Department of Physics

St. Albert's College (Autonomous)

PHY1CRT0119: METHODOLOGY AND PERSPECTIVES OF PHYSICS

I. Course Instructor

Name	Sem, Programme& Batch	Email
Dr. Sajeesh T H	Sem I B.Sc Physics, 2020-23	sajeeshth@alberts.edu.in

II. Duration of Course:

No	Activity	Duration
1	Contact hours	35
2	Assessment (CAE & ESE)	2
	Total	37

I. Course Objectives:

* Introduced with the pursuit of physics, its history and methodology.
* Illustrate different number systems and their significance in Physics
* Interpret the Importance of measurements and error analysis which is central to Physics
* Realize the role of vectors and coordinate systems in Physics
* Capable of estimation of errors for the simple experiments in Physics .

I. Course Delivery Plan

This course is designed to make students get understanding and perform numerical analysis and integration.

Topics	Session No & Date(s)	Methodology and Duration
MODULE I		
Development of physics in the last century	09/11/20	Lectures
Galileo, Newton, Einstein,	11/11/20	Lectures
J J Thomson, Curies, Rayleigh	12/11/20	Lectures

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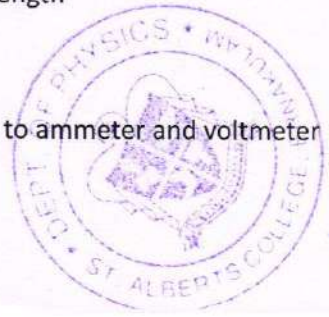
Max Plank, Heisenberg and Schrodinger	16/11/20	Lectures
Contributions of Indian physicists -C V Raman, H J Babha	18/11/20	Lectures
J C Bose, S N Bose, M Saha,	19/11/20	Lectures
S Chandrasekhar, Vikram Sarabhai,	23/11/20	Lectures
MODULE II		
Decimal, hexadecimal and Binary.Conversions,	25/11/20	Lectures
Binary arithmetic addition,	30/11/20	Lectures
subtraction and multiplication.	02/12/20	Lectures
1's complement, 2's complement	03/12/20	Lectures
Signed binary arithmetic,	07/12/20	Lectures
BCD code, ASCII code,	09/12/20	Lectures
Significance of binary number system in digital electronics	10/12/20	Lectures
INTERNAL EXAM	14/12/20	EXAM
Applications of vectors in Physics.	16/12/20	Lectures
Differential and Integral vector calculus:	17/12/20	Lectures
physical significance of Gradient,	04/01/21	Lectures
physical significance of Divergence	06/01/21	Lectures
physical significance of CURL	07/01/21	Lectures
Line integral of vectors	11/01/21	Lectures
surface integral of vectors	13/01/21	Lectures
volume integral of vectors	14/01/21	Lectures
Cartesian Co-ordinate system,	18/01/21	Lectures
plane polar and spherical polar coordinates,	20/01/21	Lectures
cylindricalcoordinates	21/01/21	Lectures
MODULE III		
least count of instruments	25/01/21	Lectures
Instruments for measuring mass	27/01/21	Lectures
Instruments for measuring length	28/01/21	Lectures
spectrometer	01/02/21	Lectures
conversion of galvanometer to ammeter and voltmeter	03/02/21	Lectures



Fundamental units.	04/02/21	Lectures
Precision and accuracy of measurements,	08/02/21	Lectures
Types of errors,	10/02/21	Lectures
Errors of computation	11/02/21	Lectures
Propagation of errors,	15/02/21	Lectures
Internal Exam	18/02/21	EXAM

III. Innovative Learning Programmes

Name of Programme	Duration	Type	Proposed Time
Hands on experiment with instruruments , identify variaous factors causing errors	3 Days	Experiment	4th Week

IV. Assignments and Seminars

Assignments

The following Assignment needs to be submitted to Google Classroom. The assignments and seminars are individual assignments.

No	Topics	Activity	Submission Deadlines	
Assignment	Assignment on given topic	Preparation of assignment	As the topics are covered	Submit the assignment to Google Classroom before dead line
Seminar	Presentation of the given topic	Presentation of 20 minutes duration with proper exhibiting materials	20th , 23rd and 26th hour of Course	Present the seminar on the given topic

Note: Failure to upload the assignment to Google Classroom *on the date mentioned will result in 0 marks for the assignment. Requests for extension of dates for submission not entertained.*

V. Attendance (one component in class participation):

95-100%	5
90-95%	4
85-90%	3
80-85%	2
75-80%	1
<75	**Not eligible for appearing for ESE**

VI. Required reading:

1. Digital electronics: Albert Paul Malvino

2. Digital logic and computer design – M. Morris Mano, PHI.

3. Text book: Advanced course in Practical Physics by D Chattopadhyay- Chapter-1

4. Practical Physics, G L Squires, Third edn. Cambridge University Press.

5. The theory of Errors in Physical Measurements- J C Pal- New Central Book Agency- 2010

Dr. LOUIE FROBEL P.G
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Department of Physics

St. Albert's College (Autonomous)

PHY1CRT0119: MECHANICS AND PROPERTIES OF MATTER

I. Course Instructor

Name	Sem, Programme& Batch	Email
Dr. Louie Frobel	Sem II B.Sc Physics, 2020-21	louiefrobel@alberts.edu.in

II. Duration of Course:

No	Activity	Duration
1	Contact hours	32
2	Assessment (CAE & ESE)	3
	Total	35

I. Course Objectives:

* Capable to demonstate the wave motions mathemtically.
* Understanding in the principle of conservation and symmetries.
* Interpret the principles of elasticity through the study of Young's & rigidity modulus.
* Learn simple principles of fluid flow and the equations governing fluid dynamics.
* Understanding of basic principles of surface tension and its application in real life

I. Course Delivery Plan

This course is designed to make students get understanding concepts of mechanicl motions and mechanical properties of materials

Topics	Session No & Date(s)	Methodology and Duration
Module I		
General wave equation, plane progressive harmonic wave	01/03/21	Lectures
energy density, intensity of a wave, superposition of waves	03/03/21	Lectures
beats, transverse waves in stretched strings, modes.	04/03/21	Lectures

Periodic motion	08/03/21	Lectures
simple harmonic motion and harmonic oscillator	10/03/21	Lectures
energy of a harmonic oscillator,	11/03/21	Online
examples of harmonic oscillator – simple and compound pendulum.	15/03/21	Lectures
Theory of Damped harmonic oscillator	17/03/21	Lectures
heory of forced oscillator	18/03/21	Lectures
resonance, applications.	22/03/21	Lectures
Internal Exam	24/03/21	EXAM
Module II		
Angular velocity- angular acceleration-	25/03/21	Lectures
angular momentum- conservation	29/03/21	Lectures
Orque-moment of inertia	31/03/21	Lectures
Parallel and perpendicular axes theorems	01/04/21	Lectures
calculation of moment of inertia	05/04/21	Lectures
Theory of flywheel.	07/04/21	Lectures
Discussions and tutorials	08/04/21	Tutorial
Module III		
Basic ideas on elasticity, Young's modulus,	12/04/21	Lectures
bulk modulus, rigidity modulus,	14/04/21	Lectures
Poisson's ratio,	15/04/21	Lectures
relations connecting various elastic constants.	19/04/21	Lectures
Work done per unit volume in a strain	21/04/21	Lectures
Bending of beams, bending moment, flexural rigidity	22/04/21	Lectures
Young's modulus – uniform and non-uniform bending	26/04/21	Lectures
cantilever.I –section girders	28/04/21	Lectures
Determination of rigidity modulus using Static and Dynamic methods.	29/04/21	Lectures
Streamline and turbulent flows	03/05/21	Lectures
coefficient of Viscosity – Determination of viscosity by	05/05/21	Lectures

Poiseuille's method		
Equation of continuity, energy possessed by a liquid,	06/05/21	Lectures
Bernoulli's theorem.	10/05/21	Lectures
Surface tension, surface energy,	12/05/21	Lectures
excess pressure in a liquid drop and bubble,	13/05/21	Lectures
Factors affecting surface tension, applications.	17/05/21	Lectures
Internal Exam	19/05/21	EXAM

III. Innovative Learning Programmes

Name of Programme	Duration	Type	Proposed Time
Hands on experiment with instruruments , identify concepts	3 Days	Experiment	4th Week and 6th week

IV. Assignments and Seminars

Assignments

The following Assignment needs to be submitted to Google Classroom. The assignments and seminars are individual assignments.

No	Topics	Activity	Submission Deadlines	
Assignment	Assignment on given topic	Preparation of assignment	As the topics are covered	Submit the assignment to Google Classroom before dead line
Seminar	Presentation of the given topic	Presentation of 20 minutes duration with proper exhibiting materials	20th , 23rd and 26th hour of Course	Present the seminar on the given topic

Note: Failure to upload the assignment to Google Classroom *on the date mentioned will result in 0 marks for the assignment. Requests for extension of dates for submission not entertained.*

V. Attendance (one component in class participation):

95-100%	5
90-95%	4
85-90%	3
80-85%	2
75-80%	1
<75	**Not eligible for appearing for ESE**

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VI. Required reading:

1. Mechanics by J.C. Upadhayaya, Ramprasad Pub.
2. Mechanics -D.S.Mathur, S.Chand.
3. Advanced course in Practical Physics by D Chattopadhyay, Central Book
4. Properties of Matter and Acoustics by Murugeshan and K. Sivaprasath, S.Chand
5. Mechanics- Hans and Puri, TMH
6. Classical Mechanics by J.C. Upadhyaya, Himalaya Pub.
7. Classical Mechanics-Takwale and Puranik, TMH.
8. Classical mechanics- K.SankaraRao, PHI.
9. Properties of Matter by Mathur, S. Chand,
10. Mechanics by Somnath Datta, Pearson
11. Mechanics by H.D Young and R.A Freedman, Pearson.

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PHY3CRT0119: OPTICS, LASER AND FIBER OPTICS

I. Course Instructor

Name	Programme	Batch	Semester	Email
Augustine Sumesh CJ (Module 3) Dr. Nisha M S (Module 1, 2 and 4)	B.Sc. PHYSICS	2020-21	III	sumeshcj@alberts.edu.in

II. Duration of Course:

No	Activity	Duration
1	Contact hours	54 (Including assignments)
2	Assessment (CAE)	3
	Total	57
	Remedial Sessions/Peer Tutoring/Tutorials (need based & Optional)	5

III. Course Objectives:

- Comprehend the fascinating area of interference
- Compare Fresnel's and Fraunhofer diffraction.
- Identify polarization by reflection, refraction and scattering.
- Classify different types of lasers, its principle and properties, application.
- Understand structure and principle of optic fibers

IV. Course Delivery Plan

Topics	Session No & Date(s)	Methodology and Duration
MODULE I		
Review of basic ideas of interference	07/7/2020	Lecture
Coherent waves-Optical path and phase change	08/7/2020	Lecture
superposition of waves	10/7/2020	Lecture
theory of interference-	13/7/2020	Lecture
intensity distribution	14/7/2020	Lecture
Young's double slit experiment, Coherence-Conditions for interference.	15/7/2020	Lecture
Thin films-plane parallel film	20/7/2020	Lecture
interference due to transmitted light	22/7/2020	Lecture
Haidinger fringes	27/7/2020	Lecture
interference in wedge shaped film	28/7/2020	Lecture

Newton's rings	03/8/2020	Lecture
Michelson interferometer	04/8/2020	Lecture
applications	05/8/2020	Lecture
MODULE II		
Fresnel Diffraction	10/8/2020	Lecture
Huygens- Fresnel theory	11/8/2020	Lecture
Difference between zone plate and convex lens.	17/8/2020	Lecture
Comparison between interference and diffraction	18/8/2020	Lecture
diffraction pattern due to a straight edge,	24/8/2020	Lecture
single silt	25/8/2020	Lecture
double slit	31/8/2020	Lecture
theory of plane transmission grating	01/9/2020	Lecture
Dispersive power and resolving power of grating	07/9/2020	Lecture
Review of basic ideas of interference	08/9/2020	Lecture
Coherent waves-Optical path and phase change	14/9/2020	Lecture
superposition of waves	15/9/2020	Lecture
MODULE III		
Concept of polarization	10/7/2020	Lecture
plane of polarization	13/7/2020	Lecture
Types of polarized light	17/7/2020	Lecture
production of plane polarized light by reflection	24/7/2020	Lecture
refraction. Malu's law	31/7/2020	Lecture
Polarization by double refraction	14/8/2020	Lecture
calcite crystal	21/8/2020	Lecture
Anisotropic crystals-optic axis	28/8/2020	Lecture
Double refraction	04/9/2020	Lecture
Huygens explanation of double refraction	11/9/2020	Lecture
Retarders - Quarter wave plate and Half wave plate	18/9/2020	Lecture
Production and Detection of plane	25/9/2020	Lecture
elliptically and circularly polarized light	02/10/2020	Lecture
Optical Activity- specific rotation.	09/10/2020	Lecture
MODULE IV		
Absorption and emission of light	21/9/2020	Lecture
Absorption-spontaneous emission and stimulated emission	22/9/2020	Lecture
Einstein relations	28/9/2020	Lecture
Population inversion	29/9/2020	Lecture
Active medium-Pumping	05/10/2020	Lecture
different pumping methods	06/10/2020	Lecture
Resonators	12/10/2020	Lecture

plane mirror and confocal resonators	13/10/2020	Lecture
Metastable state	19/10/2020	Lecture
Three level and Four level Laser systems	20/10/2020	Lecture
Ruby Laser, He-Ne laser	26/10/2020	Lecture
Semiconductor Laser	27/10/2020	Lecture
Laser beam Characteristics	02/11/2020	Lecture
coherence	03/11/2020	Lecture
Applications of Laser	09/11/2020	Lecture
Holography (qualitative study only).	10/11/2020	Lecture

V. Innovative Learning Programmes

Name of Programme	Duration	Type	Proposed Time

VI. Assignments and Seminars

Assignments

The following Assignment needs to be submitted to Google Classroom. Both the assignments & presentation are individual assignments.

No	Topics	Activity	Submission Deadlines	
Assignment -1	Problems related to polarisation	Solution of numerical problems	24/8/2020	Submit Hard copy
Assignment -2`	Problems-diffraction	Solution of numerical problems	20/10/2020	Submit Hard copy
Seminar				

Note: Failure to upload the assignment to Google Classroom *on the date mentioned will result in 0 marks for the assignment. Requests for extension of dates for submission not entertained.*

VII. Attendance (one component in class participation):

95-100%	5
90-95%	4
85-90%	3
80-85%	2
75-80%	1
<75	**Not eligible for appearing for ESE**

VIII. Required reading:

Text Book:

1. Optics by N.Subramanayam, Brijlal, M.N.Avadhanulu
2. *Semiconductor physics and optoelectronics- V.Rajendran, J.Hemaletha and M.S.M.Gibson*

References:

1.Optics, E Hecht and AR Ganesan, Pearson

2.Optics, 3rd edition, AjoyGhatak, TMH

3.Optical Electronics, AjoyGhatak and K Thyagarajan, Cambridge

4.Optics and Atomic Physics, D P Khandelwal, Himalaya Pub. House

5.Optics, S K Srivastava, CBS Pub. N Delhi

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St. Albert's College (Autonomous)

PHY4CRT0119: SEMICONDUCTOR PHYSICS

I. Course Instructor

Name	Programme	Batch	Semester	Email
(Module 1,3 and 4) Augustine Sumesh CJ (Module 2 and 3)	B.Sc. Physics	2020-21	IV	sumeshcj@alberts.edu.in

II. Duration of Course:

No	Activity	Duration
1	Contact hours	54 (Including assignments)
2	Assessment (CAE)	3
	Total	57
	Remedial Sessions/Peer Tutoring/Tutorials (need based & Optional)	5

III. Course Objectives:

1. Understand basic concept of doping, junction, and VI characteristics.
2. Understand biasing techniques for diodes and transistors.
3. Design basic amplifiers and oscillators.

IV. Course Delivery Plan

Topics	Session No & Date(s)	Methodology and Duration
MODULE I		
PN Junction, Depletion layer	01/12/2020	Lecture
Biasing- forward and reverse	07/12/2020	
Barrier potential	8/12/2020	
Reverse breakdown	14/12/2020	
Junction capacitance and diffusion capacitance	15/12/2020	
PN Junction diode – V-I characteristics	21/12/2020	
Diode current Equation, Diode testing, Ideal diode	22/12/2020	
Zener diode and its reverse characteristics.	28/12/2020	
Thermistors	29/12/2020	
Regulated Power supplies - Zener diode voltage regulator	04/01/2021	

Rectification - Half wave	05/01/2021	
Full wave	11/01/2021	
Centre tapped, Bridge rectifier circuits	12/01/2021	
Filter circuits	18/01/2021	
Inductor Filter, Capacitor Filter	19/01/2021	
LC Filter, π Filter	25/01/2021	
Voltage multipliers – Doubler & Tripler	26/01/2021	
Wave shaping circuits -	01/02/2021	
Clipper Positive, negative and biased –s	02/02/2021	
Clamper Positive, negative and biased	08/02/2021	
MODULE II		
Bipolar junction transistors	04/2/2020	
Transistor biasing, CB	11/2/2020	
CC, CE	18/2/2020	
Active, saturation and cut-off regions	25/2/2020	
Current gain α, β, γ and their relationships	01/3/2021	
Leakage currents	01/3/2021	
Thermal runaway	15/01/2021	
DC operating point	22/01/2021	
AC and DC Load line	29/01/2021	
Q-Point	05/02/2021	
Basic principles of feedback	12/02/2021	
negative feedback circuits, current series & shunt	19/02/2021	
Module III		
Need for biasing-Stabilization	26/02/2021	
Voltage divider bias	05/03/2021	
Single stage transistor Amplifiers	12/03/2021	
CE amplifier, Decibel system, Variations in Amplifier gain with frequency.	19/03/2021	
Oscillatory Circuits	21/03/2021	
LC oscillators, RC oscillators	22/03/2021	
Hartley Oscillator, Colpit's Oscillator	23/03/2021	
Astable and monostable multivibrator	29/03/2021	
Module IV		
FET -characteristics, FET- Parameters. Comparison between FET and BJT. MOSFET	30/03/2021	
OP-amp- Symbol and terminals. Characteristics of ideal OP-amp, CMRR	01/04/2021	
inverting, Non-inverting	02/04/2021	
Unity follower and Summing amplifiers	08/04/2021	
Types of modulation – AM, FM	09/04/2021	
Pulse modulation and Phase modulation (qualitative study only)	15/04/2021	

Amplitude modulation- modulation index	16/04/2021	
Analysis of AM wave – Sidebands	22/04/2021	
bandwidth- AM Demodulation.	23/04/2021	

V. Innovative Learning Programmes

Name of Programme	Duration	Type	Proposed Time

VI. Assignments and Seminars

Assignments

The following Assignment needs to be submitted to Google Classroom. Both the assignments & presentation are individual assignments.

No	Topics	Activity	Submission Deadlines	
Assignment -1	Problems related to Kirchhoff's law	Solution of numerical problems	20-01-21	Submit Hard copy
Assignment -2`	Problems-rectifier	Solution of numerical problems	3-2-21	Submit Hard copy
Seminar				

Note: Failure to upload the assignment to Google Classroom *on the date mentioned will result in 0 marks for the assignment. Requests for extension of dates for submission not entertained.*

VII. Attendance (one component in class participation):

95-100%	5
90-95%	4
85-90%	3
80-85%	2
75-80%	1
<75	**Not eligible for appearing for ESE**

VIII. Required reading:

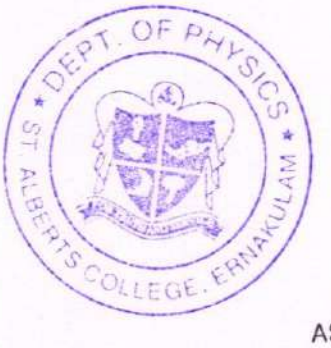
Text Book:

1. Basic Electronics-B. L. Theraja

2. A Text Book of Applied Electronics-R.S.Sedha

References:

1. Principles of electronics, VK Mehta, S Chand
2. Basic Electronics(7thEdition), Malvino and Bates, TMH
3. Electronics Fundamentals and Applications- D. Chattopadhyay and P.G.Rakshit, New Age International Publishers.
4. Electronics: Fundamentals of Analog circuits, Thomas L. Floyd, David Buchla, Prentice Hall
5. Electronic Devices and Circuit Theory, Robert Boylestad, Louis Nashelsky, Prentice Hall



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St. Albert's College (Autonomous)

PHY5CRT0219 – CLASSICAL AND QUANTUM MECHANICS

I. Course Instructor

Name	Sem, Programme & Batch	Email
Dr. Sajeesh T. H.	B.Sc. Physics semester V 2020-21	sajeeshth@alberts.edu.in

II. Duration of Course:

No	Activity	Duration
1	Contact hours	50 (Including assignments)
2	Assessment (CAE)	2
	Total	52
	Remedial Sessions/Peer Tutoring/Tutorials (need based & Optional)	5

III. Course Objectives:

- Distinguish various types of constraints in a mechanical problem.
- Understand different analytical mechanics for solving problems.
- Explain photoelectric effect and Compton effect.
- Evaluate eigen values and eigen functions
- Solve Schrodinger equation for particle in a box.

IV. Course Delivery Plan

The teaching methods include lectures, discussions, live practical sessions using mobile aaps.

Topics	Session No & Date(s)	Methodology and Duration
Module I		
Constraints Degrees of freedom generalized co-ordinates,	2-6-2021	Recorded video class
principle of virtual work D'Alembert's principle.	4-6-2021	Online Lecture/ Recorded video class
Lagrange's equations Application of Lagrangian (L.H.O)	7-6-2021	Online Lecture/Recorded video class
Planetary motion Simple Pendulum	9-6-2021	Online Lecture/Tutorial
Hamilton's Canonical eqn of motion	11-6-2021	Online Lecture

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Advantages of Hamilton's method		
Applications Linear Harmonic oscillator Simple pendulum	14-6-2021	Online Lecture/Tutorial/Google classroom
Hamilton's Principle of Least Action	16-6-021,18-6-2021	Online Lecture
Derivation of Lagrange's equation from Hamilton's Principle.	19-6-2021	Online Lecture
Module II		
Failure of classical physics Black Body radiation Planck's radiation law	21-6-2021	Online Lecture
Photoelectric effect Einstein's explanation	23-6-2021	Online Lecture
Compton effect Bohr's correspondence principle	25-6-2021	Online Lecture
Wave particle Dualism Dual nature of matter De Broglie hypothesis	28-6-2021	Online Lecture
Davisson-Germer Experiment	5-7-2021	Online Lecture
De Broglie waves	7-7-2021	Online Lecture
Wave packet, Group and phase velocities	9-7-2021	Online Lecture
Linear vector space-,Hilbert space, Orthogonality	12-7-2021	Online Lecture
Linear operator, Eigen functions and eigen values	14-7-2021	Online Lecture
Hermitian operator	16-7-2021	Online Lecture
Postulates of Quantum Mechanics	19-7-20121 21-7-2021	Online Lecture
wave function, Operators, Expectation value, Eigen value,	23-7-2021	Seminar
Time development- Simultaneous measurability	26-7-2021	Online lecture
General uncertainty relation.	28-7-2021	Seminar
Assessment test	31-7-2021	Online
Module III		
Time dependent Schrödinger equation	2-8-2021	Online
interpretation of wave function Probability density Probability current density	4-8-2021	Seminar
Ehrenfest theorem Extension to three dimensions	6-8-2021 9-8-2021 11-8-221	Online Lecture/Tutorial/Google classroom
Timeindependent Schrödinger equation Stationary states	13-8-2021	Seminar

Admissibility Conditions Of Wave function	16-8-2021	Seminar
general properties of one dimensional Schrödinger equation	18-8-2021	Online
particle in a box	20-8-2021	Online
one dimensional barrier problem square potential barrier	23–8-2021	Online
Assessment	25-8-2021	Online
Problems solving tutorials	27-8-2021 30-8-2021 1-9-2021 3-9-2021 6-9-2021 8-9-2021	Online

V. Innovative Learning Programmes

Name of Programme	Duration	Type	Proposed Time
Flipped Class	10 sessions	Seminar/Tutorial	Each module application problems

VI. Assignments and Seminars

Assignments

No	Topics	Activity	Submission Deadlines	
1	Assignment on Lagrangian and Hamilton mechanics	Problem solving	one week after ostin the assignment.	
2	Quantum mechanics	problems in QM	End of second module	

VII. Attendance (one component in class participation):

95-100%	5
90-95%	4
85-90%	3
80-85%	2
75-80%	1

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<75	Not eligible for appearing for ESE

VIII. Required reading:

Text Book:

1. *Classical Mechanics by J.C. Upadhyaya. Himalaya Pub.*
2. *Concepts of Modern Physics- Arthur Beiser, TMH*

References:

1. *Concepts of Modern Physics- Arthur Beiser, TMH*
2. *A Textbook of Quantum Mechanics- G Aruldhas- (2nd Edition)- PHI*
3. *Classical Mechanics-Takwale and Puranik, TMH.*
4. *Classical mechanics- K.SankaraRao, PHI.*
5. *Introductory Quantum Mechanics- RI Liboff, Pearson*
6. *Quantum Physics- Gasiorowicz,John Wiely*
7. *Quantum Mechanics- Griffith, Pearson*

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PHY5CRT0319: DIGITAL ELECTRONICS AND PROGRAMMING

I. Course Instructor

Name	Sem, Programme & Batch	Email
Dr. Louie Frobel P G	B.Sc. Physics semester V 2020-21	louiefrobel@alberts.edu.in

II. Duration of Course:

No	Activity	Duration
1	Contact hours	50 (Including assignments)
2	Assessment (CAE)	2
	Total	52
	Remedial Sessions/Peer Tutoring/Tutorials (need based & Optional)	2

III. Course Objectives:

- To Explain basic logic operations.
- To Understand Boolean algebra
- To Understand the fundamentals of Digital circuits.
- To Familiarized with the basics of Python programing language

IV. Course Delivery Plan

The teaching methods include lectures, discussions, live practical sessions using mobile aaps.

Topics	Session No & Date(s)	Methodology and Duration
Module I		
Basic gates NOT, OR, AND. Universal Logic Gates- NOR, NAND. XOR and XNOR Gates.	2-6-2021	Online Lecture
Rules and Laws of Boolean algebra. Duality theorem -De Morgan's Theorems.	4-6-2021	Online Lecture

DEPT. OF PHYSICS ST. ALBERTS COLLEGE ERNAKULAM

analysis and simplification of logic circuits. Boolean equation and truth table	7-6-2021	Online Lecture
SOP and POS. Minterms and Maxterms	9-6-2021	Online Lecture
Standard SOP and Standard POS- Conversion between Standard SOP & Standard POS.	11-6-2021	Online Lecture
Karnaugh Map	14-6-2021	Online Lecture
Karnaugh Map simplification	16-6-021,18-6-2021	Online Lecture
Module 1 assessment test 1	19-6-2021	Google classroom
Module II		
Half Adder and Full Adder	21-6-2021	Online Lecture
Half and Full subtractor	23-6-2021	Online Lecture
4-bit parallel Adder/Subtractor.	25-6-2021	Online Lecture
Multiplexer and De-multiplexer	28-6-2021	Online Lecture
Encoder & Decoder	5-7-2021	Online Lecture
Assessment test 2	7-7-2021	Online Lecture
Flip-Flops, RS Flip flops	9-7-2021	Online Lecture
Clocked RS Flipflops	12-7-2021	Online Lecture
Master Slave JK FF	14-7-2021	Online Lecture
DFF, T Flip-flop	16-7-2021	Online Lecture
Buffer registers- Shift register- SISO and SIPO	19-7-20121 21-7-2021	Online Lecture
Counters- Binary ripple counter	23-7-2021	Seminar
D/A converters (Ladder type)	26-7-2021	Online lecture
A/D Converter (Counter type).	28-7-2021	Seminar
Assessment test 3	31-7-2021	Online
Module III		
Basic C++ program structure	2-8-2021	Online
comments-data	4-8-2021	Seminar
arithmetic, relational, logical and assignment operators	6-8-2021 9-8-2021 11-8-221	Seminar
if, if-else and else if	13-8-2021	Seminar
do while - case	16-8-2021	Seminar
loops and nested loops	18-8-2021	Online
Arrays	20-8-2021	Online
Functions-basic ideas	23–8-2021	Online
Objects and classes	25-8-2021	Online
Programming - basic ideas	27-8-2021 30-8-2021 1-9-2021 3-9-2021 6-9-2021 8-9-2021	Through mobile app

V. Innovative Learning Programmes

Name of Programme	Duration	Type	Proposed Time
Thalsamayam oru Coding.	6 Days	Experiential Learning	End of the 3rd Module

VI. Assignments and Seminars

Assignments

No	Topics	Activity	Submission Deadlines	
1	Assignment on Logic gates	Answer the given questions based on logic gates	one week after ostin the assignment.	
2	Based on logic circuits	minimise the logic expressions using boolean algebra and K map	End of second module	

VII. Attendance (one component in class participation):

95-100%	5
90-95%	4
85-90%	3
80-85%	2
75-80%	1
<75	**Not eligible for appearing for ESE**

VIII. Required reading:

Digital principles and applications, Malvino, Leach and Saha (6th Edition) TMH

Digital Electronics- Sedha, S Chand

Object oriented programming in Turbo C++ - Robert Lafore (Galgotia Pub.)

DEPT OF PHYSICS ST. ALBERTS COLLEGE, ERNAKULAM

Dr. LOUIE FROBEL P.G
ASSISTANT PROFESSOR & HEAD
DEPARTMENT OF PHYSICS
ST. ALBERT'S COLLEGE (AUTONOMOUS)
ERNAKULAM

Department of Physics

St. Albert's College (Autonomous)

PH5CRT0517: ELECTRICITY AND ELECTRODYNAMICS

I. Course Instructor

Name	Sem, Programme& Batch	Email
Augustine Sumesh C J	Sem V B.Sc Physics, 2020-21	sumeshcj@alberts.edu.in

II. Duration of Course:

No	Activity	Duration
1	Contact hours	42
2	Assessment (CAE & ESE)	4
	Total	46

I. Course Outcomes:

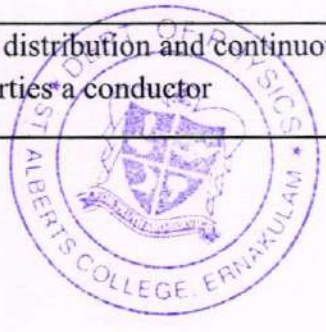
- Analyse AC circuits and networks using network theorems.
- Explain different laws in electrostatics and magnetostatics
- Apply Maxwell's equations to deduce wave equation and electromagnetic field energy.
- Explain different thermoelectric effects.
- Derive Maxwell's equation and apply boundary conditions for free space.

I. Course Delivery Plan

This course is designed to make students get familiar with Electricity, electro statics and magnetostatics. They get an understanding on the underlying physics on these topics.

Topics	Session No & Date(s)	Methodology and Duration
MODULE I		
EMF induced in a coil rotating in a magnetic field	8 Jun 20	LECTURES
AC applied to resistive, inductive and capacitance circuits	9 Jun 20	LECTURES
AC applied to LR and RC circuits	11 Jun 20	LECTURES
Analysis of LCR series circuits	15 Jun 20	LECTURES
LCR parallel resonant circuit	16 Jun 20	LECTURES
Power in ac circuits - Wattless current - choke coil	18 Jun 20	LECTURES

transformer on no load- skin effect.	22 Jun 20	LECTURES
Ideal voltage source and current source - Superposition theorem	23 Jun 20	LECTURES
Thevenin's theorem	25 Jun 20	LECTURES
Norton's theorem	29 Jun 20	LECTURES
Maximum power transfer theorem., Reciprocity theorem	30 Jun 20	LECTURES
TUTORIAL	2 Jul 20	TUTORIAL
MODULE II		
Growth and decay of current in an LR circuit	6 Jul 20	LECTURES
Charging and discharging of a capacitor through a resistor	7 Jul 20	LECTURES
Growth and decay of charge in an LCR circuit.	9 Jul 20	LECTURES
Seebeck effect - Laws of thermo emf - Peltier effect	13 Jul 20	LECTURES
Thomson effect- Thermoelectric diagrams -Thermocouple	14 Jul 20	LECTURES
Explanation of thermoelectric effects based on electron theory.	16 Jul 20	LECTURES
INTERNAL EXAM	21 Jul 20	EXAM
MODULE III		
Fundamental theorems of divergence and curl	23 Jul 20	LECTURES
Electric field - Continuous charge distribution	27 Jul 20	LECTURES
Divergence and curl of electrostatic field	28 Jul 20	LECTURES
Gauss's law and applications:	6 Aug 20	LECTURES
solid sphere, infinite wire, infinite plane sheet	10 Aug 20	LECTURES
Electric potential - Poisson's and Laplace's equations	11 Aug 20	LECTURES
Potential of a localized charge distribution	13 Aug 20	LECTURES
Electrostatic boundary conditions	17 Aug 20	LECTURES
work and energy in electrostatics – The work done to move a charge	18 Aug 20	LECTURES
Energy of a point charge distribution and continuous charge distribution- Basic properties a conductor	20 Aug 20	LECTURES



Lorentz Force law- Biot- Savart law	24 Aug 20	LECTURES
Divergence and curl of B- Applications of Amperes' law:	25 Aug 20	LECTURES
long straight wire, infinite plane, solenoid	27 Aug 20	LECTURES
Comparison of electrostatics and magnetostatics	31 Aug 20	LECTURES
Magnetic vector potential	1 Sep 20	LECTURES
Magnetostatics boundary conditions	3 Sep 20	LECTURES
Electromagnetic induction- Faraday's law	7 Sep 20	LECTURES
TUTORIAL	8 Sep 20	TUTORIAL
MODULE IV		
Maxwell's equations	10 Sep 20	LECTURES
Boundary conditions for free space	14 Sep 20	LECTURES
Continuity equations-	15 Sep 20	LECTURES
Poynting's theorem	17 Sep 20	LECTURES
Wave equations	21 Sep 20	LECTURES
Electromagnetic wave in vacuum -	22 Sep 20	LECTURES
Wave equation for E and B	24 Sep 20	LECTURES
Monochromatic plane waves- Energy of electromagnetic waves	28 Sep 20	LECTURES
INTERNAL EXAM	29 Sep 20	EXAM

III. Innovative Learning Programmes

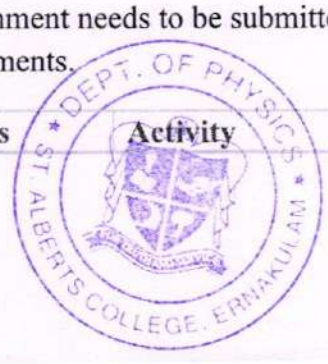
Name of Programme	Duration	Type	Proposed Time
Estimating the power consumption and power optimisation in house	2 Days	Survey and analysis	2nd Week

IV. Assignments and Seminars

Assignments

The following Assignment needs to be submitted to Google Classroom. The assignments and seminars are individual assignments.

No	Topics	Activity	Submission Deadlines



Assignment	Assignment on given topic	Preparation of assignment	As the topics are covered	Submit the assignment to Google Classroom before dead line
Seminar	Presentation of the given topic	Presentation of 20 minutes duration with proper exhibiting materials	20th , 23rd and 26th hour of Course	Present the seminar on the given topic

Note: Failure to upload the assignment to Google Classroom *on the date mentioned will result in 0 marks for the assignment. Requests for extension of dates for submission not entertained.*

V. Attendance (one component in class participation):

95-100%	5
90-95%	4
85-90%	3
80-85%	2
75-80%	1
<75	**Not eligible for appearing for ESE**

VI. Required reading:

1. Introduction to Electrodynamics, David J Griffiths .
2. Electricity and Magnetism, R. Murugeshan
3. Fundamentals of Magnetism and Electricity, D.N Vasudeva - S Chand
4. Principles of Electromagnetics, Mathew N.O Sadiku- 4 th Ed. , Oxford
5. Electricity and Magnetism, KK Tewari- S Chand
6. Electricity and Electronics, Saxena, Arora and Prakash- Pragati Prakashan
7. Classical Electromagnetism, Jerrold Franklin- Pearson
8. Electromagnetic Fields and Waves, KD Prasad- Satya Prakashan
9. Field and wave Electromagnetics, David K Cheng- Pearson.

DEPT. OF PHYSICS ST. ALBERTS COLLEGE ERNAKULAM

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ERNAKULAM

St. Albert's College (Autonomous)

PHY6CBT0117 : COMPUTATIONAL PHYSICS

I. Course Instructor

Name	Programme	Batch	Semester	Email
Dr. T.H.Sajeesh	B.Sc. Physics	2	VI	thsajeesh@gmail.com

II. Duration of Course:

No	Activity	Duration
1	Contact hours	54 (Including assignments)
2	Assessment (CAE)	3
	Total	**37**
	Remedial Sessions/Peer Tutoring/Tutorials (need based & Optional)	**5**

III. Course Objectives:

- Discuss and compare the methods to solve algebraic and transcendental equations
- Explain curve fitting and interpolation.
- Discuss various numerical integration and differentiation methods.
- Ability to solve nonlinear problems using numerical methods
- Application of numerical skill to solve differential equations

IV. Course Delivery Plan

Topics	Session No & Date(s)	Methodology and Duration
MODULE I		
Bisection Method	04/12/2020	Lectures
Regula-Falsi Method	07/12/2020	Lectures
Fixed point iteration method	11/12/2020	Lectures
Newton Raphson method	14/12/2020	Lectures
Secant method	18/12/2020	Lectures
Rate of convergence	21/12/2020	Lectures
comparisons of these Methods	22/12/2020	Lectures

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Newton Raphson method (two equation solution)	28/12/2020	Lectures
Tutorial	01/1/2021	Lectures
Gauss elimination method	04/1/2021	Lectures
pivoting strategies	11/1/2021	Lectures
Gauss-Jordan method	15/1/2021	Lectures
LU Factorization	22/1/2021	Lectures
Iterative methods	29/1/2021	Lectures
Jacobi method	01/2/2021	Lectures
Gauss-Seidel method	05/2/2021	Lectures
Tutorial	08/2/2021	Lectures
MODULE II		
Least square method of linear fit	07/12/2020	Lectures
Problem solving with LSM linear fit	14/12/2020	Lectures
Least square method of parabola	21/12/2020	Lectures
problem solving with LSM parabola	28/12/2020	Lectures
LSM for polynomial	04/1/2021	Lectures
LSM for exponential	11/1/2021	Lectures
Tutorial	18/1/2021	Lectures
Finite difference operators: forward and backward	25/1/2021	Lectures
shift, average and differential operators	01/2/2021	Lectures
Newton forward difference interpolation	08/2/2021	Lectures
Lagrange interpolation	15/2/2021	Lectures
divide difference interpolation	22/2/2021	Lectures
Problem solving	03/3/2021	Lectures
Tutorial	08/3/2021	Lectures
Internal exam	15/3/2021	Online
MODULE III		
Numerical Differentiation formulae	12/2/2021	Lectures
Maxima and minima of a tabulated function	15/2/2021	Lectures
Newton- Cote general quadrature formula	19/2/2021	Lectures
Trapezoidal rule, Simpson's 1/3 and 3/8 rule	26/2/2021	Lectures
Taylor Series Method, Picard's method	01/3/2021	Lectures
Euler's and modified Euler's method	05/3/2021	Lectures
Runge Kutta methods for 1st order	08/3/2021	Lectures
Runge Kutta methods for 2nd order	12/3/2021	Lectures
Tutorial	19/3/2021	Lectures
Internal Exam	26/3/2021	Online

V. Innovative Learning Programmes

Name of Programme	Duration	Type	Proposed Time
Development of Algorithms	1 day	Experiment	4th Week
Use the methods to fit experimental Data	2 days	Discussion	6th Week

VI. Assignments and Seminars

Assignments

The following Assignment needs to be submitted to Google Classroom. Both the assignments & presentation are individual assignments.

No	Topics	Activity	Submission Deadlines	
Assignment -1	Assignment on given topic	Preparation of assignment	As the topics are covered	Submit the assignment to Google Classroom before dead line
Assignment -2`	Assignment on given topic	Preparation of assignment	As the topics are covered	Submit Hard copy
Seminar	Presentation of the given topic	Presentation of 20 minutes duration with proper exhibiting materials	20th , 23rd and 26th hour of Course	Present the seminar on the given topic

Note: Failure to upload the assignment to Google Classroom *on the date mentioned will result in 0 marks for the assignment. Requests for extension of dates for submission not entertained.*

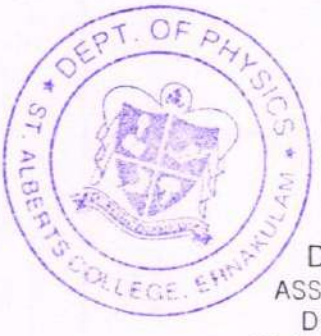
VII. Attendance (one component in class participation):

95-100%	5
90-95%	4
85-90%	3
80-85%	2
75-80%	1
<75	**Not eligible for appearing for ESE**

VIII. Required reading:

Text Book:

1. *Numerical Methods, Balagurusamy, TMH*
2. *Numerical Methods for Scientists and Engineers- K Sankara Rao- PHI*
3. *Introductory Numerical Methods, S S Sastry, PHI.*



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ERNAKULAM

St. Albert's College (Autonomous)

PHY6CRT0419: SOLID STATE PHYSICS

I. Course Instructor

Name	Programme	Batch	Semester	Email
Dr.Sumithra Sivadas Menon	B.Sc. Physics	2020-23	VI	sumitrasivadas@alberts.edu.in

II. Duration of Course:

No	Activity	Duration
1	Contact hours	66 (Including assignments)
2	Assessment (CAE)	3
	Total	**69**
	Remedial Sessions/Peer Tutoring/Tutorials (need based & Optional)	**5**

III. Course Objectives:

- Have a basic knowledge of crystal systems and spatial symmetries.
- Account for how crystalline materials are studied using diffraction, including concepts like form factor, structure factor and scattering amplitude.
- Know the principles of structure determination by diffraction.
- Understand the concept of reciprocal space and be able to use it as a tool.
- Know what phonons are, and be able to perform estimates of their dispersive and thermal properties.
- Calculate thermal and electrical properties in the free electron model.
- Understand semiconducting, dielectric and magnetic properties of materials
- Have a knowledge of superconductivity

IV. Course Delivery Plan

Topics	Session No & Date(s)	Methodology and Duration
MODULE I		
Crystal Structure		
Solid State, Crystalline, Polycrystalline and Amorphous materials	02-12-2020	Lectures
Crystal Lattice, Periodicity, Translation Vectors	03-12-2020	Lectures
Unit Cell, Basis	04-12-2020	Lectures
Symmetry operations	07-12-2020	Lectures

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Bravais Lattice in 2 and 3 dimensions	09-12-2020	Lectures
Miller indices	10-12-2020	Lectures
Inter planar spacing	11-12-2020	Lectures
Simple crystal structures-hcp, fcc	14-12-2020	Lectures
Bcc and simple cubic	16-12-2020	Lectures
Structures of NaCl, diamond and ZnS	17-12-2020	Lectures
X-ray diffraction from crystals	18-12-2020	Lectures
Bragg's law, Powder method	31-12-2020	Lectures
Reciprocal Lattice-properties	01-01-2021	Lectures
Reciprocal Lattice to sc, bcc and fcc	04-01-2021	Lectures
Bragg's law in reciprocal lattice	06-01-2021	Lectures
MODULE II		
Bonding in Solids		
Inter-atomic forces, ionic bonding	11-01-2021	Lectures
Bond dissociation and cohesive energy	13-01-2021	Lectures
Madelung energy	14-01-2021	Lectures
Covalent bonding	15-01-2021	Lectures
Metallic bonding	18-01-2021	Lectures
Hydrogen bonding	20-01-2021	Lectures
Van der Waal's bonding (basic ideas only)	21-01-2021	Lectures
Free Electron Theory and Elementary Band Theory		
Free electron gas in one dimension	25-01-2021	Lectures
Three dimension	27-01-2021	Lectures
Electronic specific heat	28-01-2021	Lectures
Band Theory	29-01-2021	Lectures
Bloch Theorem	01-02-2021	Lectures
Kronig-penney model (derivation not expected)	03-02-2021	Lectures
Energy-wave vector relations	04-02-2021	Lectures
Different zone schemes	05-02-2021	Lectures
Velocity and effective mass of electrons	08-02-2021	Lectures
Distinction between metals, insulators and semiconductors	10-02-2021	Lectures
Semiconducting Properties of Materials		
Intrinsic and Extrinsic Semiconductors	12-02-2021	Lectures
Drift Velocity	15-02-2021	Lectures
Mobility and Conductivity of Intrinsic Semiconductors	17-02-2021	Lectures
Carrier Concentration of Intrinsic Semiconductors	18-02-2021	Lectures
Fermi Level for Intrinsic Semiconductors	19-02-2021	Lectures
Carrier Concentration for Extrinsic Semiconductor	22-02-2021	Lectures
Conductivity and Fermi Level for Extrinsic Semiconductor	24-02-2021	Lectures
Hall Effect	25-02-2021	Lectures

Direct and Indirect Band Gap	26-02-2021	Lectures
Principles of LED	01-03-2021	Lectures
Principles of Photo Diodes	03-03-2021	Lectures
Module III		
Dielectric Properties of Materials		
Polarization and Susceptibility	04-03-2021	Lectures
Local Field	05-03-2021	Lectures
Dielectric Constant and Polarizability	08-03-2021	Lectures
Sources of Polarizability	10-03-2021	Lectures
Clausius-Mossoti Relations, Piezo Electricity	11-03-2021	Lectures
Magnetic Properties of Materials		
Response of Materials to Magnetic Field	12-03-2021	Lectures
Classification of Magnetic Materials	15-03-2021	Lectures
Langevin's Classical Theory of Diamagnetism and Paramagnetism	17-03-2021	Lectures
Ferro Magnetism	18-03-2021	Lectures
Weiss Theory	19-03-2021	Lectures
Domain Theory	22-03-2021	Lectures
Antiferro Magnetism and Ferimagnetism	24-03-2021	Lectures
Superconductivity		
Origin of Superconductivity	25-03-2021	Lectures
Response of Magnetic Field	26-03-2021	Lectures
Meissner Effect	29-03-2021	Lectures
Super Current and Penetration Depth	01-04-2021	Lectures
Critical Field and Critical Temperature	02-04-2021	Lectures
Type I and Type II Superconductors	05-04-2021	Lectures
Thermodynamic and Optical Properties	07-04-2021	Lectures
Isotope Effect, Josephson Effect and Tunnelling	08-04-2021	Lectures
SQUID BCS Theory	09-04-2021	Lectures
Cooper Pairs	12-04-2021	Lectures
Existence of Band Gap	14-04-2021	Lectures

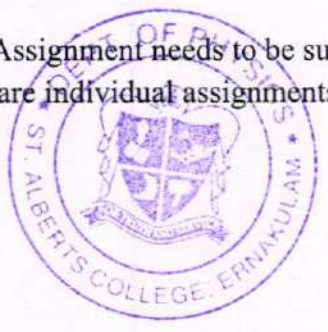
V. Innovative Learning Programmes

Name of Programme	Duration	Type	Proposed Time

VI. Assignments and Seminars

Assignments

The following Assignment needs to be submitted to Google Classroom. Both the assignments & presentation are individual assignments.



No	Topics	Activity	Submission Deadlines	
Assignment -1	Assignment on given topic	Preparation of assignment	16-12-2020	Submit Hard copy
Assignment -2	Assignment on given topic	Preparation of assignment	09-04-2021	Submit Hard copy
Seminar	Power Point Presentation on given topic	Presentation of prepared power point	26-02-2021	Submit Hard copy

Note: Failure to upload the assignment to Google Classroom *on the date mentioned will result in 0 marks for the assignment. Requests for extension of dates for submission not entertained.*

VII. Attendance (one component in class participation):

95-100%	5
90-95%	4
85-90%	3
80-85%	2
75-80%	1
<75	**Not eligible for appearing for ESE**

VIII. Required reading:

Text Book:

1. Solid State Physics by Puri and Babbar
2. Heat and Thermodynamics-Brijlal & Subrahmanyam (S.Chand))

References:

1. Solid State Physics, M. A. Wahab, (2nd Edition), Narosa
2. Introduction to Solid State Physics, Charles Kittel, (7th Edition), Wiley
3. Crystallography applied to solid state physics, AR Verma, ON Srivastava, New age
4. Solid State Physics, AJ Dekker-Macmillian
5. Solid state Physics, NW Ashcroft, ND Mermin- Cengage Learning
6. Elementary Solid-State Physics, M Ali Omer, Pearson
7. Solid State Physics, R L Singal, KNRN & Co.
8. Solid State Physics, S O Pillai, New Age

DEPT. OF PHYSICS * ST. ALBERT'S COLLEGE ERNAKULAM *

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St. Albert's College (Autonomous)

PHY6CRT0219: RELATIVITY ND SPECTROSCOPY

I. Course Instructor

Name	Programme	Batch	Semester	Email
Augustine Sumesh C J. (Module 1 and 4) Dr. Sajeesh T H (Module 2 and 3)	B.Sc. Physics	~~2019-22~~ 2020-21	VI	sumeshcj@alberts.edu.in sajeeshth@alberts.edu.in

II. Duration of Course:

No	Activity	Duration
1	Contact hours	72 (Including assignments)
2	Assessment (CAE)	7
	Total	79
	Remedial Sessions/Peer Tutoring/Tutorials (need based & Optional)	5

III. Course Objectives:

- Understand Special Theory of Relativity
- Analyze Lorentz transformnation equations
- Apply relativistic variations in mass, length and time
- Describe various atom models
- Explain Zeeman effect
- Familiarize the various regions of electromagnetic spectra and the spectroscopic technique outlaying in each region.
- Classify molecule based on the principle moment of inertia.

IV. Course Delivery Plan

Topics	Session No & Date(s)	Methodology and Duration
MODULE I - Special Theory of Relativity	17-11-21	
Inertial and non inertial frames of reference	18-11-21	
Galilean transformation	24-11-21	

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Significance of Michelson-Morley experiment	25-11-21	
Postulates of Special Theory of Relativity	1-12-21	
Lorentz transformation.	2-12-2022	
Derivation of Lorentz transformation	8-12-22	
Spatial contraction	9-12-22	
Spatial contraction -problems	15-12-22	
Time dilation	16-12-22	
Time dilation - problems	22-12-22	
composition of velocities	23-12-22	
Velocity addition -problems	5-1-22	
mass of moving particle	6-1-22	
Equivalence of mass and energy	12-1-22	
Mass – energy relation -applications	13-1-22	
Introductory concept of general theory of relativity	19-1-22	
composition of velocities	20-2-22	
MODULE II - Atomic Spectroscopy		
Introduction to spectroscopy	17-11-2021	
Electromagnetic spectrum	17-11-2021	
Characterisation of wave	17-11-2021	
quantum theory-review	12-1-22	
early atom models.	18-1-22	
early atom models	19-1-22	
Bohr model	25-1-22	
electron spin and magnetic moment	26-1-22	
Exclusion principle	1-2-22	
Stern-Gerlach experiment	2-2-22	
Vector atom model	8-2-22	
quantum numbers	9-2-22	
Spin orbit iteraction	15-2-22	
Total angular momentum and LS coupling	16-2-22	
fine structure of Sodium D lines	22-2-22	
Zeeman effect	22-2-22	
Anomalous Zeeman effect	22-2-22	
quantum mechanical explanation for anomalous Zeeman effect	23-2-22	
Paschen-Back effect	23-2-22	
Problems	23-2-22	
Module III - Molecular Spectrocopy		
Molecular energy levels	18-11-21 (Special Class)	
Interaction of em radiation with molecules	23-11-21	
Electronic energy	24-11-21	
rotational energy	30-11-21	

vibrational energies	1-12-21	
rotational spectra	2-12-21	
explanation in terms of rigid rotator model	7-12-21	
vibrational energy levels	8-12-21	
explanation in terms of harmonic oscillator	14-12-21	
problems	15-12-21	
Electronic energy levels of atoms	21-12-21	
Fluorescence	22-12-21	
Phosphorescence	23-12-21	
Raman effect	28-12-21	online
experimental arrangement and result	29-12-21	online
classical theory	4-1-22	
Failiure of classical theory	5-1-22	
quantum theory of Raman effect.	5-1-22	
Application of spectroscopy	11-1-22	
Problems	12-1-22	
Module III – NMR and ESR		
NMR Spectroscopy- Basic principles	23-2-22	
NMR Spectroscopy instrumentation	23-2-22	
Medical applications of NMR.	23-2-22	
ESR Spectroscopy- Basic principles	24-2-22	
ESR Spectroscopy- instrumentation	24-2-22	

V. Innovative Learning Programmes

Name of Programme	Duration	Type	Proposed Time

VI. Assignments and Seminars

Assignments

The following Assignment needs to be submitted to Google Classroom. Both the assignments & presentation are individual assignments.

No	Topics	Activity	Submission Deadlines	
Assignment -1	Problems related to entropy	Solution of numerical problems	6-12-21	Submit Hard copy

Assignment -2`	Problems-Relativity	Solution of numerical problems	17-1-22	Submit Hard copy
Seminar	Early atom model, tutorials		12-2-22	

Note: Failure to upload the assignment to Google Classroom *on the date mentioned will result in 0 marks for the assignment. Requests for extension of dates for submission not entertained.*

VII. Attendance (one component in class participation):

95-100%	5
90-95%	4
85-90%	3
80-85%	2
75-80%	1
<75	**Not eligible for appearing for ESE**

VIII. Required reading:

Text Book:

1. *Molecular structure and spectroscopy, Aruldas 2nd ed. EEE.*
2. *Modern Physics, Kenneth S Krane (2nd Edition) -Wiley.*
3. *Concepts of modern Physics, Arthur Beiser (6th Edition) - SIE*

References:

1. *Spectroscopy: Straughan and Walker –(Vol.1) John Wiley*
2. *Fundamentals of Molecular Spectroscopy: CN Banwell –(4th edition) TMH.*
3. *Introduction to Atomic Spectra, HE White, TMH*
4. *Elements of spectroscopy, Guptha, Kumar and Sharma (Pragathi Prakash)*
5. *Special Relativity- Resnick, (Wiley)*
6. *Mechanics – D.S.Mathur (S.Chand).*
7. *Mechanics by J.C. Upadhayaya (Ramprasad)*
8. *Semiconductor physics and optoelectronics- V Rajendran, J Hemaletha and M S M Gibson.*

DEPT. OF PHYSICS ST. ALBERT'S COLLEGE ERNAKULAM

Dr. LOUIE FROBEL P.G
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ERNAKULAM

Department of Physics

St. Albert's College (Autonomous)

PHY6CRT0317: NUCLEAR, PARTICLE PHYSICS AND ASTROPHYSICS

I. Course Instructor

Name	Sem, Programme& Batch	Email
Dr.Louie Frobel	Sem VI B.Sc Physics, 2020-21	louiefrobel@alberts.edu.in

II. Duration of Course:

No	Activity	Duration
1	Contact hours	51
2	Assessment (CAE & ESE)	2
	Total	53

I. Course Objectives:

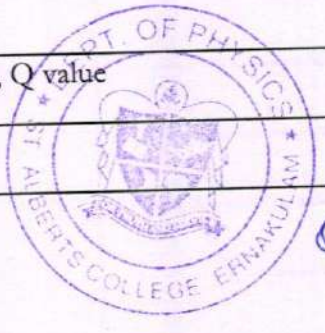
* Learn radioactivity, its applications and nuclear reactors.
* Gain knowledge on the fundamentals of elementary particle physics. The students should know about the symmetries and quantum numbers of these particles.
* Introductory knowledge about Star formation and stellar evolution, Basic ideas on the celestial objects such as Neutron stars, Black holes and Supernova explosion.
* Learn about the detectors of nuclear radiations- the Geiger-Mueller counter, the scintillation counter, the photo-multiplier tube, the solid state and semiconductor detectors

I. Course Delivery Plan

This course is designed to make students get understanding and perform numerical analysis and integration.

Topics	Session No & Date(s)	Methodology and Duration
MODULE I		
Nuclear composition, Nuclear properties: Nuclear radii	02/12/20	Lectures
Binding energy	03/12/20	Lectures
Nuclear electrons	07/12/20	Lectures

Discovery of neutron	09/12/20	Lectures
Spin and magnetic moment	10/12/20	Lectures
Stable nuclei	14/12/20	Lectures
Semi empirical binding energy formula with correction factors	16/12/20	Lectures
Shell model	17/12/20	Lectures
Nuclear forces	21/12/20	Lectures
Meson theory of nuclear forces	23/12/20	Lectures
Discovery of pion	24/12/20	Lectures
Virtual Photons	28/12/20	Lectures
Interactions between energetic particles and matter	30/12/20	Lectures
Ionization chamber	31/12/20	Lectures
Solid state detectors, Proportional counter	04/01/21	EXAM
Geiger-Muller counter, The Wilson cloud chamber	06/01/21	Lectures
Bubble chamber, Scintillation counters	07/01/21	Lectures
Van de Graaff generator, Linear accelerator	11/01/21	Lectures
Cyclotron, Betatron	13/01/21	Lectures
MODULE II		
Radio activity properties of Alpha beta gamma	18/01/21	Lectures
laws of radio activity	20/01/21	Lectures
Radio active series , hazards	21/01/21	Lectures
Radio dating,	25/01/21	Lectures
Tunnel theory of alpha decay	27/01/21	Lectures
beta decay, positorn emission, electron capture,	28/01/21	Lectures
inverse beta and gamma decay	01/02/21	Lectures
Concept of interactin crossection	03/02/21	Lectures
Nuclear reactions	04/02/21	Lectures
Center of mass coordinate, Q value	08/02/21	Lectures
Nuclerar fission	10/02/21	Lectures



Nuclear reactors	11/02/21	Lectures
nuclear fusion	15/02/21	Lectures
Reactors: confinement methods	17/02/21	Lectures
Internal Exam	18/02/21	Exam
Lattitude effect, altitude effect, azimuth effect	22/02/21	Lectures
Primary and secondary cosmic rays	24/02/21	Lectures
Cosmic ray showers, discovery of positron	25/02/21	Lectures
Mesons, Van allen belt, Origin of Crs	01/03/21	Lectures
MODULE III		
Interaction and particles	04/03/21	Lectures
Leptons,neutrins and anti nuetrinos	08/03/21	Lectures
Hadrons, Resonace particles	10/03/21	Lectures
Elementary particle QN	11/03/21	Lectures
Symmetries and conservations	15/03/21	Lectures
Basic idea of quarks	17/03/21	Lectures
Properties of quarks, Confinement	18/03/21	Lectures
Internal Exam	22/03/21	Lectures
Classification of stars	24/03/21	Lectures
HR diagram, Luminosity of star	25/03/21	Lectures
Stellar evolution	29/03/21	Lectures
white dwarf, Chadrasekhar limit	31/03/21	Lectures
Neutron star, Black holes	01/04/21	Lectures
Supernova	05/04/21	Lectures
Photon diffusion time	07/04/21	Lectures

III. Innovative Learning Programmes

Name of Programme	Duration	Type	Proposed Time
Thought Experiments	1 Days	Experiment	4th Week
Group Discussions	2 Days	Discussion	6th Week

IV. Assignments and Seminars

Assignments

The following Assignment needs to be submitted to Google Classroom. The assignments and seminars are individual assignments.

No	Topics	Activity	Submission Deadlines	
Assignment	Assignment on given topic	Preparation of assignment	As the topics are covered	Submit the assignment to Google Classroom before dead line
Seminar	Presentation of the given topic	Presentation of 20 minutes duration with proper exhibiting materials	20th , 23rd and 26th hour of Course	Present the seminar on the given topic

Note: Failure to upload the assignment to Google Classroom *on the date mentioned will result in 0 marks for the assignment. Requests for extension of dates for submission not entertained.*

V. Attendance (one component in class participation):

95-100%	5
90-95%	4
85-90%	3
80-85%	2
75-80%	1
<75	**Not eligible for appearing for ESE**

VI. Required reading:

1. Concepts of Modern Physics, Arthur Beiser, 6th Edition, Tata McGraw-Hill publishing company
2. Modern Physics, R Murugeshan and K. Sivaprasath, 15th Edition (Revised) (2010), S.Chand
3. Atomic and Nuclear Physics, S N Ghoshal, S.Chand.
4. Nuclear and Particle Physics S L Kakani and Subhra Kakani -Viva Books 2008
5. Elements of Nuclear Physics, M L Pandya and R P S Yadav, Kedar Nath RamNath
6. Modern Physics, Kennth Krane, 2nd Edition, Wiley India (Pvt) Ltd.
7. Modern Physics , G. Aruldhas and P. Rajagopal, Prentice-Hall India
8. An Introduction to Astrophysics, Baidyanath Basu, 2nd Edition, Prentice-Hall India

DEPT. OF PHYSICS ST. ALBERTS COLLEGE ERNAKULAM

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ERNAKULAM

St. Albert's College (Autonomous)

PPH1CRT0220: CLASSICAL MECHANICS

I. Course Instructor

Name	Programme	Batch	Semester	Email
Dr. Sajeesh T H (Module 1, 2 and 3) Dr. Paxy(Module 4)	M.Sc. Physics	2020-21	I	sajeeshth@alberts.edu.in paxygeorge@alberts.edu.in

II. Duration of Course:

No	Activity	Duration
1	Contact hours	72 (Including assignments)
2	Assessment (CAE)	7
	Total	79
	Remedial Sessions/Peer Tutoring/Tutorials (need based & Optional)	5

III. Course Objectives:

(i) understand the fundamental concepts of the Lagrangian and the Hamiltonian methods and will be able to apply them to various problems;

(ii) understand the physics of small oscillations and the concepts of canonical transformations and Poisson brackets ;

(iii) understand the basic ideas of central forces and rigid body dynamics;

(iv) understand the Hamilton-Jacobi method and the concept of action-angle variables. This course aims to give a brief introduction to the Lagrangian formulation of relativistic mechanics.

IV. Course Delivery Plan

Topics	Session No & Date(s)	Methodology and Duration
MODULE I - Lagrangian formulation (14 hrs)		
Introduction to the course	25-10-2021	Video Lecture
Review of Newtonian Mechanics: Mechanics of a Particle; Mechanics of a System of Particles	27-10-2021	Lecture
Degree of freedom , Constraints	28-10-2021	Video Lecture
Principle of virtual work ; D' Alembert's principle	29-10-2021	Lecture

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and Lagrange's equations-derivation	1-11-2021	Lecture+ Recorded Video
velocity-Dependent potentials and the Dissipation Function	3-11-2021	Lecture
Lagrangian for a charged particle in electromagnetic field	8-11-2021	Lecture+Tutorial
Application of Lagrange's equation to: motion of a single particle in Cartesian coordinate system and plane polar coordinate system; bead sliding on a rotating wire.	10-11-2021	Lecture+Tutorial
Hamilton's Principle; Technique of Calculus of variations	11-11-2021	Lecture
The Brachistochrone problem	13-11-2021	Lecture+Tutorial
Derivation of Lagrange's equations from Hamilton's Principle.	15-11-2021	Lecture
Canonical momentum; cyclic coordinates	17-11-2021	Lecture+Tutorial
Conservation laws and Symmetry properties-homogeneity of space and conservation of linear momentum	18-11-2021	Lecture+Tutorial
isotropy of space and conservation of angular momentum; homogeneity of time and conservation of energy;	22-11-2021	Lecture+Tutorial
Noether's theorem(statement only; no proof is expected)	23-11-2021	Flipped Class / Assignment
MODULE I - Hamiltonian formulation: (4hrs)		
Legendre Transformations	18-11-21	Lecture
Hamilton's canonical equations of motion	22-11-21	Lecture
Hamiltonian for a charged particle in electromagnetic field	25-11-21	Lecture
Cyclic coordinates and conservation theorems	29-11-21	Lecture
Hamilton's equations of motion from modified Hamilton's principle	2-12-21	Lecture
MODULE II - Small oscillations (8hrs)	3-12-2021	
Stable equilibrium unstable equilibrium and neutral equilibrium	5-12-2021	Lecture
motion of a system near stable equilibrium-Lagrangian of the system and equations of motion	6-12-21	Lecture
Small oscillations- frequencies of free vibrations	9-12-21	Lecture
normal coordinates and normal modes	13-12-21	Lecture
system of two coupled pendula-resonant frequencies normal modes and normal coordinates	16-12-21	Lecture+Tutorial
free vibrations of CO_2 molecule	27-12-21	Lecture+Tutorial
resonant frequencies normal modes and normal coordinates- CO2	30-12-21	Lecture+Tutorial
Module II -Canonical transformations and poisson brackets (10 hrs)		
Equations of canonical transformations	03-11-21	Lecture

Four basic types of generating functions and the corresponding basic canonical transformations. (F1 and F2)	10-11-21	Lecture
F3 and F4 -functions and the corresponding basic canonicaltransformations	17-11-21	Lecture
Examples of canonical transformations	01-12-21	Tutorial
identity transformation	08-12-21	Lecture
point transformation	15-12-21	Lecture
Module III - Central force problem (9hours)		
Reduction to the equivalent one body problem	22-11-2021	Lecture
Equations of motion and first integrals	23-11-2021	Lecture
Equivalent one-dimensional problem and classification of orbits	25-11-2021	Lecture
Differential equation for the orbits	26-11-2021	Lecture
Keplerproblem.	29-11-2021	Lecture
Rigid body motion	1-12-2021	Lecture
Angular momentum	2-12-2021	Lecture
kinetic energy	3-12-2021	Lecture
Euler's angles	6-12-2021	Lecture
infinitesimal rotations	8-12-2021	Lecture
rate of change of a vector	10-12-2021	Lecture
Coriolis force	13-12-2021	Lecture
Euler's equations of motion of a symmetric top	15-12-2021	Lecture
heavy symmetric top with one point fixed	16-12-2021	Lecture
Module IV -Hamilton-Jacobi theory and action - angle variables (12 hrs)		
Hamilton-Jacobi Equation for Hamilton's Principal Function	22-12-2021	Lecture
physical significance of the principal function.	05-01-2022	Lecture
Harmonic oscillator problem using the Hamilton-Jacobi method.	12-01-2022	Lecture
Hamilton-Jacobi Equation for Hamilton's characteristic function	19-02-2022	Lecture
Separation of variables in the Hamilton-Jacobi Equation, Separability of a cyclic coordinate in Hamilton-Jacobi equation	02-02-2022	Lecture
		Lecture
Hamilton-Jacobi equation for a particle moving in a central force field(plane polar coordinates).	09-02-2022	Lecture
Action-Angle variables, harmonic oscillator problem in action-angle variables.	16-02-2022	Lecture
Module IV –Classical mechanics of relativity (6 hrs.)		
Lorentz transformation in matrix form	20-12-2021	Lecture
velocity addition,Thomas preecession.	22-12-2021	Lecture
Lagrangian formulation of relativistic mechanics	23-12-2021	Lecture

Application of relativistic Lagrangian to (i)motion under a constant force (ii) harmonic oscillator	3-1-2022	Tutorial
Application of relativistic Lagrangian to (iii) charged particle under constant magnetic field	4-1-2022	Tutorial

V. Innovative Learning Programmes

Name of Programme	Duration	Type	Proposed Time
Student Centred micro teaching	4hrs	seminar	10-1-22
Group Discussion	3 hrs	Brain storming	17-1-22
Blended Class	3 hrs	Class + prepared video	25-10-2021, 28-10-2021, 1-11-2021

VI. Assignments and Seminars

Assignments

Newtonian Mechanics

The following Assignment needs to be submitted to Google Classroom. Both the assignments & presentation are individual assignments.

No	Topics	Activity	Submission Deadlines	
Assignment -1	Problems related to Lagrangian mechanics	Solution of numerical problems	6-12-21	Submit Hard copy
Assignment -2`	Problems-Hamiltonian mechanics	Solution of numerical problems	17-1-22	Submit Hard copy
Seminar				

Note: Failure to upload the assignment to Google Classroom *on the date mentioned will result in 0 marks for the assignment. Requests for extension of dates for submission not entertained.*

VII. Attendance (one component in class participation):

<75	**Not eligible for appearing for ESE**

VIII. Required reading:

Text Book:

DEPT. OF PHYSICS ST. ALBERT'S COLLEGE ERNAKULAM

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ERNAKULAM

1. *Classical Mechanics: Herbert Goldstein , Charles Poole and John Safko, (3/e); Pearson Education.*
2. *Classical Mechanics: G. Aruldhas, Prentice Hall 2009.*

References:

1. *Theory and Problems of Theoretical Mechanics (Schaum Outline Series): Murray R. Spiegel, Tata McGraw-Hill 2006.*
2. *Classical Mechanics : An Undergraduate Text: Douglas Gregory, Cambridge University Press.*
3. *Classical Mechanics: Tom Kibble and Frank Berkshire, Imperial College Press.*
4. *Classical Mechanics (Course of Theoretical Physics Volume 1): L.D. Landau and E.M. Lifshitz, Pergamon Press.*
5. *Analytical Mechanics: Louis Hand and Janet Finch, Cambridge University Press.*
6. *Classical Mechanics: N.C.Rana and P. S. Joag, Tata Mc Graw Hill.*
7. *Classical Mechanics: J.C. Upadhyaya, Himalaya Publications, 2010.*
8. *www.nptelvideos.in/2012/11/classicalphysics.html.*

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St. Albert's College (Autonomous)

PPH1CRT0319: ELECTRODYNAMICS

I. Course Instructor

Name	Programme	Batch	Semester	Email
Augustine Sumesh C. J.	M.Sc. Physics	2020-21	I	sumeshcj@alberts.edu.in

II. Duration of Course:

No	Activity	Duration
1	Contact hours	72 (Including assignments)
2	Assessment (CAE)	3
	Total	75
	Remedial Sessions/Peer Tutoring/Tutorials (need based & Optional)	5

III. Course Objectives:

- Explain the basic theories of electrostatics and magneto-statics and solve the problems related to these numerically.
- Discuss propagation of electromagnetic waves through different medium and categorize the conservation laws. Categorize the factors affecting the surface tension
- Investigate the power radiated from different radiating systems.Classify different thermodynamic systems
- Analyze the applications of electromagnetic radiation and wave guidesCourse Delivery Plan

Topics	Session No & Date(s)	Methodology and Duration
MODULE I		
Introduction	08-07-20	Lecture
Vector algebra	15-07-20	Lecture
Differential calculus	22-07-20	Lecture
Gradient Diveregence and Curl	29-07-20	Lecture
Electrostatics: Electric field of a polarized object	05-08-20	Lecture
Electric field in a conductor, dielectric ,Electric displacement -Gauss's law in dielectric medium	12-08-20	Lecture

linear dielectric medium-. Boundary condition different interface.		
Uniqueness theorem and electrostatic potential-Solving Poisson's and Laplace equations for boundary value problems	19-08-20	Lecture
Solving Poisson's and Laplace equations for boundary value problems-II	02-09-20	Lecture
Method of images- point charge -line charge above a grounded conducting plane	09-09-20	Lecture
Potential at large distance-multipole expansion due to a localized charge distribution-Electric field of a dipole.	16-09-20	Lecture
Magnetostatics: Biot-Savart law-divergence and curl of B- Ampere's law.	23-09-20	Lecture
Magnetic vector potential-multipole expansion of vector potential-boundary conditions	30-09-20	Lecture
Magnetic field inside matter-Magnetization (M)-Magnetic flux density (B)-Auxiliary field (H).	07-10-20	Lecture
Electrodynamics: Electromotive force - motional emf - Faraday's law-, electrodynamic equations - displacement current.	14-10-20	Lecture
Uniform sinusoidal time varying fields E and B and Maxwell's equations in free space and matter. Boundary conditions of electric and magnetic field	21-10-20	Lecture
Conservation laws- continuity equation-Poynting's theorem	28-10-20	Lecture
Maxwell's stress tensor- momentum conservation.	04-11-20	Lecture
MODULE II		
Wave equation for E and B	07-07-20	Lecture
Monochromatic plane waves	09-07-20	Lecture
Plane wave- problems	10-07-20	Lecture
Energy, momentum	14-07-20	Lecture
Propagation of em waves through linear media	16-07-20	Lecture
Plane wave	17-07-20	Lecture
Normal incidence	21-07-20	Lecture
Oblique incidence	23-07-20	Lecture
Electromagnetic waves in a conducting medium	24-07-20	Lecture
Class test	28-07-20	Lecture

Reflection at conducting surface	30-07-20	Lecture
Frequency dependence of permittivity	31-07-20	Lecture
Dispersion of electromagnetic waves in non-conductors	04-08-20	Lecture
conductors and plasma medium	06-08-20	Lecture
MODULE III		
Potential formulation of electrodynamics	07-08-20	Lecture
Gauge transformations-Coulomb and Lorentz gauge	11-08-20	Lecture
Continuous charge distribution	13-08-20	Lecture
Retarded potential-Jefmenko's equation	14-08-20	Lecture
Point charges- Lienard Wiechert potentials	18-08-20	Lecture
Field of a point charge in motion- Power radiated by a point charge	20-08-20	Lecture
Electric and magnetic dipole radiation	21-08-20	Lecture
Radiation from arbitrary distribution of charges	25-08-20	Lecture
Radiation reaction	27-08-20	Lecture
Abraham-Lorentz formula	28-08-20	Lecture
MODULE IV		
Relativistic electrodynamics	01-09-20	Lecture
Structure of space time- Four vectors-Proper time and proper velocity-	03-09-20	Lecture
Relativistic energy and momentum-Relativistic dynamics-Minkowski force.	04-09-20	Lecture
Lorentz transformation of em field	08-09-20	Lecture
field tensor-electrodynamics in tensor notation	10-09-20	Lecture
Potential formulation of relativistic electrodynamics	11-09-20	Lecture
Magnetism as a relativistic phenomenon	15-09-20	Lecture
Waveguides	17-09-20	Lecture
Waves between parallel planes-TE-TM-TEM waves	18-09-20	Lecture
Rectangular waveguide	22-09-20	Lecture
TE-TM waves -impossibility of TEM wave	24-09-20	Lecture
Cylindrical waveguide- TE-TM waves	25-09-20	Lecture

IV. Innovative Learning Programmes

Name of Programme	Duration	Type	Proposed Time

V. Assignments and Seminars

Assignments

The following Assignment needs to be submitted to Google Classroom. Both the assignments & presentation are individual assignments.

No	Topics	Activity	Submission Deadlines	
Assignment -1	Problems related to em waves	Solution of numerical problems	11-08-19	Submit Hard copy
Assignment -2`	Problems-wave giudes	Solution of numerical problems	06-10-20	Submit Hard copy
Seminar				

Note: Failure to upload the assignment to Google Classroom *on the date mentioned will result in 0 marks for the assignment. Requests for extension of dates for submission not entertained.*

VI. Attendance (one component in class participation):

95-100%	5
90-95%	4
85-90%	3
80-85%	2
75-80%	1
<75	**Not eligible for appearing for ESE**

VII. Required reading:

Text Book:

1. Introduction to Electrodynamics, David J. Griffiths, PHI.
2. Electromagnetics, John D.Kraus, McGraw-Hill International
3. Classical electrodynamics, J.D Jackson, John Wiley & Sons Inc

References:

1. Electromagnetic waves and radiating systems Edward C Jordan, Keith G Balamin, Printice Hall India Pvt.Ltd
2. Elements of Electromagnetic, Mathew N. O Sadiku, Oxford University Press
3. Antenna and wave propagation, K.D Prasad, Satyaprakashan, New Delhi
4. Electromagnetism problems with solutions, Ashutosh Pramanik, PHI

DEPT. OF PHYSICS ST. ALBERT'S COLLEGE ERNAKULAM

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Department of Physics

St. Albert's College (Autonomous)

PPH1CRT0419 ELECTRONICS

I. Course Instructor

Name	Sem, Programme& Batch	Email
Dr. Sajeesh T. H.	Sem I M.Sc Physics, 2020-21	sajeeshth@alberts.edu.in

II. Duration of Course:

No	Activity	Duration
1	Contact hours	59
2	Assessment (CAE & ESE)	4
	Total	63

I. Course Objectives:

* Apply the knowledge of op amp circuits to construct and analyze various practical op amp circuits.
* Study the application of Op Amp as a current to voltage converter and inverter
* Discuss the frequency response of compensated and non-compensated op-amps and working of oscillators, comparators, converters, voltage regulators, superheterodyne AM and FM radio receivers, generators.
* Describe the working of an instrumentation amplifier and its applications.
* Distinguish various active filters, integrator and differentiator.

I. Course Delivery Plan

This course is designed to make students get understanding and perform numerical analysis and integration.

Topics	Session No & Date(s)	Methodology and Duration
MODULE I		
Inverting amplifier	16/11/20	Lectures
Non Inverting amplifier	17/11/20	Lectures
Voltage series feedback	19/11/20	Lectures
closed loop voltage gain	20/11/20	Lectures
Difference input voltage	21/11/20	Lectures
Input and output resistance with feedback	23/11/20	Lectures

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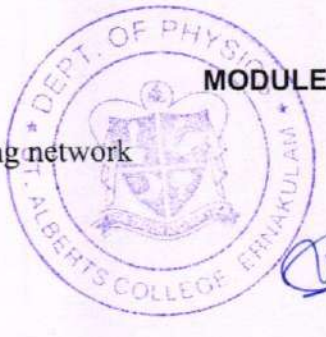
Bandwidth with feedback	24/11/20	Lectures
Total output offsetvoltagewithfeedback	26/11/20	Lectures
Voltagefollower	27/11/20	Lectures
Closed loop voltage gain : inverting input terminal and virtual ground	28/11/20	Lectures
Input and output resistance with feedback	30/11/20	Lectures
Bandwidth with feedback	01/12/20	Lectures
Total output offset voltage with feedback.	03/12/20	Lectures
Current to voltage converter	04/12/20	Lectures
Differential amplifier with one OP-AMP and 2 OP-AMP	05/12/20	Lectures
Tutorial	07/12/20	TUTORIAL
MODULE II		
Input offset voltage	08/12/20	Lectures
input bias voltage, input offset current	10/12/20	Lectures
Total outut offset voltage	11/12/20	Lectures
Effect of variation in power supply	12/12/20	Lectures
Changes in input offset voltage and current with time	14/12/20	Lectures
Noise and CMRR	15/12/20	Lectures
DC and AC amplifier	17/12/20	Lectures
AC with supply voltage	18/12/20	Lectures
Peaking summing averaging	19/12/20	Lectures
Instrumentation amp	21/12/20	Lectures
Low voltage DC AC voltmeter	22/12/20	Lectures
Voltage to current converter, current to voltage	23/12/20	Lectures
Very high input impedence	24/12/20	Lectures
integrator, differentiator	26/12/20	Lectures
Internal EXAM	28/12/20	EXAM
MODULE III		
Frequency response, copensating network	29/12/20	Lectures



frequency response, internaly compensated and non compensated	31/12/20	Lectures
High freq. Op-amp	01/01/21	Lectures
Open loop gain as function of freq	02/01/21	Lectures
circuit stability , slew rate	04/01/21	Lectures
First order BW filter	05/01/21	Lectures
Second order BW filter	07/01/21	Lectures
First order and second order high pass BW filter	08/01/21	Lectures
wide and narrow band filter	09/01/21	Lectures
rejector filter	11/01/21	Lectures
All pass filter, Oscillators	12/01/21	Lectures
Phase shift oscillator	14/01/21	Lectures
Wein bridge oscillator	15/01/21	Lectures
square wave, triangular, sawtooth wave, generator,	16/01/21	Lectures
Voltage controller	18/01/21	Lectures
Tutorial	19/01/21	TUTORIAL
MODULE IV		
Basic comparator- Zero crossing detector-	21/01/21	Lectures
Schmitt Trigger – Comparator characteristics-	22/01/21	Lectures
Limitations of op-amp as comparators-	23/01/21	Lectures
Voltage to frequency and frequency to voltage converters	25/01/21	Lectures
D/A and A/D converters	26/01/21	Lectures
Peak detector Sample and Hold	28/01/21	Lectures
IC555 Internal architecture	29/01/21	Lectures
Applications IC565-PLL,	30/01/21	Lectures
Voltage regulator Ics 78XX and 79XX	01/02/21	Lectures
Review of analog modulation	02/02/21	Lectures
Radio receivers – AM receivers	04/02/21	Lectures
superhetrodyne receiver	05/02/21	Lectures

detection and automatic gain control	06/02/21	Lectures
Communication receiver – FM receiver	08/02/21	Lectures
Ratio detector – stereo FM reception.	09/02/21	Lectures
Internal EXAM	11/02/21	EXAM

III. Innovative Learning Programmes

Name of Programme	Duration	Type	Proposed Time
Circuit designing and evaluation	1 Days	Design	4th Week

IV. Assignments and Seminars

Assignments

The following Assignment needs to be submitted to Google Classroom. The assignments and seminars are individual assignments.

No	Topics	Activity	Submission Deadlines	
Assignment	Assignment on given topic	Preparation of assignment	As the topics are covered	Submit the assignment to Google Classroom before dead line
Seminar	Presentation of the given topic	Presentation of 20 minutes duration with proper exhibiting materials	20th , 23rd and 26th hour of Course	Present the seminar on the given topic

Note: Failure to upload the assignment to Google Classroom *on the date mentioned will result in 0 marks for the assignment. Requests for extension of dates for submission not entertained.*

V. Attendance (one component in class participation):

95-100%	5
90-95%	4
85-90%	3
80-85%	2
75-80%	1
<75	**Not eligible for appearing for ESE**

VI. Required reading:

1. Op-amps and linear integrated circuits R.A. Gayakwad 4thEdn.PHI
2. Fundamentals of Electronic Devices and Circuits 5th Ed. David A. Bell, Cambridge.
3. Electronic Devices (Electron Flow Version), 9/E Thomas L. Floyd, Pearson
4. Electronic Communications Dennis Roddy and John Coolen, 4th Ed. Pearson.

5. Modern digital and analog communication systems, B.P. Lathi & Zhi Ding 4th Ed., Oxford University Press.

6. Linear Integrated Circuits and Op Amps, S Bali, TMH

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ERNAKULAM

Department of Physics

St. Albert's College (Autonomous)

PPH2CRT0119: MATHEMATICAL METHODS IN PHYSICS – II

I. Course Instructor

Name	Sem, Programme& Batch	Email
Dr. LouieFrobel	Sem II M.Sc Physics, 2020-21	Louiefrobel@alberts.edu.in

II. Duration of Course:

No	Activity	Duration
1	Contact hours	61
2	Assessment (CAE & ESE)	4
	Total	65

I. Course Objectives:

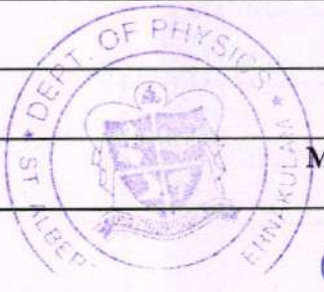
* Learn the basic elements of complex analysis, including the integral theorems
* Introduce the concepts of Laplace and Fourier transforms
* Introduce the Fourier series and it's application to solutions of partial differential equations.
* Discuss special functions and differential equations as the basis for further application in theoretical physics.

I. Course Delivery Plan

This course is designed to make students get understanding and perform mathematical methods for getting solutions of physic problems.

Topics	Session No & Date(s)	Methodology and Duration
Module I		
Functions of a complex variable	01/03/21	Lectures
Analytic functions	18/11/20	Lectures
Cauchy-Riemann equation	03/03/21	Lectures
Integration in a complex plane	04/03/21	Lectures
Cauchy Theorem	05/03/21	Lectures

Cauchy's integral formulas	06/03/21	Lectures
Cauchy's integral formulas continues.	25/11/20	Lectures
Taylor expansion	08/03/21	Lectures
Laurent expansion	10/03/21	Lectures
Residue	12/03/21	Lectures
Poles	02/12/20	Lectures
Cauchy residue theorem	13/03/21	Lectures
Cauchy's principle value theorem	15/03/21	Lectures
Evaluation of integrals	17/03/21	Online
Tutorials and discussions	09/12/20	DISCUSSIONS
18/03/21		
Fourier Series	19/03/21	Lectures
Application of Fourier series	20/03/21	Lectures
Square Wave	22/03/21	Lectures
Full wave rectifier	16/12/20	Lectures
Fourier Integral	24/03/21	Lectures
Fourier Transform	25/03/21	Lectures
Finite Wave Train	26/03/21	Lectures
Convolution Theorem of parseval's relation	27/03/21	Lectures
Momentum representation	23/12/20	Lectures
Hydrogen atom	29/03/21	Online
Harmonicoscillator	31/03/21	Lectures
Laplace Transform	30/12/20	Lectures
Inverse Laplace Transform	05/04/21	Lectures
Earth Mutation	06/01/21	Lectures
Damped Oscillator	07/04/21	Lectures
LCR circuit	08/04/21	Lectures
Tutorials and discussions	09/04/21	DISCUSSIONS
Module III		



Gamma Function	10/04/21	Lectures
Beta Function	13/01/21	Lectures
Symmetry Property of Functions	12/04/21	Lectures
Evaluation of Beta functions	15/04/21	Lectures
Other forms of Beta Functions	16/04/21	Lectures
Transformation of P functions	20/01/21	Lectures
Evaluation of Gamma Functions	17/04/21	Lectures
Other forms of Gamma Functions	19/04/21	Lectures
Transformation of Gamma Functions	27/01/21	Lectures
Relation between Beta and Gamma functions	22/04/21	Lectures
Evaluation of Integrals	23/04/21	Lectures
Bessel's Differential Equation,	24/04/21	Lectures
Legendre Differential Equation	26/04/21	Lectures
Associated Legendre Differential Equations	03/02/21	Lectures
Hermite Differential Equations	28/04/21	Lectures
Laguerre Differential Equations	29/04/21	Lectures
INTERNAL EXAM	30/04/21	EXAM
Module IV		
Characteristics of boundary conditions for partial differential equation	10/02/21	Lectures
Solution of PDF by method of separation of variables in Cartesian	03/05/21	Lectures
Solution of PDF by method of separation of variables in Cylindrical	05/05/21	Lectures
Solution of PDF by method of separation of variables in spherical polar	06/05/21	Lectures
Solution of Laplace eqn in cartesian	17/02/21	Lectures
Solution of Laplace eqn in cylindrical	07/05/21	Lectures
Solution of Laplace eqn in sperical polar	08/05/21	Lectures
Heat equation in Cartesian co-ordinates	10/05/21	Lectures

Non-Homogeneous equation	24/02/21	Lectures
Green's function	15/05/21	Lectures
Symmetry of Green's Function	17/05/21	Lectures
Green's Function for Poisson Equation	19/05/21	Lectures
Green's Function for Laplace Equation	20/05/21	Lectures
Green's Function for Helmholtz Equation	21/05/21	Lectures
Application of Greens equation in scattering problem	22/05/21	Lectures
Internal Exam	24/05/21	EXAM

III. Innovative Learning Programmes

Name of Programme	Duration	Type	Proposed Time
Tutorials	1 Days	Experiment	4th Week
Group Discussions	2 Days	Discussion	6th Week

IV. Assignments and Seminars

Assignments

The following Assignment needs to be submitted to Google Classroom. The assignments and seminars are individual assignments.

No	Topics	Activity	Submission Deadlines	
Assignment	Assignment on given topic	Preparation of assignment	As the topics are covered	Submit the assignment to Google Classroom before dead line
Seminar	Presentation of the given topic	Presentation of 20 minutes duration with proper exhibiting materials	20th , 23rd and 26th hour of Course	Present the seminar on the given topic

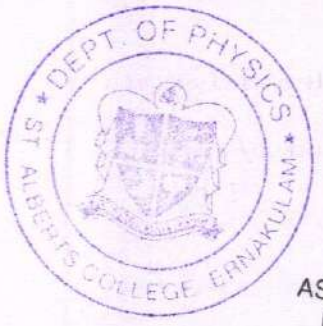
Note: Failure to upload the assignment to Google Classroom *on the date mentioned will result in 0 marks for the assignment. Requests for extension of dates for submission not entertained.*

V. Attendance (one component in class participation):

95-100%	5
90-95%	4
85-90%	3
80-85%	2
75-80%	1
<75	**Not eligible for appearing for ESE**

VI. Required reading:

1. Mathematical methods for Physicists, G.B. Arfken& H.J. Weber 5th edition, Academic Press.
2. Mathematical Physics , V.Balakrishnan,Ane Books Pvt Limited
3. Advanced Engineering Mathematics E.Kreyszig 7thedition John Wiley
4. Mathematical Physics, B.S.Rajput,Y.Prakash 9th edition PragatiPrakashan
5. Mathematical Physics,B.D.Gupta ,Vikas Publishing House
6. Matrices and tensors in Physics,A.W.Joshi
7. Mathematical Physics , P.K.Chatopadhyay ,New Age International Publishers
8. Mathematical Physics, Sathyaprakash, Sultan Chand & Sons



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St. Albert's College (Autonomous)

PPH2CRT0419: CONDENSED MATTER PHYSICS

I. Course Instructor

Name	Programme	Batch	Semester	Email
Augustine Sumesh C. J (Module 1) (Module 2,3 and 4)	M.Sc. Physics	2020-21	II	sumeshcj@alberts.edu.in

II. Duration of Course:

No	Activity	Duration
1	Contact hours	72 (Including assignments)
2	Assessment (CAE)	3
	Total	75
	Remedial Sessions/Peer Tutoring/Tutorials (need based & Optional)	5

III. Course Objectives:

- Formulate basic models for electrons and lattice vibrations for describing the physics of crystalline materials.
- To develop an understanding of relation between band structure and the electrical/optical properties of a material.

Topics	Session No & Date(s)	Methodology and Duration
MODULE I		Lecture
Diffraction of waves by crystals-Bragg's Law	07-12-20	
Scattered wave amplitude	14-12-20	
reciprocal lattice vectors	21-12-20	
diffraction condition-Laue equations-Ewald construction	28-12-20	
Brillouin zones- reciprocal lattice to SC, BCC and FCC lattices-properties of reciprocal lattice	04-01-21	
diffraction intensity - structure factor and atomic form factor- physical significance.	11-01-21	

Crystal symmetry-symmetry elements in crystals	18-01-21	
point groups, space groups Ordered phases of matter	25-01-21	
translational and orientational order-kinds of liquid crystalline order	01-02-21	
Elements of Quasi crystals	08-02-21	
Energy levels in one dimension-quantum states and degeneracy	15-02-21	
density of states	22-02-21	
Fermi-Dirac statistics -Effect of temperature on Fermi-Dirac distribution	01-03-21	
Free electron gas in three dimensions-	08-03-21	
Heat capacity of the electron gas-relaxation time and mean free path	15-03-21	
Electrical conductivity and Ohm's law	22-03-21	
Widemann-Franz-Lorentz law - electrical resistivity of metals.	29-03-21	
MODULE II		
Nearly free electron model- Origin of energy gap-Magnitude of the Energy Gap	08-12-20	
Bloch functions, Kronig-Penney model	10-12-20	
Wave equation of election in a periodic potential-Restatement of Bloch theorem	11-12-20	
Crystal momentum of an Electron-Solution of the central equations	15-12-20	
Brillouin zone- construction of Brillouin zone in one and two dimensions	17-12-20	
extended, reduced and periodic zone scheme of Brillouin zone	18-12-20	
Effective mass of electron	22-12-20	
Distinction between conductors, semiconductors and insulators	24-12-20	
Equations of motion-Effective mass-Physical interpretation of effective mass - Effective mass in semiconductors	25-12-20	
Intrinsic carrier concentration	29-12-20	
Impurity conductivity-Thermal ionization of Donors and Acceptors	31-12-20	
Thermoelectric effects-semimetals-super lattices	01-01-21	
Bloch Oscillator-Zener tunnelling	05-01-21	

MODULE III		
Vibrations of crystals with monatomic basis –First Brillouin zone-Group Velocity	07-01-21	
Two atoms per Primitive Basis	12-01-21	
Quantization of elastic waves	14-01-21	
Phonon momentum	15-01-21	
Inelastic scattering of phonons	19-01-21	
Phonon Heat Capacity-Plank distribution	21-01-21	
Density of States in one and three dimensions	22-01-21	
Debye model for density of states-Debye T3 Law	26-01-21	
Einstein Model for Density of states	28-01-21	
Anharmonic Crystal interactions-Thermal Expansion	29-01-21	
Thermal Conductivity-thermal resistivity of phonon gas	02-02-21	
Umklapp Processes-Imperfections	04-02-21	
MODULE IV		
Quantum theory of para magnetism	05-02-21	
Hund's rules-crystal field splitting-spectroscopic splitting factor	09-02-21	
Cooling by adiabatic demagnetization – Nuclear Demagnetization	11-02-21	
Ferromagnetic order-Curie point and the exchange integral	12-02-21	
Temperature dependence of the saturation-Magnetization-Saturation Magnetization at absolute Zero	16-02-21	
Magnons- Quantization of spin waves-Thermal excitation of Manganons	18-02-21	
Neutron Magnetic Scattering-	19-02-21	
Ferromagnetic order-curie temperature and Susceptibility	23-02-21	
Antiferromagnetic order-susceptibility below Neel-Temperature	25-02-21	
Ferromagnetic domains-Anisotropic Energy-transition region between Domains-origin of domains	26-02-21	
Coercivity and Hysteresis	02-03-21	
Single Domain Particles	04-03-21	
Geomagnetism and Biomagnetism-Magnetic scope microscopy	05-03-21	
Elements of superfluidity	09-03-21	

IV. Innovative Learning Programmes

Name of Programme	Duration	Type	Proposed Time

V. Assignments and Seminars

Assignments

The following Assignment needs to be submitted to Google Classroom. Both the assignments & presentation are individual assignments.

No	Topics	Activity	Submission Deadlines	
Assignment -1	Problems related to reciprocal lattice	Solution of numerical problems	18-03-21	Submit Hard copy
Assignment -2`	Problems-crystal symmetry	Solution of numerical problems	1-4-21	Submit Hard copy
Seminar				

Note: Failure to upload the assignment to Google Classroom *on the date mentioned will result in 0 marks for the assignment. Requests for extension of dates for submission not entertained.*

VI. Attendance (one component in class participation):

95-100%	5
90-95%	4
85-90%	3
80-85%	2
75-80%	1
<75	**Not eligible for appearing for ESE**

VII. Required reading:

Text Book:

1. Introduction to Solid State Physics, Charles Kittel, Wiely, Indian reprint (2015).
2. Solid State Physics, A.J. Dekker, Macmillan & Co Ltd. (1967)
3. Introduction to Solids, L V Azaroff, McGRAW-HILL BOOK COMPANY, INC. New York (1960)

References:

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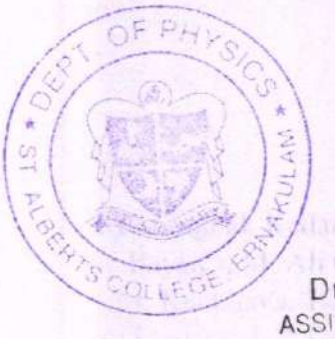
1. Solid State Physics, R.L. Singhal, KedarNath Ram Nath& Co (1981)
2. Elementary Solid State Physics, M. Ali Omar, Pearson, 4th Indian Reprint (2004).
3. Solid State Physics, C.M. Kachhava, Tata McGraw-Hill (1990).
4. Elements of Solid State Physics, J. P. Srivastava, PHI (2004)
5. Solid State Physics, Dan Wei, Cengage Learning (2008)
6. Solid State Physics, J S Blackemore, Cambridge University Press (1985)
7. 8.Electronic Properties of Crystalline Solids, Richard Bube, Academic Press New York (1974)



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St. Albert's College (Autonomous)

PPH4CRT0119 NUCLEAR AND PARTICLE PHYSICS

I. Course Instructor

Name	Sem, Programme & Batch	Email
Dr.Sumithra Sivadas Menon	SemesterII, M.Sc 2020-21	sumithrasivadas@alberts.edu.in

II. Duration of Course:

No	Activity	Duration
1	Contact hours	51(Including assignments)
2	Assessment (CAE & ESE)	7
	Total	58
	Remedial Sessions/Peer Tutoring/Tutorials (need based & Optional)	6

III. Course Objectives:

. To understand the fundamental concepts of the Dirac formalism .

. To understand how quantum systems evolve in time

- To understand the basics of the quantum theory of angular momentum
- This course enable the student to solve the hydrogen atom problem which is a prelude to more complicated problems in quantum mechanics

IV. Course Delivery Plan

This course is a course requiring lot of student centric learning processes. The teaching methods include lectures, discussions, field based assignments etc.

Topics	Session No & Date(s)	Methodology and Duration
Topics	Session No & Date(s)	Methodology and Duration
These are the topics to be covered in the modules		

UNIT-1 *Basics Formulation of Quantum Mechanics*		
1.1 Development of the idea of state vectors from sequential Stern-Gerlach experiments ;Dirac notation for state vectors: ket space, bra space and inner products;	01/12/2020 02/12/2020	Class exercises Lectures GD
1.2 Operators; Associative axiom; outer product;	03/12/2020	
1.3 Hermitian adjoint; Hermitian operator; Eigenkets and eigenvalues of Hermitian operators. Eigenkets of observables as base kets; concept of complete set. Projection operators	04/12/2020 07/12/2020	
. 1.4 Matrix representations of operators, kets and bras	08/12/2020	
1.5 Measurements in quantum mechanics; expectation value ;Compatible observables and existence of simultaneous eigenkets; General Uncertainty Relation.	10/12/2020 09/12/2020	
1.6 Unitary operator, change of basis and transformation matrix, unitary equivalent observables.	11/12/2020	
1.7Position eigenkets, infinitesimal translation operator and its properties, linear momentum as generator of translation, canonical commutation relations. Wavefunction as an expansion coefficient; eigenfunctions, momentum eigen function	14/12/2020 15/12/2020 16/12/2020	
1.8 momentum space wavefunctions and the relation between wavefunctions in position space and momentum space. Gaussian wave packet- compuatation of dispersions in position and momentum.	17/12/2020 21/12/2020 18/12/2020 22/12/2020	
UNIT – 2 *Quantum Dynamics*		
2.1 Time evolution operator and its properties.	23/12/2020 24/12/2020	
2.2 Schrodinger equation for the time evolution operator; solution of the	28/12/2020 29/12/2020	

Schrodinger equation for different time dependences of the Hamiltonian	30/12/2020	
2.3 Energy eigenkets; time dependence of expectation values	31/12/2020	
2.4 time evolution of a spin half system and spin precession	04/01/2021	
2.5 Correlation amplitude; time-energy uncertainty relation and its interpretation	05/01/2021 06/01/2021	
2.6 Schrodinger picture and Heisenberg picture; behavior of state kets and observables in Schrodinger and Heisenberg pictures; Heisenberg's equation of motion	11/01/2021 10/01/2021 07/01/2021	
2.7 Ehrenfest's theorem; time evolution of base kets; transition amplitudes. 2.8 Simple Harmonic Oscillator: Energy eigenvalues and energy eigenkets	12/01/2021 15/01/2021 14/01/2021 13/01/2021	
Unit III *Theory of Angular Momentum*		
3.1 Non-commutativity of rotations around different axes; the rotation operator; fundamental commutation relations for angular momentum operators	18/01/2021 21/01/2021 20/01/2021 19/01/2021	
3.2 rotation operators for spin half systems; spin precession in a magnetic field	22/01/2021 25/01/2021 26/01/2021 27/01/2021	
3.3 Pauli's two component formalism; 2X2 matrix representation of the rotation operator	28/01/2021 30/01/2021 29/01/2021	
3.4 ladder operators; eigenvalue problem for angular momentum operators	02/02/2021 01/02/2021 31/01/2021	
3.5 matrix representation of angular momentum operators.	03/02/2021 04/02/2021	
3.6 Orbital angular momentum ; orbital angular momentum as a generator of rotation.	05/02/2021 08/02/2021 09/02/2021	
3.7 Addition of orbital angular momentum and spin angular momentum; addition of	10/02/2021 11/02/2021	

angular momenta of two spin-1/2 particles. General theory of Angular Momentum addition-Computation of Clebsch-Gordon coefficients	12/02/2021 15/02/2021 18/02/2021 17/02/2021 16/02/2021	
Unit IV ***The Hydrogen Atom***		
4.1 Behaviour of the radial wavefunction near the origin; the Coulomb potential and the hydrogen atom; hydrogenicwavefunctions; degeneracy in hydrogen atom.	19/02/2021 22/02/2021 23/02/2021 24/02/2021 25/02/2021	

V. Innovative Learning Programmes

Name of Programme	Duration	Type	Proposed Time
Demonstration of Theoreical models	1 hour	Demonstration	4th Week
Interactive section	1 hour		1st Week

VI. Assignments and Seminars

Assignments

The following Assignment needs to be submitted to Google Classroom. Both the assignments & presentation are individual assignments.

No	Topics	Activity	Submission Deadlines	
Assignment	Assignment on given topic	Preparation of assignment	Wednesday of 8th Week of Course	Submit the assignment to Google Classroom before 11.59 pm
Seminar	PowerPoint presentation on given topic	PowerPoint Presentation for a presentation of 10 minutes duration	Wednesday of 10th Week of Course	Submit the assignment Google Classroom before 11.59 pm

Note: Failure to upload the assignment to Google Classroom *on the date mentioned will result in 0 marks for the assignment. Requests for extension of dates for submission not entertained.*

VII. Attendance (one component in class participation):

95-100%	5
90-95%	4
85-90%	3
80-85%	2
75-80%	1
<75	**Not eligible for appearing for ESE**

VIII. Required reading:

1. Modern Quantum Mechanics : J. J. Sakurai, Pearson Education.
2. A Modern Approach to Quantum Mechanics: J S Townsend, Viva Books.
1. Quantum Mechanics (Schaum's Outline) :Yoav Peleg *etal*. Tata Mc Graw Hill Private Limited, 2/e.
2. Quantum Mechanics: 500 Problems with Solutions: G Aruldhas, Prentice Hall of India.
3. Quantum Mechanics Demystified: David McMohan, McGrawHill 2006.
4. Introductory Quantum Mechanics: Richard L Liboff, Pearson Education .
5. Introduction to Quantum Mechanics: D.J. Grifith, Pearson Education.
6. Quantum Mechanics : V. K. Thankappan, New Age International.
7. Quantum Mechanics: An Introduction: Walter Greiner and Allan Bromley, Springer.
8. Quantum Mechanics : Non-Relativistic Theory(Course of Theoretical Physics Vol3): L. D. Landau and E. M. Lifshitz, Pregamon Press.
9. The Feynman Lectures on Physics Vol3, Narosa.

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St. Albert's College (Autonomous)

PPH4CRT0119 NUCLEAR AND PARTICLE PHYSICS

I. Course Instructor

Name	Sem, Programme & Batch	Email
CJ Agustine Sumesh	SemesterIV, M.Sc 2020-21	sumeshcj@albertsiedu.in

II. Duration of Course:

No	Activity	Duration
1	Contact hours	51(Including assignments)
2	Assessment (CAE & ESE)	7
	Total	58
	Remedial Sessions/Peer Tutoring/Tutorials (need based & Optional)	6

III. Course Objectives:

- To identify the various properties of nucleus, nuclear forces, and nuclear models.
- To discuss about the different nuclear decay processes, interactions, their characteristics and analyses beta decay in detail.
- Classify the elementary particles, nuclear interactions, symmetries and their conservation law
- Explain the basic ideas of Higg's boson and the LHC experiments; detection of gravitational waves and LIGO

IV. Course Delivery Plan

This course is a course requiring lot of student centric learning processes. The teaching methods include lectures, discussions, field based assignments etc.

Topics	Session No & Date(s)	Methodology and Duration
Topics	Session No & Date(s)	Methodology and Duration
These are the topics to be covered in the modules		

UNIT-1 ***Nuclear properties and forces between nucleons***		
Nuclear radius **Distribution of nuclear charge** - Isotopic shft	01/12/2020 02/12/2020	Class exercises Lectures GD
Muonic shift	03/12/2020	
Mirror nuclei	04/12/2020	
Distribution of nuclear matter	07/12/2020	
Mass and abundance of nucleids	08/12/2020	
Nuclear binding energy	09/12/2020	
Nuclear angular momentum and parity	10/12/2020	
Nuclear electromagnetic moments-quadrupole moment	11/12/2020	
The deuteron – binding energy, spin , parity	14/12/2020	
Mangnetic moment and electric quadrupole moment	15/12/2020	
Nucleon – nucleon scattering	16/12/2020	
Proton- proton interaction	17/12/2020	
Neutron – neutron interaction	18/12/2020	
Properties of nuclear forces	21/12/2020	
Exchange force model	22/12/2020	
UNIT – 2 ***Nuclear models and nuclear decay***		

Liquid drop model, Bethe – Weizacker formula	23/12/2020 24/12/2020	
Applications of semi – empirical binding energy formula	28/12/2020	GD Lectures
Shell model- shell model potential	29/12/2020	
Spin orbit potential	30/12/2020	
Magnetic dipole moments, electric quadrupole moments, valence nucleons	31/12/2020	
Collective structure – Nuclear vibrations, nuclear rotations	04/01/2021	
Beta decay – energy release in beta decay	05/01/2021	
Fermi theory of beta decay	06/01/2021	
Angular momentum and parity selection rules – allowed and forbidden transitions	07/01/2021	
Comparative half lives and forbidden decays	10/01/2021	
Non conservation of parity in beta decay	11/01/2021	
Gamma decay – angular momentum and parity selection rules	12/01/2021	
Internal conversion	13/01/2021	
Unit III *Nuclear reactions*		
Types of reactions	14/01/2021	GD, Lectures
Conservation laws	15/01/2021	
Energetic of nuclear reaction	18/01/2021	
Isospin	19/01/2021	
Reaction crosssections	20/01/2021	
Coulomb scattering	21/01/2021	
Rutherford formula	22/01/2021	
Nuclear scattering	25/01/2021	
Scattering and reaction cross sections in terms of partial wave amplitudes	26/01/2021	
Compound nucleus reactions	27/01/2021	
Direct reactions	28/01/2021	
Resonance reactions	29/01/2021	
Unit IV ***Particle Physics***		

Yukawa's hypothesis- Properties of pi mesons – electric charge, isospin, mass, spin and parity	30/01/2021 31/01/2021	GD, Lectures
Decay modes and production of pi-mesons	01/02/2021	
Types of interactions between elementary particles, hadrons and leptons	02/02/2021 03/02/2021	
Symmetries and conservation laws	03/02/2021	
CP and CPT invariance	04/02/2021	
Applications of symmetry arguments to particle reactions	05/02/2021	
Parity non – conservation in weak interactions	08/02/2021	
Quark model confined quarks, coloured quarks and gluons	09/02/2021 10/02/2021	
Experimental evidences of quark model, quark gluon interaction, quark dynamics	11/02/2021	
Grand unified theories	12/02/2021	
Standard model of particle physics	15/02/2021	
Unit V ***Nuclear Astrophysics and particle Applications of nuclear physics***		
Particle and nuclear interactions in the early universe	16/02/2021	GD, Lectures
Primordial nucleosynthesis	17/02/2021	
Stellar nucleosynthesis(for both A<60 and A>60)	18/02/2021	
Higgs boson and LHC experiments	19/02/2021	
Detection of gravitational waves and LIGO(qualitative ideas only)	22/02/2021	
Rutherford backscattering spectroscopy and applications	23/02/2021	
Computerized axial tomography(CAT)	24/02/2021	
Positron emission tomography(PET)	25/02/2021	

V. Innovative Learning Programmes

Name of Programme	Duration	Type	Proposed Time
Nuclear models	1 hour	Demonstration	4th Week
Interactive section	1 hour		1st Week

VI. Assignments and Seminars

Assignments

The following Assignment needs to be submitted to Google Classroom. Both the assignments & presentation are individual assignments.

No	Topics	Activity	Submission Deadlines	
Assignment	Assignment on given topic	Preparation of assignment	Wednesday of 8th Week of Course	Submit the assignment to Google Classroom before 11.59 pm
Seminar	PowerPoint presentation on given topic	PowerPoint Presentation for a presentation of 10 minutes duration	Wednesday of 10th Week of Course	Submit the assignment Google Classroom before 11.59 pm

Note: Failure to upload the assignment to Google Classroom *on the date mentioned will result in 0 marks for the assignment. Requests for extension of dates for submission not entertained.*

VII. Attendance (one component in class participation):

95-100%	5
90-95%	4
85-90%	3
80-85%	2
75-80%	1
<75	**Not eligible for appearing for ESE**

VIII. Required reading:

1.Introductory nuclear physics, K. S Krane John Wiley

2.Nuclear Physics, S. N. Ghoshal, S Chand & Company

3. Nuclear Physics: Problem – based Approach Including MATLAB, Hari M Agarwal, PHI Learning Private Limited, Delhi.

4. Problems and Solutions in Atomic, Nuclear and Particle Physics: Yung – Kuo Lim, World Scientific.

5. Introduction to Nuclear and Particle Physics: V. M Mittal, R. C. Verma, S. C. Gupta(Prentice Hall India).

6. Concepts of Nuclear Physics: B. L. Cohen, Tata McGrawHill.

7. Nuclear Physics: An introduction – SB Patel. New Age International.

8. Nuclear Physics: R R Roy and B P Nigam, New Age International.

9. Nuclear Physics: R Prasad, Pearson.

10. Atomic Nucleus: R D Evans, Mc GrawHill, New York.

11. Nuclear Physics: I Kaplan, Narosa, New Delhi(2/e)

12. Introduction to Elementary Particles: David Griffith, Wlley – VCH.

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St. Albert's College (Autonomous)

PPH4CRT0320: COMMUNICATION SYSTEMS

I. Course Instructor

Name	Programme	Batch	Semester	Email
Dr.Louie Frobel	M.Sc. Physics	2020-21	4	louiefrobel@alberts.edu.in

II. Duration of Course:

No	Activity	Duration
1	Contact hours	82 (Including assignments)
2	Assessment (CAE)	3
	Total	85
	Remedial Sessions/Peer Tutoring/Tutorials (need based & Optional)	5

III. Course Objectives:

- Explain the theories of digital communication
- Discuss modulation and demodulation
- Understand multiplexing techniques
- Introduce wireless communication systems
- Explain multiple access techniques
- Illustrate fundamentals of satellite communication
- Discuss theories related to fiber optic communications
- Differentiate Chromatic, intermodal and nonlinear dispersion
- Fundamentals and basic principles in radar system

IV. Course Delivery Plan

Topics	Session No & Date(s)	Methodology and Duration
MODULE I		
Digital Communication		
Pulse Communication – Introduction	01-12-2020	Lectures
Pulse Modulation	02-12-2020	Lectures
PAM-PWM-PPM-PCM	03-12-2020	Lectures
PCM-Sampling Theorem- Quantisation-Noise Generation and Demodulation	04-12-2020	Lectures
Companding-DPCM	07-12-2020	Lectures
ADPCM-Delta Modulation	08-12-2020	Lectures

Information Theory – Coding - Noise	09-12-2020	Lectures
Data Communication	10-12-2020	Lectures
Digital Codes- Error Detection and Correction	11-12-2020	Lectures
Data Sets and Interconnection Requirements	14-12-2020	Lectures
Modem Classification Interfacing	15-12-2020	Lectures
Multiplexing Techniques	16-12-2020	Lectures
Frequency Division Multiplex	17-12-2020	Lectures
Time Division Multiplex	18-12-2020	Lectures
Digital Transmission Techniques	31-12-2020	Lectures
ASK-FSK	01-01-2021	Lectures
PSK-QPSK	04-01-2021	Lectures
MODULE II		
Mobile Communication		
Introduction to Wireless Communication Systems-Mobile Radio Systems Around the World	05-01-2021	Lectures
Examples of Wireless Communication Systems: - Paging System- Cordless Telephone System- Cellular Telephone System	06-01-2021	Lectures
How a Cellular Telephone Call is Made-Comparison of Common Mobile Radio System	07-01-2021	Lectures
Trends is Cellular and Personnel Communications	10-01-2021	Lectures
Wireless Communication Systems-2G	11-01-2021	Lectures
Wireless Communication Systems-3G	12-01-2021	Lectures
Wireless Communication Systems-4G	13-01-2021	Lectures
Cellular Concept – Frequency Reuse	14-01-2021	Lectures
Channel Assignment Strategies-Handoff Strategies	15-01-2021	Lectures
Prioritising Handoffs and Practical Handoff Consideration	18-01-2021	Lectures
Interference and System Capacity	19-01-2021	Lectures
Improving Coverage and Capacity in Cellular Systems-Cell Splitting- Sectoring – Microcell Zone Concept	20-01-2021	Lectures
Basic Idea of Path Loss and Multipath Fading	21-01-2021	Lectures
Multiple Access Technique- Introduction--FDMA-TDMA-SSMA	22-01-2021	Lectures
FHMA-CDMA-Hybrid Spread Spectrum Techniques	25-01-2021	Lectures
SDMA	26-01-2021	Lectures
GSM	27-01-2021	Lectures
MODULE III		
Satellite Communication		

Satellite Communication fundamentals	28-01-2021	Lectures
Satellite orbits	29-01-2021	Lectures
Satellite positioning	01-02-2021	Lectures
Frequency allocations	02-02-2021	Lectures
Polarization	03-02-2021	Lectures
Antennas-gain-beam width	04-02-2021	Lectures
Multiple access techniques	05-02-2021	Lectures
Geostationary Satellite Communication	08-02-2021	Lectures
Satellite Parameters	09-02-2021	Lectures
VSAT(Basic Idea)	10-02-2021	Lectures
Geostationary satellite Path/Link Budget	11-02-2021	Lectures
Satellite TV Systems	12-02-2021	Lectures
Satellite TV broadcasting	15-02-2021	Lectures
GPS	16-02-2021	Lectures
MODULE IV		
Fiber Optics Communication		
Introduction, Ray theory transmission	17-02-2021	Lectures
Total internal reflection, acceptance angle	18-02-2021	Lectures
Numerical aperture, Skew rays	19-02-2021	Lectures
Electromagnetic mode theory for optical propagation	22-02-2021	Lectures
Electromagnetic waves	23-02-2021	Lectures
Modes in planar guide	24-02-2021	Lectures
Phase and group velocity	25-02-2021	Lectures
Fiber classification, cylindrical fiber	26-02-2021	Lectures
Step index, graded index	01-03-2021	Lectures
Single mode fiber, Cut off wavelength, group delay	02-03-2021	Lectures
Photonic crystal fibers, index guided micro structures	03-03-2021	Lectures
Photonic band gap fibers	04-03-2021	Lectures
Dispersion, Chromatic	05-03-2021	Lectures
Intermodal, nonlinear effects	08-03-2021	Lectures
Optical fiber connections- Fiber splices-fusion splices	09-03-2021	Lectures
Mechanical splices, Multiple splices	10-03-2021	Lectures
Fiber connectors, cylindrical ferrule connectors	11-03-2021	Lectures
Duplex and multiple fiber connectors	12-03-2021	Lectures
Fiber couplers	15-03-2021	Lectures
MODULE V		
Radar Systems		
Basic Principles, Basic radar system	16-03-2021	Lectures
Development of radar	17-03-2021	Lectures
Performance factors, radar range equation	18-03-2021	Lectures
Factors influencing maximum range	19-03-2021	Lectures
Effect of noise, target properties	22-03-2021	Lectures

Pulsed system- block diagram and description	23-03-2021	Lectures
Antennas scanning-antenna tracking -display method	24-03-2021	Lectures
Pulsed radar system	25-03-2021	Lectures
Moving target indication: -doppler effect	26-03-2021	Lectures
Fundamentals of MTI- delay line-blind speeds- radar beacons	29-03-2021	Lectures
Other radar systems- CW Doppler Radar-frequency modulated CW Radar	30-03-2021	Lectures
Phased Array Radars- Planar Array Radars	01-04-2021	Lectures

V. Innovative Learning Programmes

Name of Programme	Duration	Type	Proposed Time

VI. Assignments and Seminars

Assignments

The following Assignment needs to be submitted to Google Classroom. Both the assignments & presentation are individual assignments.

No	Topics	Activity	Submission Deadlines	
Assignment -1	Assignment on given topic	Preparation of assignment	13-01-2021	Submit Hard copy
Assignment -2`	Assignment on given topic	Preparation of assignment	29-03-2021	Submit Hard copy
Seminar	Power Point Presentation on given topic	Presentation of prepared power point	01-03-2021	Submit Hard copy

Note: Failure to upload the assignment to Google Classroom *on the date mentioned will result in 0 marks for the assignment. Requests for extension of dates for submission not entertained.*

VII. Attendance (one component in class participation):

95-100%	5
90-95%	4
85-90%	3
80-85%	2
75-80%	1
<75	**Not eligible for appearing for ESE**

VIII. Recommended Text Books:

1. Electronic Communication Systems by Kennedy/Davis, Mc Graw Hill Publication, 4th edition, (Module-1 and 5).
2. Wireless Communication Principles and Practice by Theodore S Rappaport, Person Publication, 2nd edition (Module-2).
3. Telecommunication Transmission Systems by Robert G Winch, McGrawHill Publication, 2nd edition, (Module-3)
4. Optical fiber communications – Principles and practice John M Senior, Pearson publications, 3rd edition, (Module-4).

Recommended References:

1. Optical Fiber Communications by Gerd Keiser (Module-2)
2. Satellite Communications by Dennis Roddy, Mc Graw Hill Publication, 3rd edition.
3. Introduction to RADAR Systems by Skolnik, McGraw Hills, 3rd edition
4. Satellite communication by Dr. D.C.Agarwal.
5. Electronic Communication Systems by Wayne Thomas, Pearson Publication, 5th Edition

DEPT. OF PHYSICS ST. ALBERT'S COLLEGE ERNAKULAM

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St. Albert's College (Autonomous)

PPH3CRT0119: QUANTUM MECHANICS-II

I. Course Instructor

Name	Programme	Batch	Semester	Email
Dr. Sajeesh T. H.	M.Sc. Physics	2020-21	III	sajeeshth@alberts.edu.in

II. Duration of Course:

No	Activity	Duration
1	Contact hours	72 (Including assignments)
2	Assessment (CAE)	3
	Total	75
	Remedial Sessions/Peer Tutoring/Tutorials (need based & Optional)	5

III. Course Objectives:

- Learning time dependent problems in quantum mechanics.
- Familiarise quantum field theory and to the techniques of quantum mechanics underlining the scattering problem.
- Learning the concepts of relativistic quantum mechanics.

Topics	Session No & Date(s)	Methodology and Duration
MODULE I		
Non-degenerate Perturbation Theory: First order energy shift	08-07-20	Lecture
first order correction to the energy eigenstate, second order energy shift	09-07-20	Lecture
Harmonic oscillator subjected to a constant electric field	15-07-20	Lecture
Degenerate Perturbation theory First order Stark effect in hydrogen	16-07-20	Lecture
Zeeman effect in hydrogen and the Lande g-factor	22-07-20	Lecture
The variational Method	23-07-20	Lecture
Estimation of ground state energies of harmonic oscillator and delta function potential	29-07-20	Lecture
Ground State of Helium atom; Hydrogen Molecule ion.	30-07-20	Lecture

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The WKB method and its validity	05-08-20	Lecture
The WKB wavefunction in the classical region; non-classical region	06-08-20	Lecture
connection formulas (derivation not required)	12-08-20	Lecture
Potential well and quantization condition; the harmonic oscillator	13-08-20	Lecture
Tunneling; application to alpha decay	19-08-20	Lecture
MODULE II		
Time dependent potentials; interaction picture	20-08-20	Lecture
time evolution operator in interaction picture	26-08-20	Lecture
Spin Magnetic Resonance in spin half systems	27-08-20	Lecture
Time dependent perturbation theory	02-09-20	Lecture
Dyson series; transition probability	03-09-20	Lecture
constant perturbation	09-09-20	Lecture
Fermi's Golden Rule; Harmonic perturbation	10-09-20	Lecture
interaction of atom with classical radiation field; absorption and stimulated emission	16-09-20	Lecture
electric dipole approximation; photoelectric effect	17-09-20	Lecture
Energy shift and decay width.	23-09-20	Lecture
MODULE III		
Bosons and fermions; anti-symmetric wave functions and Pauli's exclusion principle	09-07-20	Lecture
The Helium Atom	10-07-20	Lecture
The Asymptotic wave function -	16-07-20	Lecture
differential scattering cross section and scattering amplitude	17-07-20	Lecture
The Born approximation- scattering amplitude in Born approximation, validity of the Born approximation	23-07-20	Lecture
Yukawa potential	24-07-20	Lecture
Coulomb potential and the Rutherford formula	30-07-20	Lecture
Partial wave analysis- hard sphere scattering	31-07-20	Lecture
S-wave scattering for finite potential well	06-08-20	Lecture
Resonances and Ramsauer-Townsend effect	13-08-20	Lecture
MODULE IV		

DEPT. OF PHYSICS * ST. ALBERT'S COLLEGE ERNAKULAM *

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Klein-Gordon Equation; continuity equation and probability density in Klein-Gordon theory	14-08-20	Lecture
Non-relativistic limit of the Klein-Gordon equation	20-08-20	Lecture
Solutions of the Klein –Gordon equation for positive	21-08-20	Lecture
Negative and neutral spin 0 particles	27-08-20	Lecture
Klein-Gordon equation in the Schrodinger form	28-08-20	Lecture
Dirac Equation in the Schrodinger form	03-09-20	Lecture
Dirac's matrices and their properties	04-09-20	Lecture
Solutions of the free particle Dirac equation	10-09-20	Lecture
single particle interpretation of the plane waves; velocity operator; zitterbewegung	11-09-20	Lecture
Non-relativistic limit of the Dirac equation	17-09-20	Lecture
spin of Dirac particles; Total angular momentum as a constant of motion	18-09-20	Lecture
Negative energy states and Dirac's hole theory	24-09-20	Lecture

IV. Innovative Learning Programmes

Name of Programme	Duration	Type	Proposed Time

V. Assignments and Seminars

Assignments

The following Assignment needs to be submitted to Google Classroom. Both the assignments & presentation are individual assignments.

No	Topics	Activity	Submission Deadlines	
Assignment -1	Problems related to variational method	Solution of problems	14-08-20	Submit Hard copy
Assignment -2`	Problems-WKB method	Solution of problems	24-09-20	Submit Hard copy
Seminar				

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Note: Failure to upload the assignment to Google Classroom *on the date mentioned will result in 0 marks for the assignment. Requests for extension of dates for submission not entertained.*

VI. Attendance (one component in class participation):

95-100%	5
90-95%	4
85-90%	3
80-85%	2
75-80%	1
<75	Not eligible for appearing for ESE

VII. Required reading:

Text Book:

1. Modern Quantum Mechanics: J. J. Sakurai, Pearson Education
2. A modern Approach to Quantum Mechanics: John Townsend, Viva Books New Delhi
3. Introduction to Quantum Mechanics: D.J. Griffith, Pearson Education
4. Relativistic Quantum Mechanics: Walter Greiner, Springer-Verlag

References:

1. Quantum Mechanics (Schaum's Outline Series): Yoav Peleg etal., Tata McGraw Hill .Education Private Limited, 2/e
2. Quantum Mechanics: 500 Problems with Solutions: G Aruldhas, Prentice Hall of India.
3. Problems and Solutions in Quantum Mechanics: Kyriakos Tamvakis, Cambridge University Press.
4. Introductory Quantum Mechanics: Richard L. Liboff, Pearson Education.
5. Quantum Mechanics: V. K. Thankappan, New Age International.
6. A Textbook of Quantum Mechanics: P M Mathews and R Venkatesan, Tata McGraw Hill.
7. Quantum Mechanics: Non Relativistic Theory (Course of Theoretical Physics Course Vol3) : L. D. Landau and E. M. Lifshitz, Pregamon Press.
8. Relativistic Quantum Mechanics: James D Bjorken and Sidney D Drell, Tata McGraw Hill 2013

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