a scalar, the electrostatic potential φ, and has components $E_i = -\frac{\partial\varphi}{\partial x_i}$. Show that $\mathbf{E}$ is a first order tensor.
5. Find the circular cylindrical components of the velocity and acceleration of a moving particle. (Hint: $\mathbf{r}(t) = \rho(t)\hat{\mathbf{e}}_\rho(t) + z(t)\hat{\mathbf{e}}_z$ and $x = \rho\cos\phi$, $y = \rho\sin\phi$, $z = z$)

G.C University, Faisalabad

Final Term Examination Paper, Fall -2018

(For Affiliation Colleges)

Subjective Part

Subject: Methods of Mathematical Physics-II **Course Code: Phy-502**

Class: BS (PHY)6th **Time Allowed: 150min** **Total Marks: 30**

Name of Student: **Roll No:**

Note: Attempt All Questions.

Q#2 Solve the equation of variable methods $\frac{\partial 2u}{\partial x2}+\frac{\partial 2u}{\partial y2}-\frac{1}{c2}\frac{\partial 2u}{\partial t2}$=0 where a≤x≤b , c≤y≤d and ≤0.

Q#3 Find the Laplace transformation of $j_0(t)=\frac{1}{\pi}\int_0^{\pi}\cos(t\sin\emptyset)\,d\emptyset$ also find Laplace transformation of $j_0(at)$= where a>0.

Q#4 Discuss the any three Special case of Euler-Lagrange differential equation.

Q#5 Find the geodesic cure of cylinder $x^2 + y^2 +=a^2$.

Q#6 Use the Fred Holm series methods to find the Resolvent kernel of Reduce the boundary value problem y''(s)+sy(s)=1, y(0)=y'(1)=0, to Fred Holm integral equation.

UNIVERSITY OF THE PUNJAB

B.S. 4 Years Program : Fifth Semester – 2020

R

Paper: Mathematical Methods of Physics-I
Course Code: PHY-302

Time: 2 Hrs. 45 Min. Marks: 50

Part – II

ATTEMPT THIS (SUBJECTIVE) ON THE SEPARATE ANSWER SHEET PROVIDED

Q.2. Solve the following: (5x4=20)

1. Show that an arbitrary tensor (neither symmetric nor antisymmetric) can always be written as sum of a symmetric tensor and an antisymmetric tensor.
2. Evaluate the surface integral $I = \int_S \mathbf{a}.d\mathbf{S}$, where $\mathbf{a} = x\mathbf{i}$ and S is the surface of the hemisphere $x^2 + y^2 + z^2 = a^2$ with $z \geq 0$.
3. Show that the quantities $g_{ij} = \mathbf{e}_i.\mathbf{e}_j$ form the covariant components of a second-rank tensor.
4. Determine the order of the poles of $f(z) = \frac{\sin z}{z^2 - z}$.
5. Expand $f(z) = \frac{1}{z(z-1)}$ in a Laurent series valid for $1 < |z|$.

Q.3. Solve the following. (5×6 =30)

1. Evaluate the Cauchy principal value of

$$\int_{-\infty}^{+\infty} \frac{x \sin x}{x(x^2+2)} dx.$$

2. Prove the following identities

$$(\epsilon^i.\epsilon^j)(\epsilon_j.\epsilon_k) = \delta^i_k, \qquad \Gamma^m_{jk} = \Gamma^m_{kj}.$$

3. Calculate the basis vectors $\mathbf{e}_r, \mathbf{e}_\theta$, and $\mathbf{e}_\phi$. Also compute the basis vectors $\epsilon_r, \epsilon_\theta$ and ϵ_ϕ. FurtherShow that $\{\mathbf{e}_r, \mathbf{e}_\theta, \mathbf{e}_\phi\}$ and $\{\epsilon_r, \epsilon_\theta, \epsilon_\phi\}$ are reciprocal systems of vectors. ($x = r\sin\theta\cos\phi$, $y = r\sin\theta\sin\phi$ and $z = r\cos\theta$).
4. Use an indented contour and residues, show that

$$P.V\left(\int_{-\infty}^{+\infty} \frac{\sin x}{x} dx\right) = \pi.$$

5. Suppose that C is a piecewise-smooth simple closed curve bounding a simple connected region R. If the functions $P(x,y)$ and $Q(x,y)$ and their partial derivatives are continuous on R, then show that

$$\oint_C (P(x,y)dx + Q(x,y)dy) = \iint_R \left(\frac{\partial Q}{\partial x} - \frac{\partial P}{\partial y}\right) dA.$$

Department of Physics

GC University, Faisalabad.

Examination: Fall semester Examination [illegible] Paper: Physics Title: Mathematical Method of Physics - I

Course Code: Phy- 501 Tota[illegible]: 30 Class: BS(H) Semester: 5th Session: 2019-2023 Time Allowed: 2: ho

Subjective part

Note: attempt all questions

Q.No.1 Is the functions $u(x,y) = (2x-1)y$ harmonic? If your answer is yes, find a corresponding analytic function $f(z) = u(x, y) - iv(x, y)$.

Q.No.1.b. Determine the function $f(z) = \frac{-i}{z^3}$ is analytic or not. 4+3

Q.No.2 Integrate $\oint_C \frac{\ln(z+1)}{z^2+1} dz$ C: $|z - i| = 1.4$ 5

Q.No.3 Integrate $\oint_C \frac{\cosh 4z}{(z-4)^3}$ C: $|z|=6$ counterclockwise and $|z|=1$ clockwise 5

Q.No.4 Evaluate $\oint_C \frac{z-23}{z^2-4z-5} dz$, C: $|z-2-i| = 3.2$ co[illegible]ckwise. Show the details of your work (using residue [illegible]tion). 5

Q.No.5 Find the Maclaurin series of $f(z) = 1/(1+z^2)$. 3

Q.No.6 Evaluate the $\int_0^{2\pi} \left(\frac{1}{5-4\sin\theta}\right) d\theta$, integrals counterclockwise around the unit circle and show the details of your work. 5

Department of Physics
GC University, Faisalabad.

Examination: Fall semester Examination 2022 Paper: Physics Title: Mathematical Method of Physics - I Course Code: Phy - 501 Total Marks: 80 Class: BS(H) Semester: 5th
Time Allowed: 2: 30 hours

Subjective part

Note: attempt all questions

QNo.2 Evaluate the surface integral $\iint_S F\cdot n\, dA$ counterclockwise by the divergence theorem. show the details of your work. $F = [x^2,\ y^2,\ z^2]$, R consisting of the s the surface of the ~~box~~ $x^2,\ y^2 \leq y^2,\ z^2,\ 0 \leq z \leq 2$ x: −a → a , 0 → π/2 , 0 → 2 13
hemi-sphere

QNo.3 Evaluate $\oint_c F(r).dr$ counterclockwise around the boundary C of the region R by Green's theorem, where $\mathbf{F} = [x, y]$, where C the circle $x^2+y^2=1/4$ 13

Q.No.4.a. Is the function $u(x,y) = e^{-x}\sin 2y$ harmonic? If your answer is yes, find a corresponding analytic function $f(z) = u(x, y) - iv(x, y)$.

Q.No.4.b. Determine the function $f(z) = \frac{-i}{z^4}$ is analytic or not. 7+7

Q.No. 5 Integrate $\oint_c \frac{e^z}{z^n}dz$, n = 1,2,3,4 ..... counterclockwise around the unit circle. 13

Q.No.6 Evaluate $\oint_c \frac{e^z}{\cos z}dz$, C: $(z - \frac{\pi i}{2}) = 4.5$ the integrals and show the details of your work. 13

Q.No.7 Evaluate the $\int_0^{2\pi}(\frac{2}{k-\sin\theta})d\theta$, integrals counterclockwise around the unit circle, and show the details of your work. 14

GOVERNMENT COLLEGE UNIVERSITY FAISALABAD

Mid Term Exams

Course Title: Method of Mathematical Physics- I **Course Code:** Phy-501

Credit Hours: 3(3-0) **Total Marks:** 12 **Time Allow:** 1hour

Attempt All questions compulsory;

Q no 1. Evaluate $\int\int_S F\cdot n\, ds$ where $F = x^2y^2\hat{\imath} + yz^2\hat{\jmath} + e^z\widehat{K}$ With boundaries x=0, x=1, y=0,y=2 and z=0,z=3. (04)

Q no 2. If a vector function F depends on both space coordinates (x, y, z) and time(t), Show that (04)

$$d\bar{F} = \left(\overline{dr}\cdot\nabla\right)\bar{F} + \frac{\partial\bar{F}}{\partial t}dt$$

Q no 3. Prove that: (02+02=04)

(a) $grad\left(\frac{1}{r}\right) = \frac{-\vec{r}}{r^3}$

(b) $\text{curl}(\text{grad}\,\varphi) = \nabla\times\nabla\varphi$

Best of Luck

UNIVERSITY OF THE PUNJAB

Sixth Semester - 2018

Examination: B.S. 4 Years Programme

Roll No. ....

PAPER: Mathematical Methods of Physics-II **TIME ALLOWED: 15 Mints.**

Course Code: PHY-307 Part – I (Compulsory) **MAX. MARKS: 10**

Attempt this Paper on this Question Sheet only.

Please encircle the correct option. Each MCQ carries 1 Mark. This Paper will be collected back after expiry of time limit mentioned above.

Section-I (Objective) Marks=10

Fill in the blank or answer true/false.

1. $\left(\frac{d}{dx}\right)^2 + k^2$ is a linear operator. (True/False)
2. $(k+1)! = \Gamma(k-1)$ (True/False)
3. $\mathcal{F}\left[\frac{d^n}{dt^n}f(t)\right] = g(\omega)$. (True/False)
4. If χ is a solution of Laplace's equation $\nabla^2\chi = 0$, then $\chi_{xy} = \frac{\partial^2\chi}{\partial x\partial y}$ is also a solution. (True/False)
5. Hermite equation $(y'' - 2xy' + 2ay = 0)$ has no singularity other than an irregular singularity at $x = \infty$. (True/False)
6. $\frac{\partial\psi}{\partial x} + \frac{\partial\psi}{\partial y} + (x+y)\psi = 0$ is a linear partial differential equation. (True/False)
7. $f(x) = \sum_{n=0}^{\infty} a_n P_n(x)$, where $a_n =$ ....
8. $\Gamma(1/2) =$ ....
9. $\mathcal{F}\{f'(t)\} =$ ....
10. $\mathcal{L}\{J_0(at)\} =$ ....

Section-II (Short Questions) Marks=20 (4×5)

1. The functions $u_1(x)$ and $u_2(x)$ are eigenfunctions of the same Hermitian operator but for distinct eigenvalues λ_1 and λ_2. Prove that $u_1(x)$ and $u_2(x)$ are linearly independent.

2. A different sawtooth wave is described by

$$f(x) = \begin{cases} -\frac{1}{2}(\pi + x), & -\pi \le x < 0 \\ \frac{1}{2}(\pi - x), & 0 < x \le \pi. \end{cases}$$

Show that $f(x) = \sum_{n=1}^{\infty} \frac{\sin(nx)}{n}$.

3. Show that

$$\mathcal{F}\left[\frac{d^n}{dt^n}f(t)\right] = \left[\frac{d^n}{dt^n}f(t)\right]^T(\omega) = (-i\omega)^n\mathcal{F}[f(t)] = (-i\omega)^n[f(t)]^T(\omega).$$

4. Use mathematical induction to show that

$$J_n(x) = (-1)^n x^n \left(\frac{1}{x}\frac{d}{dx}\right)^n J_0(x).$$

5. Show that

$$\int_{-\infty}^{+\infty} x^2 e^{-x^2} H_n(x) H_n(x) dx = \pi^{1/2} 2^n n! (n + \frac{1}{2}).$$

Section-III Marks=30 (6×5)

1. Find the Green's function for

$$\frac{d^2y}{dx^2} + k\frac{dy}{dx} = f(x),$$

subject to the initial conditions $y(0) = y'(0) = 0$, and solve this ODE for $x > 0$ given $f(x) = \exp(-x)$.

2. A function $f(x)$ is expanded in a Legendre series $f(x) = \sum_{n=0}^{\infty} a_n P_n(x)$. Show that

$$\int_{-1}^{+1} [f(x)]^2 dx = \sum_{n=0}^{\infty} \frac{2a_n^2}{2n+1}.$$

3. Show that

$$\int_0^{\infty} e^{-x} L_l(x) L_m(x) dx = \delta_{lm},$$

where $L_l(x)$ and $L_m(x)$ are Laguerre's polynomials.

4. Derive the recurrence relations

$$\Gamma(z+1) = z\Gamma(z),$$

from the Euler integral

$$\Gamma(z) = \int_0^{\infty} e^{-t} t^{z-1} dz.$$

where z is a positive real number.

5. Show that

$$\Gamma(k+1)\Gamma\left(\frac{1}{2} + k\right) = \frac{\sqrt{\pi}}{2^{2k}}\Gamma(2k+1),$$

where k is an integer.

G.C University, Faisalabad

Final Term Examination Paper, Fall -2018

(For Affiliation Colleges)

Subjective Part

Subject: Methods of Mathematical Physics-II Course Code: Phy-502

Class: BS (PHY)6th Time Allowed: 150min Total Marks: 30

Name of Student: Roll No:

Note: Attempt All Questions.

Q#2 Solve the equation of variable methods $\frac{\partial 2u}{\partial x2} + \frac{\partial 2u}{\partial y2} - \frac{1}{c2}\frac{\partial 2u}{\partial t2}$=0 where a≤x≤b , c≤y≤d and ≤0.

Q#3 Find the Laplace transformation of $j_0(t)= \frac{1}{\pi}\int_0^{\pi} \cos(t sin\emptyset)\, d\emptyset$ also find Laplace transformation of $j_0(at)$= where a>0.

Q#4 Discuss the any three Special case of Euler-Lagrange differential equation.

Q#5 Find the geodesic cure of cylinder $x^2 + y^2$ +=a^2.

Q#6 Use the Fred Holm series methods to find the Resolvent kernel of Reduce the boundary value problem y''(s)+sy(s)=1, y(0)=y'(1)=0, to Fred Holm integral equation.

Department of Physics
GC University, Faisalabad.

GC UNIVERSITY Faisalabad

Examination: Final Semester Examination 2019 Paper: Physics Title: Mathematical Method of Physics - II
Course Code: Phy-502 Marks: 30 Class: BS(H). Semester: 6th Time Allowed: 02:30 Hour
Roll #____________ Registrations____________ Signature____________

Attempt all question: **Subjective Part** Marks: 30

Q.No. 2. Is the given function even or odd or neither even nor odd? Find its Fourier series. Show details of your work. 6

Q.No. 3. if a and b are two different roots of $J_n(ap) = 0$ and $J_n(bp) = 0$. Show that Bessel's function is orthogonal, $\int_0^p x\, J_n(ap)\, J_n(bp)\, dx = 0$. 6

Q.No. 4. Determine the recurrence relations of the various orders of the Bessel's, Legendre's, Hermite' function, given as under. 3x2=6

i. $J_{m-1}(x) - J_{m+1}(x) = 2J'_m(x)$

ii. $mP_m(x) = (2m-1)x\,P_{m-1}(x) - (m-1)P_{m-2}(x)$

iii. $2xH_m(x) = H_{m+1}(x) + 2mH_{m-1}(x)$

Q. No. 5. Show that the integral represents the indicated function. The integral tells you which one, and its value tells you what function to consider. Show your work in detail.

$$\int_0^\infty \frac{\cos xw + w\sin xw}{1+w^2}\,dw = \begin{cases} 0 & \text{if } x < 0 \\ \pi/2 & \text{if } x = 0 \\ \pi e^{-x} & \text{if } x > 0 \end{cases}$$

Q. No. 6. Find the Laplace transform of the function $f(t) = t^n$

Govt. College UNIVERSITY, FAISALABAD

EXTERNAL SEMESTER EXAMINATIONS SPRING 2020

Roll No.: 672807

BS PHYSICS (6TH SEMESTER)

Subject: Methods of Mathematical Physics-II **Cr. Hr. :** 3(3-0)

Course Code: PHY-502 **MAX. Marks:** 75(50+25)

MCQS Marks: 50 Time: 90 minutes

Choose the correct option.

1) Laplace transform any function changes it domain to s-domain.			
a) True	b) False	c) Not Always	D) Nothing to say
2) Value of $\int_{-\infty}^{\infty} e^t Sin(t)Cos(t)dt$			
a) $\frac{a}{a^2+s^2}$	b) $\frac{s^2}{a^2+s^2}$	c) $\frac{a^2}{a^2+s^2}$	d) $\frac{1}{a^2+s^2}$
3) Any system is said to be stable if and only if _____			
a) It poles lies at the left of imaginary axis	b) Its zeros lie at the left of imaginary axis	c) It poles lies at the right of imaginary axis	d) Its zeros lie at the right of imaginary axis
4) Time domain function of $\frac{s}{a^2+s^2}$ is given by?			
a) Cos(at)	b) Sin(at)	c) Cos(at)Sin(at)	d) Sin(t)
5) A Laplace Transform exists when _____.			
a) The function is piece-wise continuous	b) The function is of exponential order	c) The function is piecewise discrete	d) Both (a) & (b)
6) An impulse response of the system at initially rest condition is basically a response to its input & hence also regarded as,			
a) Black's function	b) Red's function	c) Green's function	d) None of the above
7) When is the system said to be causal as well as stable in accordance to pole/zero of ROC specified by system transfer function?			
a) Only if all the poles of system transfer function lie in left-half of S-plane	b) Only if all the poles of system transfer function lie in right-half of S-plane	c) Only if all the poles of system transfer function lie at the center of S-plane	d) None of the above
8) Which property is exhibited by the auto-correlation function of a complex valued signal?			
a) Commutative property	b) Distributive property	c) Conjugate property	d) Associative property
9) What is the possible range of frequency spectrum for discrete time Fourier series (DTFS)?			
a) 0 to 2π	b) -π to +π	c) Both a & b	d) None of the above
10) What is the nature of Fourier representation of a discrete & a periodic signal?			
a) Continuous & periodic	b) Discrete and aperiodic	c) Continuous & aperiodic	d) Discrete & periodic
11) Which are the only waves that correspond/ support the measurement of phase angle in the line spectra?			
a) Sine waves	b) Cosine waves	c) Triangular waves	d) Square waves
12) Which kind of frequency spectrum/spectra is/are obtained from the line spectrum of a continuous signal on the basis of Polar Fourier Series Method?			
a) Continuous in nature	b) Discrete in nature	c) Sampled in nature	d) All of the above
13) Which types of Fourier series allows to represent the negative frequencies by plotting the double-sided spectrum for the analysis of periodic signals?			
a) Trigonometric Fourier Series	b) Polar Fourier Series	c) Exponential Fourier Series	d) All of the above
14) Why are the negative & positive phase shifts introduced for positive & negative frequencies respectively in amplitude and phase spectra?			
a) To change the symmetry of the phase spectrum	b) To maintain the symmetry of the phase spectrum	c) Both a & b	d) None of the above
15) Which property of Fourier transform gives rise to an additional phase shift of $-2\pi f t_d$ for the generated time delay in the communication system without affecting an amplitude spectrum?			
a) Time Scaling	b) Linearity	c) Time Shifting	d) Duality
16) Which is/are the mandatory condition/s to get satisfied by the transfer function for the purpose of distortion less transmission?			
a) Amplitude Response should be constant for all frequencies	b) Phase should be linear with frequency passing through zero	c) Both a & b	d) None of the above
17) Laplace transform is basically an			
a) Algebraic transform	b) Rational transform	c) Integral transform	d) Differential transform
18) Transformation in which function in one space is transformed to another space by process of integration that involves kernel is termed as			
a) Algebraic transform	b) Rational transform	c) Integral transform	d) Differential transform
19) Mathematically, the functions in Green's theorem will be			
a) Continuous derivatives	b) Discrete derivatives	c) Continuous partial derivatives	d) Discrete partial derivatives
20) Find the value of Green's theorem for $F = x^2$ and $G = y^2$ is			
a) 0	b) 1	c) 2	d) 3
21) Which of the following is not an application of Green's theorem?			
a) Solving two-dimensional flow integrals	b) Area surveying	c) Volume of plane figures	d) Centroid of plane figures
22) The path traversal in calculating the Green's theorem is			
a) Clockwise	b) Anticlockwise	c) Inwards	d) Outwards

23) Calculate the Green's value for the functions $F = y^2$ and $G = x^2$ for the region $x = 1$ and $y = 2$ from origin
a) 0 | b) 2 | c) -2 | d) 1

24) If two functions A and B are discrete, their Green's value for a region of circle of radius a in the positive quadrant
a) ∞ | b) $-\infty$ | c) 0 | d) Do not exist

25) Applications of Green's theorem are meant to be in
a) One dimensional | b) Two dimensional | c) Three dimensional | d) Four dimensional

26) The Green's theorem can be related to which of the following theorems mathematically?
a) Gauss divergence theorem | b) Stokes's theorem | c) Euler's theorem | d) Leibnitz's theorem

27) Find the area of a right-angled triangle with sides of 90-degree unit and the functions described by $L = \cos y$ and $M = \sin x$.
a) 0 | b) 45 | c) 90 | d) 180

28) Which of the following theorem convert line integral to surface integral?
a) Gauss divergence and Stake's theorem. | b) Stoke's theorem only | c) Green's theorem only | d) Stoke's and Green's theorem

29) For a non-negative real constant n, an equation of the form $(1-x^2)y'' - 2xy' + n(n+1)y = 0$ is called ...
a) Legendre's equation | b) Legendre's polynomial | c) Bessel's equation | d) None of these

30) The value of Legendre's polynomial $P_2(x)$ is ....
a) 0 | b) 1 | c) $\frac{1}{3}(3x^2-1)$ | d) $\frac{1}{2}(5x^3-3x)$

31) The polynomial $2x^2 - 4x + 3$ in terms of Legendre's polynomial is ......
a) $\frac{1}{3}(4P_2 - 4P_1 + 11P_0)$ | b) $\frac{1}{3}(4P_2 + 12P_1 + 11P_0)$ | c) $\frac{1}{3}(P_2 - 12P_1 + 11P_0)$ | d) $\frac{1}{3}(4P_2 - 12P_1 + 11P_0)$

32) Which of the following is an even function of t?
1) t^2 | 2) $\sin 2t + 3t$ | c) $t^2 - 4t$ | d) $t^3 + 6$

33) "A periodic function" is given by a function which
a) Has a period $T = 2\pi$ | b) Satisfied $f(t+T) = -f(t)$ | c) Has a period $T = \pi$ | d) Satisfied $f(t+T) = f(t)$

34) The Fourier Transform of a real valued time signal has
a) Odd symmetry | b) Conjugate symmetry | c) Even symmetry | d) Real

35) A signal $X(t)$ has a Fourier Transform $X(\omega)$. If $X(t)$ is real and odd Function of t, then $X(\omega)$ is
a) A real and even function of ω | b) An imaginary and odd function of ω | c) An imaginary and even function of ω | d) A real and odd function of ω

36) The Fourier Transform of a conjugate symmetric function is always
a) Imaginary | b) Conjugate anti-symmetric | c) Real | d) Conjugate symmetric

37) The Fourier Transform of the exponential signal $e^{j\omega_0 t}$ is
a) A constant | b) A rectangular gate | c) An impulse | d) A series of impulses

38) Dirac Delta function is known as function
a) Impulse | a) Non impulse | b) Both a and b | c) None Of these

39) Bessel function is a kind of function
a) Special | b) Ordinary | c) Both a and b | d) None of these

40) What is the value of P(x) in Legendre equation
a) 1 – x2 | b) zero | c) 1+x | d) 1-x

41) Difference between homogeneous and nonhomogeneous equation is a function
a) Cosine | b) Sine | c) Cot | d) None of these

42) The solution of simple harmonic oscillator of quantum mechanics is expressed
a) Hermite | b) Non Hermite | c) Both a and b | d) None of these

43) The Fourier Series expansion of an odd periodic function
a) Sine Term | b) Cosine Term | c) linear Term | d) Both a and b

44) A differential equation gives a
a) Variable | b) Constant | c) Both a and b | d) None of these

45) A Laplace transform exist when
a) Function is an exponential order | b) Function is a non-exponential order | c) linear | d) Non linear

46) In Laplace transform "L "is act as
a) Symbol | b) An operator | c) Both a and b | d) None of these

47) Laplace transform of unit impulse
a) 1 | b) 2 | c) 0 | d) -1

48) Nonlinear system cannot be analyzed by Laplace transform because
a) No zero initial conditions | b) zero initial conditions | c) Both a and b | d) None of these

49) The necessary condition for convergence of the Laplace transform is the absolute integrability of $f(t)e^{-\sigma t}$.
a) True | b) False | c) Not always | d) Nothing to say

50) Laplace of function f(t) is given by
a) $F(s) = \int_{-\infty}^{\infty} f(t)e^{-st}dt$ | b) $F(t) = \int_{-\infty}^{\infty} f(t)e^{-t}dt$ | c) $f(s) = \int_{-\infty}^{\infty} f(t)e^{-st}dt$ | d) $f(t) = \int_{-\infty}^{\infty} f(t)e^{-t}dt$

Marks: 25 Time: 50 minutes

Short Questions

Question # 01: Prove that $\int_0^1 x J_n(\alpha x) J_n(\beta x)\,dx = 0$

Question # 02: Prove that $\int_0^{\pi/2} J_1(x\cos\theta)\,d\theta = \frac{1-\cos x}{x}$

Question # 03: Prove that $\int_0^{\infty} e^{-pt} J_o(at)\,dt = (p^2 + a^2)^{-1/2}$

Question # 04: Prove that $\int_{-1}^{+1} x P_n(x) P_{n-1}(x)\,dx = \frac{2n}{4n^2-1}$

Question # 05: Find the value of $\mathcal{L}(1+\cos 2t)$
Find the value of $\mathcal{L}^{-1}\left[\frac{S}{4S^2-25}\right]$

Department of Physics, Government College University, Faisalabad.

Examination: Mid Term 2022 **Title:** M.M.P-II / 3(3-0) **Course Code:** PHY-502
Total Marks: 18 **Class:** BS 6th-bridge (M) **Time Allowed:** 1 Hour **Session:** 2021-23

1. Obtain the Fourier series of the following function, (6)

$$f(x) = x^2 , \qquad 0 < x < 2\pi$$

2. Find the complex Fourier series of a function (6)

$$f(x) = \begin{cases} 0 \\ 1 \end{cases} , \quad \begin{pmatrix} -\pi < x < 0 \\ 0 < x < \pi \end{pmatrix}$$

3. Differentiate between even and odd function? (4)
4. How many Dirichlet conditions are there for Fourier series? (4)

Department of Physics
GC University, Faisalabad.

GC UNIVERSITY Faisalabad

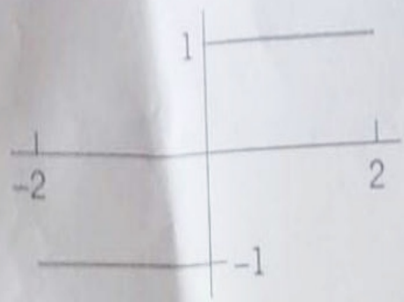
Examination: Final Semester Examination 2022 Paper: Physics Title: Mathematical Method of Physics - II
Course Code: Phy-5002 Total Marks: 18 Class: MSc. Semester: 2nd Time Allowed: 01:00 Hour
Roll # 4410 Registration 2019- 23 Signature ____

Attempt all question Marks: 18

Q. No. 1. Show that the integral represents the indicated function 6

$$\int_0^{\infty} \frac{1-\cos \pi w}{w} \sin xw \, dw = \begin{cases} \frac{\pi}{2}, & if \quad 0<x<\pi \\ 0, & if \quad x>\pi \end{cases}$$

Q.No.2. Is the given function even or odd or neither even nor odd? Find its Fourier series. Show details of your work. 6



Q. No. 3. Find the Fourier transform of the function $f(t) = \begin{cases} e^{-x} & if \ x \geq 0 \\ 0 & otherwise \end{cases}$ 6

BS. 468-19-23 Press Copy

Bahauddin Zakariya University Multan

Program: BS. (Physics) **Semester:** VI (Final Term) **Session:** (2019-2023)

Course Title: Methods of Mathematical Physics-II **Course Code:** PHYS-302

Time Allowed: 02:30 hrs **Max. Marks:** 60

Note: Attempt all the Questions:

Q.No.	Questions	Marks
Q.1:	**Write short answer of the following.**	5 X 2 = 10
	i. Define Fourier Series and its co-efficients? ii. What is importance of Laplace Transformation? iii. What do you understand about physical significance of Differential Equations? iv. Find Fourier Sine transform of $f(t) = 1$ for $0 < t < a$ and $f(t) = 0$ for $t > a$. v. Write orthogonal property of Hermite polynomial	
Q.2:	Develop Fourier Series for the out put of full wave rectifier?	10
Q.3:	Find the solution of Bessel's Differential Equation by using Frobenius Method?	10
Q.4:	Find the Fourier transform of $f(x) = e^{-\alpha x^2}$, where N and α are constant?	10
Q.5:	State and prove Rodrigues formula for Legendre Polynomial?	10
Q.6:	Show that $\frac{d}{dx}\{x^n J_n(x)\} = x^n J_{n-1}(x)$	10