I (3) GA I 'F'

2010

UNIVERSITY OF CALICUT

(Abstract)

M.Sc programme in Physics under Credit Semester System in affiliated colleges-Scheme and Syllabus-approved-implemented with effect from 2010 admission onwards-orders issued.

GENERAL & ACADEMIC BRANCH-IV 'J' SECTION

No. GA IV/J2/4170/10 Dated, Calicut University PO, 26.07.2010

Read: 1. U.O.No. GAIV/J1/1373/08 dated, 23.07.2010.

2. Item Nos. 1 to 9of the minutes of the meeting of the Board of Studies in Physics (PG) held on 07.06.2010

3. Item No.III a.30 of the minutes of the meeting of the Academic Council, held on 03.07.2010

ORDER

Credit Semester System was implemented for Post Graduate programmes in affiliated colleges with effect from 2010 admission onwards, vide paper read as Ist above.

The Board of Studies in Physics (PG) vide paper read as 2nd finalized the scheme and syllabus of Ist Semester of M.Sc Physics programme under Credit Semester System.

The Vice-Chancellor, due to exigency approved the syllabus subject to ratification by the Academic Council and the Academic Council vide paper read as 3rd ratified the action of the Vice-Chancellor in having approved the minutes of the meeting of the Board of Studies in Physics(PG) of 07.06.2010.

Sanction has therefore been accorded for implementing the scheme and syllabus of PG programme in Physics under Credit Semester System for the 1st Semester in affiliated colleges with effect from 2010 admission onwards.

Orders are issued accordingly. Scheme and syllabus appended.

Sd/-
ASSISTANT REGISTRAR(GA IV)
for **REGISTRAR**

To

The Principals of affiliated Arts & Science colleges offering.
M.Sc programme in Physics.

Copy to:

PS to VC,PA/Registrar, Chairman Board of Studies, CE,EX,DR III,DR(PG),EGI,Enquiry, System Administrator, with a request to upload in University website, GA I 'F','A',GA II,III.

Forwarded/By Order

SECTION OFFICER.

Appendix to U.O - GAIV/J2/4170/10 - 26.07.10.

Ist SEMESTER

PHY1C01 : CLASSICAL MECHANICS (4 Credits)

1. Lagrangian and Hamiltonian Formulation : Constraints and Generalized coordinates, D'Alemberts principle and Lagrange's equation, Velocity dependent potentials, Simple applications, Hamilton's Principle, Lagrange's equation from Hamilton's principle, Scattering in a central force field, Transformation to lab coordinates, Legendre Transformation , Hamilton's canonical equations, Principle of least action, Canonical transformations, examples, Enough exercises **(14 hours)**
Text : Goldstein, Sections 1.3 – 1.6, 2.1 – 2.3, 3.10, 3.11, 8.1, 8.5, 8.6, 9.1, 9.2

2.The classical background of quantum mechanics : Equations of canonical transformations, Examples, Poisson brackets and other canonical invariants, Equation of motion in Poisson bracket form, Angular momentum Poisson brackets, Hamilton-Jacobi equation, Hamilton's principal and characteristic function, H-J equation for the linear harmonic oscillator, Separation of variables, Action-angle variables, H-J formulation of the Kepler problem, H-J equation and the Schroedinger equation **(15 hours)**
Text : Goldstein, Sections 9.1, 9.2, 9.4 - 9.6, 10.1 – 10.5, 10.7, 10.8

3. The Kinematics and Dynamics of Rigid Bodies : Space-fixed and body-fixed systems of coordinates, Description of rigid body motion in terms of direction cosines and Euler angles, Infinitesimal rotation, Rate of change of a vector, Centrifugal and Coriolis forces, Moment of inertia tensor, Euler's equation of motion, Forcefree motion of a rigid body. **(13 hours)**
Text : Goldstein, Sections 4.1, 4.4, 4.8 – 4.10

4. Small Oscillations : Formulation of the problem, Eigen value equation, Eigenvectors and Eigenvalues, Orthogonality, Principal axis transformation, Frequencies of free vibrations, Normal coordinates, Free vibrations of a linear tri atomic molecule **(8 hours)**
Text : Goldstein, Sections 6.1 – 6.4

5. Nonlinear Equations and Chaos : Introduction, Singular points of trajectories, Nonlinear oscillations, Limitcycles, Chaos : Logistic map, Definitions, Fixed points, Period doubling, Universality. **(12 hours)**

Text : Bhatia, Sections10.1, 10.2, 10.3, 10.4, 10.5, 10.51
Text Books : 1. Goldstein "Classical Mechanics" (Addison Wesley)
2. V.B.Bhatia : "Classical Mechanics" (Narosa Publications, 1997)
Books for reference :
1. Michael Tabor : "Chaos and Integrability in Nonlinear Dynamics" (Wiley, 1989)
2. N.C.Rana and P.S.Joag : "Classical Mechanics" (Tata McGraw Hill)
3. R.G.Takwale and P.S.Puranik : "Introduction to Classical Mechanics" (Tata McGraw Hill)
4. Atam P. Arya : "Introduction to Classical Mechanics, (2nd Edition)" (Addison Wesley 1998)
5. Laxmana : "Nonlinear Dynamics" (Springer Verlag, 2001)

PHY1C02 : MATHEMATICAL PHYSICS – I (4 Credits)

1. Vectors : Rotation of coordinates, Orthogonal curvilinear coordinates, Gradient, Divergence and Curl in orthogonal curvilinear coordinates, Rectangular, cylindrical and spherical polar coordinates, Laplacian operator, Laplace's equation – application to electrostatic field and wave equations, Vector integration **(9 hours)**
Text : Arfken & Weber , Sections 1.2, 1.6 - 1.9, 1.10, 2.1 – 2.5

2. Matrices and Tensors : Basic properties of matrices (Review only), Orthogonal matrices, Hermitian and Unitary matrices, Similarity and unitary transformations, Diagonalization of matrices, Definition of Tensors, Contraction, Direct products,, quotient rule, Pseudo tensors, Dual tensors, Levi Cevita symbol, irreducible tensors **(9 hours)**
Text : Arfken & Weber , Sections 3.2 - 3.5, 2.6 – 2.9

3. Second Order Differential Equations : Partial differential equations of Physics, Separation of variables, Singular points, Ordinary series solution, Frobenius method, A second solution, Self adjoint differential equation, eigen functions and values, Boundary conditions, Hermitian operators and their properties, Schmidt orthogonalization, Completeness of functions **(12 hours)**
Text : Arfken & Weber , Sections 8.1, 8.3 – 8.6, 9.1 – 9.4

4. Special functions : Gamma function, Beta function, Delta function, Dirac delta function, Bessel functions of the first and second kinds, Generating function, Recurrence relation, Orthogonality, Neumann function, Spherical Bessel function, Legendre polynomials, Generating function, Recurrence relation, Rodrigues' formula, Orthogonality, Associated Legendre polynomials, Spherical harmonics, Hermite polynomials, Laguerre polynomials (**20 hours)**
Text : Arfken & Weber , Sections 10.1, 10.4, 1.15, 11.1 – 11.3, 11.7, 12.1 – 12.4, 12.6, 13.1, 13.2

5. Fourier Series : General properties, Advantages, Uses of Fourier series, Properties of Fourier series, Fourier integral, Fourier transform, Properties, Inverse transform, Transform of the derivative, Convolution theorem, Laplace transform **(10 hours)**
Text : Arfken & Weber , Sections 14.1 – 14.4, 15.2 – 15.5, 15.8

Textbook :
1. G.B.Arfken and H.J.Weber : "Mathematical Methods for Physicists (5th Edition, 2001)" (Academic Press)

Reference books :
1. J.Mathews and R.Walker : "Mathematical Methods for Physics" (Benjamin)
2. L.I.Pipes and L.R.Harvill : "Applied Mathematics for Engineers and Physicists (3rd Edition)" (McGraw Hill)
3. Erwin Kreyzig : "Advanced Engineering Mathematics - 8th edition" (Wiley)
4. M. Greenberg : "Advanced Engineering Mathematics – 2nd edition " (Pearson India 2002)
5. A.W. Joshi : Matrices and tensors

PHY1C03 : ELECTRODYNAMICS AND PLASMA PHYSICS (4 Credits)

1. Time varying fields and Maxwell's equations : Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and their solutions, Time harmonic fields **(8 hours)**
Text : Cheng, Sections 7.3 – 7.7

2. Plane electromagnetic waves : Plane waves in lossless media, Plane waves in lossy media, Group velocity, Flow of electromagnetic power and the Poynting vector, Normal incidence at a plane conducting boundary, Oblique incidence at a plane conducting boundary, Normal incidence at a plane dielectric boundary, Oblique incidence at a plane dielectric boundary **(10 hours)**
Text : Cheng , Sections 8.2 – 8.10

3. Transmission lines, Wave guides and cavity resonators : Transverse electromagnetic waves along a parallel plane transmission line, General transmission line equations, Wave characteristics on finite transmission lines, General wave behaviour along uniform guiding structures, Parallel plate wave guides, Rectangular wave guides, Cavity resonators **(12 hours)**
Text : Cheng, Sections 9.2 - 9.4 , 10.2 – 10.4, 10.7

4. Relativistic electrodynamics : Magnetism as a relativistic phenomenon, Transformation of the field, Electric field of a point charge moving uniformly, Electromagnetic field tensor, Electrodynamics in tensor notation, Potential formulation of relativistic electrodynamics (**14 hours)**
7
Text : Griffiths, Sections 10.3.1 – 10.3.5

5. Plasma Physics : Plasma - Definition, concepts of plasma parameter, Debye shielding, Motion of charged particles in an electromagnetic field - Uniform electric and magnetic fields, Boltzmann and Vlasov equations, Plasma oscillations, Derivation of moment equation, Hydromagnetic waves, magnetosonic waves and Alfven waves **(16 hours)**
Text : Chen, Sections 1.1 - 1.6, 2.2 - 2.2.2, 3.1 - 3.3.2, 4.3, 4.18, 4.19

Text Books :

1. David K. Cheng : "Field and Wave Electromagnetics" (Addisson Wesley)
2. David Griffiths : "Introductory Electrodynamics" (Prentice Hall of India, 1989)
3. F. F. Chen, Introduction to Plasma Physics and Controlled Fusion, Volume I and II, Plenum Press, recent edition

Reference books :

1. K.L. Goswami, Introduction to Plasma Physics – Central Book House, Calcutta
2. J.D.Jackson : "Classical Electrodynamics" (3rd Ed.) (Wiley,1999)

PHY1C04 : ELECTRONICS (4 Credits)

1. Field Effect Transistor : Biasing of FET, Small signal model, Analysis of Common Source and Common Drain amplifier, High frequency response, FET as VVR and its applications, Digital MOSFET circuits (**8 hours**)

Text : Millman and Halkias : "Integrated Electronics" (Tata McGraw Hill 2002) Sections 10.4 - 10.11

Reference : Electronic devices and circuit theory, Robert L Boylstead & L. Nashelsky – Pearson Education (fifth Edition)

2. Microwave and Photonic Devices : Tunnel diode, Transferred electron devices , negative differential resistance and devise operation, radiative transitions and optical absorption, Light emitting diodes (LED) – visible and IR, semiconductor lasers - materials, operation (population inversion, carrier and optical confinement, optical cavity and feedback, threshold current density), Photodetectors - photoconductor (Light dependent resistor- LDR) and photodiode, p-n junction solar cells - short circuit current, fill factor and efficiency **(12 hours)**

Text : "Semiconductor Devices- Physics and Technology" - S.M.Sze , John Wiley and Sons (2002) Sections 8.2, 8.4, 9.1, 9.2, 9.3 - 9.3.3, 9.4, 9.5 – 9.5.3

3. Operational Amplifier : Basic operational amplifier characteristics, OPAMP differential amplifier, Emitter coupled differential amplifier, OPAMP parameters (Open loop gain, CMRR, Input offset current and voltage,output offset voltage, slew rate) and their measurement, Frequency response, Principle of Bode plots, Phase and gain margins, Dominant pole, pole zero and lead compensation **(10 hours)**

Text : Millman and Halkias : "Integrated Electronics" (Tata McGraw Hill 2002), Sections 15.1 – 15.4, 15.6, 15.8 – 15.13

4. OPAMP Application : OPAMP as inverter, scale changer, summer, V to I converter, Analog integration and differentiation, Electronic analog computation, Active low pass filter, High pass Butterworth filters, Band pass filter, Active resonant band pass filter, OPAMP based astable and monostable multivibrators, Schmidt trigger. **(12 hours)**

Text : Millman and Halkias : "Integrated Electronics" (Tata McGraw Hill 2002), Sections 16.5 – 16.7, 16.15, 16.16

Reference :

1. Ramakant A. Gaekwad : "OPAMPS and Linear Integrated Circuits"

2. D. Roychoudhuri : "Linear Integrated circuits" – New Age International Publishers (1997)

5. Digital Electronics : Minimization of functions using Karnaugh map, Representation using logic gates, JK and MSJK flip-flops, Synchronous and asynchronous counters, MOD 3,5,10,16 counters, Cascade counters, Static and dynamic random access memory, CMOS, Non-volatile NMOS, Magnetic memories, Charge coupled devices, Microprocessor architecture, Organization of a general microcomputer, CPU architecture of 8 bit processor such as INTEL 8085 **(20 hours)**

Text books for module 5 :

1. Malvino and Leach : "Digital Principles and Applications(3 nd Ed.)" (Tata McGraw Hill, 1978) Sections 6.5 - 6.9, 7.2 - 7.5, Chapter 8 complete, 12.1, 12.4, 12.5

2. R.P.Jain : "Modern Digital Electronics" (Tata McGraw Hill) sections 11.9, 11.91 - 11.93 (For charge coupled devices)

3. B.Ram : "Fundamentals of Microprocessors and Microcomputers (Dhanapathi Rai & Sons) Sections 1.5 to 1.7, 3.1 - 3.1.6

General references :

1. M.S.Tyagi ; "Introduction to Semiconductor Devices" (Wiley)
2. Millman and Halkias : "Integrated Electronics"
3. Gupta and Kumar : "Handbook of Electronics"

PHY1P01 : GENERAL PHYSICS PRACTICAL – I (2 Credits)

Note : 1. At least 8 experiments should be done . All the experiments should involve error analysis. Practical observation book to be submitted to the examiners at the time of external examination. One mark is to be deducted from internal marks for each experiment not done by the student if a total of 8 experiments are not done in each semester.

2. The PHOENIX Experimental Kit developed at the Inter University Accelerator Centre, New Delhi, may be used for the experiments wherever possible.

(At least 8 experiments should be done)

1. Y and σ - Interference method (a) elliptical (b) hyperbolic fringes. To determine Y and σ of the material of the given specimen by observing the elliptical and hyperbolic fringes formed in an interference set up
2. Y and σ by Koenig's method
3. Viscosity of a liquid - Oscillating disc method. To determine the viscosity of the given liquid by measurements on the time period of oscillation of the disc in air and in the liquid
4. Variation of surface tension with temperature - Jaegar's method. To determine the surface tension of water at different temperatures by Jaeger's method of observing the air bubble diameter at the instant of bursting inside water
5. Mode constants of a vibrating strip. To determine the first and second mode constants of a steel vibrating strip; Y to be measured by the Cantilever method and frequency of vibration by the Melde's string method
6. Stefan's constant - To determine Stefan's constant
7. Constants of a thermo - couple and temperature of inversion.
8. Thermal conductivity of a liquid and air by Lee's Disc Method.
9. Study of magnetic hysteresis - B-H Curve. Sample in the form of a toroidal ring; by noting the throw in a B.G. when the magnetising current is changed from the maximum value to intermediate values.
10. Dielectric constant by Lecher Wire - To determine the wavelength of the waves from the given RF oscillator and the dielectric constant of the given oil by measurement of a suitable capacitance by using Lecher wire setup.
11. Maxwell's L/C bridge -To determine the resistance and inductance of the given unknown inductor by Maxwell's L/C bridge

Reference books

1. B.L. Worsnop and H.T. Flint - Advanced Practical Physics for students - Methusen & Co (1950)
2. E.V. Smith - Manual of experiments in applied Physics - Butterworth (1970)
3. R.A. Dunlap - Experimental Physics - Modern methods - Oxford University Press (1988)
4. D. Malacara (ed) - Methods of experimental Physics - series of volumes - Academic Press Inc (1988)
5. S.P. Singh –Advanced Practical Physics – Vol I & II – Pragati Prakasan, Meerut (2003) – 13th Edition

PHY1P02 ELECTRONICS PRACTICAL – I (2 Credits)

Note : At least 8 experiments should be done. Practical observation book to be submitted to the examiners at the time of external examination. One mark is to be deducted from internal marks for each experiment not done by the student if a total of 8 experiments are not done in the semester

1. MOSFET characteristics and applications: To study the characteristics of a MOSFET and to determine I/O impedances and frequency response.
2. UJT characteristics and relaxation oscillator (construct relaxation oscillator & sharp pulse generator)
3. Characteristics of s Silicon controlled rectifier (Half wave and full wave)
4. Voltage regulation using transistors with feedback (regulation characteristics with load for different input voltages and variation of ripple % with load)
5. Single stage RC coupled Negative feed back amplifier (input, output resistance, frequency response with & without feedback)
6. Two stage RC coupled amplifier (input and output resistance and frequency response including Bode plots)
7. RC coupled FET amplifier - common source (frequency response, input &output resistance)
8. Complementary symmetry Class B push-pull power amplifier (transformerless) (I/O impedances, efficiency and frequency response)
9. Differential amplifier using transistors (I/O impedances, frequency response, CMRR)
10. Amplitude modulation and detection using transistors (modulation index & recovery of modulating signal)
11. Darlington pair amplifier (gain, frequency response, input &output resistances)
12. Wien bridge oscillator using OP AMP (For different frequencies, distortion due to feedback resistor, compare with design values)
13. Sawtooth generator using transistors and Miller sweep circuit using OPAMPS (for different frequencies)

Reference Books :

1. Paul B. Zhar and A.P. Malvino - Basic Electronics - A Text Book Manual - JMH publishing (1983)
2. A.P. Malvino - Basic Electronics - A textlab manual - Tata McGraw Hill (1992)
3. R. Bogart and J. Brown -Experiments for electronic devices and circuits - Merrill International series (1985)
4. Buchla - Digital Experiments - Merrill International series (1984)
5. S.P. Singh – Pragati Advanced Practical Physics – Vol I & II – Pragati Prakasan Meerut (2003) – 13th Edition