

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2025

PHY3MN203 – ELECTRONIC COMMUNICATIONS

(FYUGP 2024 Admission onwards)

Time: 2 hours

Max. Marks : 70

PART – A

All questions can be attended.
Each question carries **Three** mark.

Ceiling -24 Marks

		COs	Cognitive Level	Marks
1	Explain noise in a communication system	CO1	U	3
2	Define the 'selectivity' and 'sensitivity' of a receiver,	CO1	R	3
3	Describe the three basic parts of a communication system.	CO2	R	3
4	Write a note on active filters.	CO1	U	3
5	Differentiate pulse modulation and pulse code modulation.	CO3	AN	3
6	Name and briefly define two types of pulse modulation.	CO3	U	3
7	Write a note on microwave tube?	CO5	U	3
8	Define microwave communication system.	CO5	R	3
9	Define frequency, amplitude and bandwidth.	CO1	U	3
10	Why is modulation important in communication?	CO2	AP	3

PART – B

All questions can be attended.
Each question carries six marks.

Ceiling -36 Marks

		COs	Cognitive Level	Marks
11	Explain multiplexing and modulation.	CO3	U	6
12	Draw the block diagram of an AM transmitter and briefly explain the function of each block.	CO4	AP	6
13	Compare Amplitude Modulation (AM) and Frequency Modulation (FM) based on bandwidth requirements, noise immunity, and common applications.	CO3	AN	6
14	Describe Fourier theory.	CO4	U	6

15	Explain microwave semiconductor diode.	CO5	U	6
16	Describe the process of serial and parallel data transmission.	CO4	U	6
17	Explain the working of a basic frequency modulator circuit.	CO3	U	6
18	What are the main benefits of digital communication over analogue communication	CO4	AP	6

PART - C

Answer any *one* questions.
Each question carries **Ten** marks.

		COs	Cognitive Level	Marks
19	Explain Frequency Modulation (FM), Principles of Phase modulation and modulation index and side bands.	CO3	U	10
20	Explain the communication process. Discuss different types of communication systems, Define modulation and multiplexing.	CO4	U	10

1 x 10 = 10 Marks

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2025

PHY3MN202 – Solid-state Physics and Spectroscopy

(FYUGP 2024 Admission onwards)

Time: 2 hours

Max. Marks : 70

PART – A

All questions can be attended.
Each question carries **Three** mark.

Ceiling -24 Marks

		COs	Knowledge Level (KL)	Marks
1	Identify the physical quantity represented by the eigenvalue of the Hamiltonian operator for a stationary state wavefunction?	CO1	Understand	3
2	Give the expressions for the expectation values of position and momentum.	CO1	Understand	3
3	Explain the properties of a well-behaved wave function.	CO1	Understand	3
4	Define Fermi energy. Write down its significance at absolute zero temperature.	CO3	Understand	3
5	Explain the cohesive energy of a solid and write the significance of it being high.	CO2	Understand	3
6	Compare the structure and properties of diamond and graphite.	CO2	Understand	3
7	Describe the physical mechanism of Doppler broadening.	CO4	Understand	3
8	Write down the key requirement for a molecule to have a rotational spectrum?	CO4	Understand	3
9	Write a short note on Einsteins coefficients.	CO4	Understand	3
10	Why do homonuclear molecules like H ₂ and N ₂ have electronic spectra even though they lack rotational and vibrational spectra?	CO5	Analyze	3

PART – B
All questions can be attended.
Each question carries six marks.
Ceiling -36 Marks

		COs	Knowledge Level (KL)	Marks
11	Show that the function $\psi(x)=e^{3x}$ is an eigenfunction of the operator, $\frac{d}{dx}$ and find the corresponding eigen value.	CO1	Apply	6
12	If $\psi(x) = A\cos(kx)$ for $0 < x < L$, find the allowed values of k satisfying the admissibility conditions.	CO1	Apply	6
13	Find the expectation value of the position x for a particle in an infinite potential well of width L .	CO1	Apply	6
14	The resistivity of copper at 293.5K is $\rho = 1.72 \times 10^{-8} \Omega m$. Estimate the mean free path λ between collisions of the free electrons in copper at 293.5K.	CO2	Apply	6
15	Explain the concept of quantization of energy with energy level diagram.	CO4	Understand	6
16	In CO the $J = 0$ to $J = 1$ absorption line occurs at a frequency of 2.35×10^{11} Hz. What is the bond length of the CO molecule?	CO5	Apply	6
17	Explain vibrational spectra of diatomic molecule treating it as a simple harmonic oscillator.	CO5	Understand	6
18	Describe quantum theory of Raman spectroscopy.	CO5	Understand	6

PART - C
Answer any *one* questions.
Each question carries Ten marks.

		COs	Knowledge Level (KL)	Marks
19	Explain the formation of n-type and p-type semiconductors and how doping affects the position of the Fermi level and the overall electrical conductivity of the material.	CO3	Understand	10
20	Discuss the principle of laser and describe the essential components of a laser system with diagram. Write any 3 characteristics of laser radiation.	CO4	Understand	10

1 x 10 = 10 Marks

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2025

PHY3MN201 – Mathematical Methods for Physics

(FYUGP 2024 Admission onwards)

Time: 2 hours

Max. Marks : 70

PART – A

All questions can be attended.

Each question carries **Three** mark.**Ceiling -24 Marks**

		COs	Knowledge Level(KL)	Marks
1	What is the geometrical meaning of the gradient of a scalar function?	CO1	R	3
2	If $\vec{F}(x, y, z) = x^2 \hat{i} + y^2 \hat{j} + z^2 \hat{k}$, find $\nabla \cdot \vec{F}$ and $\nabla \times \vec{F}$	CO2	AP	3
3	What happens to the argument of the quotient when one complex number is divided by another?	CO2	U	3
4	Explain the addition, subtraction, and multiplication of complex numbers.	CO1	U	3
5	What are curvilinear coordinates of a point in space, and under what condition are they called orthogonal curvilinear coordinates?	CO4	R	3
6	Solve the differential equation. $\frac{dy}{dx} = (x + 1)(y + 2)$	CO3	AP	3
7	Define the order and degree of a differential equation with an example.	CO1	R	3
8	Give one physical example where spherical coordinates are useful. Explain why this coordinate system is convenient in that case	CO4	U	3
9	Express Gauss's law in differential and integral form.	CO2	U	3
10	Represent a complex number $z=3+4i$ on the Argand plane and find its modulus.	CO1	U	3

PART – B

All questions can be attended.
Each question carries six marks.
Ceiling -36 Marks

		COs	Knowledge Level(KL)	Marks
11	Show that the curl of the electrostatic field $\vec{E}$ is zero.	CO2	AP	6
12	A long cylinder carries a charge density that is proportional to the distance from the axis: $\rho = ks$, for some constant k . Find the electric field inside this cylinder.	CO2	AP	6
13	Explain the behavior of a resistor, an inductor, and a capacitor in an AC circuit. What are the expressions for their voltage-current relationships, define inductive and capacitive reactance?	CO2	U	6
14	Find the modulus and principal argument of the complex number $\frac{1+2i}{1-(1-i)^2}$	CO2	AP	6
15	Explain the spherical polar coordinate system. Write down the expressions for gradient in this coordinate system.	CO4	AP	6
16	Using the relations between unit vectors, express the components of a vector in cylindrical coordinates (T_r, T_ϕ, T_z) in terms of its components in spherical coordinates (T_r, T_θ, T_ϕ) .	CO4	AP	6
17	Determine $y(x)$ that satisfies $x \frac{dy}{dx} + y \log(y) = xy e^x$	CO3	AP	6
18	Find the solution of $\cos(x+y) dy = dx$	CO3	AP	6

PART - C

Answer any *one* questions.
Each question carries **Ten** marks.

		COs	Knowledge Level(KL)	Marks
19	a) State Ampere's law in differential form. b) Derive the integral form of Ampere's law using Stokes' theorem. c) Apply the integral form to determine the magnetic field B at a distance s from a long straight wire carrying a steady current	CO2	AP	10
20	a) Discuss about simple harmonic motion. b) Give its differential equation and general solution and explain the main features of SHM c) Extend the discussion to damped oscillations, and explain the effect of damping on the motion.	CO3	U	10

1 x 10 = 10 Marks

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
Third Semester B.Sc Degree Examination, November 2025

PHY3CJ201 - MECHANICS I

(FYUGP 2024 Admission onwards)

Time: 2 hours

Max. Marks : 70

PART – A

All questions can be attended.
Each question carries **Three** mark.
Ceiling -24 Marks

		COs	Knowledge Level(KL)	Marks
1	Differentiate between tangential and radial acceleration for a point on a rotating body?	CO1	U	3
2	Explain why objects experience weightlessness in free fall.	CO2	U	3
3	A glass dropped on the floor is more likely to break if the floor is concrete than if it is wood. Why?	CO1	U	3
4	A woman stands in the middle of a perfectly smooth, frictionless, frozen lake. She can set herself in motion by throwing things, but suppose she has nothing to throw. Can she propel herself to shore <i>without</i> throwing anything?	CO5	Ap	3
5	Explain Parallel Axis Theorem.	CO2	U	3
6	Two hollow cylinders have the same inner and outer radii and the same mass, but they have different lengths. One is made of low-density wood and the other of high-density lead. Compare their moments of inertia.	CO5	Ap	3
7	Can a single force applied to a body change both its translational and rotational motions? Explain.	CO1	U	3
8	The work done by a force is the product of force and distance. The torque due to a force is the product of force and distance. Does this mean that torque and work are equivalent? Explain.	CO4	U	3
9	State Newton's law of universal gravitation.	CO5	U	3
10	What is gravitational potential?	CO5	U	3

PART – B

All questions can be attended.

Each question carries six marks.

Ceiling -36 Marks

		COs	Knowledge Level(KL)	Marks
11	James (mass 90.0 kg) and Ramon (mass 60.0 kg) are 20.0 m apart on a frozen pond. Midway between them is a mug of their favourite beverage. They pull on the ends of a light rope stretched between them. When James has moved 6.0 m toward the mug, how far and in what direction has Ramon moved?	CO3 CO5	Ap	6
12	A hunter on a frozen, essentially frictionless pond uses a rifle that shoots 4.20g bullets at 965 m/s. The mass of the hunter (including his gun) is 72.5 kg, and the hunter holds tight to the gun after firing it. Find the recoil velocity of the hunter if he fires the rifle (a) horizontally and (b) at 56.0° above the horizontal.	CO5 CO3	Ap	6
13	A 7.0-kg shell at rest explodes into two fragments, one with a mass of 2.0 kg and the other with a mass of 5.0 kg. If the heavier fragment gains 100 J of kinetic energy from the explosion, how much kinetic energy does the lighter one gain?	CO5	Ap	6
14	A flywheel with a radius of 0.300 m starts from rest and accelerates with a constant angular acceleration of 0.600 rad/s^2 . Compute the magnitude of the tangential acceleration, the radial acceleration, and the resultant acceleration of a point on its rim (a) at the start; (b) after it has turned through 60° (c) after it has turned through 120° .	CO1 CO5	Ap	6
15	A long thin rod of length L lies along the x-axis. The end points of the rod are at $x = 0$ and $x' = L$. Assume the rod can be represented as a continuous mass distribution with linear density λ mass per unit length. Determine the gravitational field at the point $x = 4L$.	CO5	Ap	6

16	A door 1.00 m wide, of mass 15 kg, can rotate freely about a vertical axis through its hinges. A bullet with a mass of 10 g and a speed of 400 m/s strikes the center of the door, in a direction perpendicular to the plane of the door, and embeds itself there. Find the door's angular speed. Is kinetic energy conserved?	CO1 CO4 CO5	An	6
17	An electric motor consumes 9.00 kJ of electrical energy in 1.00 min. If one-third of this energy goes into heat and other forms of internal energy of the motor, with the rest going to the motor output, how much torque will this engine develop if you run it at 2500 rpm?	CO1 CO5	Ap	6
18	A certain gyroscope precesses at a rate of 0.50 rad/s when used on earth. If it were taken to a lunar base, where the acceleration due to gravity is 0.165g, what would be its precession rate?	CO5	Ap	6

PART - C

Answer any *one* questions.
Each question carries **Ten** marks.

		COs	Knowledge Level(KL)	Marks
19	Discuss the principle of linear momentum conservation and how does it apply in collisions.	CO1	U	10
20	Explain the concept of Moment of Inertia and its significance in rotational motion. Derive the expression for Moment of Inertia about the central axis of a solid sphere.	CO2	U	10

1 x 10 = 10 Marks

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2025

PHY3CJ202 - Computational Physics

(FYUGP 2024 Admission onwards)

Time: 2 hours

Max. Marks : 70

PART – A

All questions can be attended.
Each question carries **Three** mark.

Ceiling -24 Marks

		COs	Knowledge Level(KL)	Marks
1	Explain the concept of an algorithm.	CO1	Understand	3
2	Describe the term “logical thinking”.	CO1	Remember	3
3	Mention the purpose of the eval() function in Python.	CO2	Understand	3
4	Explain the difference between $x = y$ and $x == y$ in Python.	CO2	Remember	3
5	Write down the use of the subplot() function in Matplotlib.	CO3	Understand	3
6	Write a Python program to generate five random numbers between 0 and 1.	CO3	Apply	3
7	Explain the truncation error? How can it be reduced?	CO4	Understand	3
8	Differentiate between interpolation and extrapolation?	CO5	Understand	3
9	Explain the concept of linearization of a nonlinear function.	CO5	Understand	3
10	Write down the steps involved in simple integration by the Monte Carlo method?	CO5	Understand	3

PART – B

All questions can be attended.
Each question carries six marks.
Ceiling -36 Marks

		COs	Knowledge Level(KL)	Marks
11	Write an algorithm to find the factorial of a number.	CO1	Understand	6
12	Explain how to create user-defined functions in Python with examples. Differentiate between local and global variables.	CO2	Understand	6
13	Describe file operations in Python with suitable example programs.	CO2	Understand	6
14	Write short notes on the following with syntax and examples: (a) linspace() function, (b) arange() function, (c) zeros() and ones() function.	CO3	Understand	6
15	Evaluate $I = \int_0^1 \frac{1}{1+x} dx$ by Simpson's rule with $h=0.125$.	CO5	Apply	6
16	Write a Python program to fit a straight line using the least squares method.	CO5	Apply	6
17	Solve the differential equation $\frac{dy}{dx} = -y$ using Euler's method with initial condition $y(0)=1$. Solve it for $x=0.04$ with a step size of 0.01.	CO5	Apply	6
18	Write a Python program to calculate the number of remaining nuclei in a radioactive decay process using Euler's method.	CO5	Apply	6

PART - C

Answer any *one* questions.
Each question carries **Ten** marks.

		COs	Knowledge Level(KL)	Marks
19	Derive Newton's formula for interpolation. Develop a Python program for it.	CO5	Apply	10
20	Explain the second-order Runge-Kutta method for solving first-order differential equations. Develop a Python program for it.	CO5	Apply	10

1 x 10 = 10 Marks