C-1.1.2-a

Academic Council AGENDA Item No.: 05

MINUTES OF THE MEETING OF THE FACULTY OF SCIENCE HELD ON 26-11-2019

A meeting of the Faculty of Science was held on 26-11-2019 at 3.00 PM in the chamber of the Dean, University College of Science. Following members were present in the meeting :-

1.	Prof. P.K. Choudhury	Chairman
2.	Prof. K.B. Joshi	Member
3.	Prof. Kanika Sharma	Member
4.	Prof. Arti Prasad	Member
5.	Prof. Atul Tyagi	Member
6.	Prof. G.S. Rathore	Member
7.	Prof. M.K. Jain	Member
8.	Dr. Jyoti Chaudhary,	Member
9.	Dr. Avinash Panwar	Member
10.	Dr. Harshda Joshi	Member
11.	Dr. Dr. Shikha Agarwal	Member

Prof. M. Roy could not attend the meeting.

At the outset members of the Faculty of Science welcome Prof. P.K. Choudhary as the new Chairman of the Faculty of Science. Prof. P.K. Choudhary Chairman, Faculty of Science also welcome the members present in the meeting. Thereafter, after thorough discussion following resolution were taken in the meeting :

1. Considered the minutes of the meeting of the Committee of Courses in Physics held on 22-11-2019. The Faculty of Science approved resolution No. 1 of the minutes of the meeting of Committee of Courses regarding minor changes made in paper M1PHY03-CT03- Quantum Mechanics-I, M2PHY06-CP04-Computational Physics Laboratory, M3PHY04-ET02D - Semiconductor Physics and Devices and M3PHY05-CP05 - Data Analysis Techniques in Experimental Physics as recommended by the Committee.

2. It was resolved that a proper guidelines should be framed for the moderation of marks. A committee may be constituted to consider :-
   (i) justification of moderation
   (ii) If moderation is required, sample checking of answer sheets be done before recommendation.

   It was also resolved that in case of RTI by the students, factual report should be given on the basis of original answer copy of the student only.

The meeting ended with a vote of thanks to the Chair.

26/11/2019

(Prof. P.K.Choudhary)
Chairman, Fac. of Sc.

UNIVERSITY COLLEGE OF SCIENCE : UDAIPUR

No. UCS/PA/2019/632

Dated : 27th November,2019

Copy forwarded for information & necessary action to :-

1. P.S. to V.C. for kind information of Hon'ble Vice-Chancellor, Udaipur.
2. Registrar, M.L.S.U., Udaipur with request to include the Resolution No. 1 in the next meeting of the Academic Council.
3. The Head/Course Director, Deptt. of _____, UCoS, Udaipur.
4. The Convener, Committee of Courses in _____.

Registrar

Prof. J.P. Sharma

26/11/2019

M3PHY04-ET02D: Semiconductor Physics and Devices

(Note: At the beginning of the semester, students must be provided: Detailed lecture schedule of topics to be covered in each lecture, tutorial topics, clearly defining chapters/ section of reference books followed, link to web resources etc. Examiners are expected to take into consideration the lecture schedule while setting the question papers to ensure questions are set within the scope of the syllabus)

External: 80 Marks | Internal: 20 marks

Lectures: 40hrs | Tutorials: 10hrs

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

Unit-I — 8L

Semiconductor Concepts and Energy Bands; energy band diagram, semiconductor statistics, extrinsic semiconductors, compensation doping and degenerate and non-degenerate semiconductors, Direct and indirect bandgap semiconductors

Carrier Transport Phenomena: Carrier drift and diffusion. Graded impurity distribution

Semiconductor process technology; MBE and MOCVD

Unit-II — 8L

Non-equilibrium excess carriers in semiconductors: Carrier generation and recombination, Characteristics of excess carriers, Ambipolar transport, Quasi-Fermi energy levels, Excess carrier lifetime; Shockley-Read-Hall theory of recombination,

pn Junction Principles; open circuit, forward and reversed bias, Depletion layer capacitances Recombination lifetime

Metal-semiconductor junctions; Ohmic and non-Ohmic contacts

Unit-III — 8L

Bipolar Transistors: Bipolar transistor action and minority carrier distribution

Field Effect Transistors: JFET; concept and characterization, MOSFET; two terminal MOS structure, energy band diagrams, depletion layer thickness and work function differences

Light-Emitting Diodes: Principles and device structure, Homojunction and Heterostructure LEDs, LED characteristics

Unit-IV **8L**

Principle of the Laser diode, Heterostructure laser diodes, Elementary laser diode characteristics, Steady state semiconductor rate equations, Quantum well devices
Photodetectors: Principle of the pn Junction Photodiode, Quantum efficiency and responsivity, pin Photodiode, Avalanche photodiode, Phototransistors, Photoconductive detectors and Photoconductive gain

Unit-V **8L**

Photovoltaic Devices: Solar energy spectrum, Photovoltaic device principle, Photovoltaic I-V characteristics; photocurrent and quantum efficiency, dark current, open circuit voltage, short circuit current, Fill factor and efficiency, Effect on p-n junction characteristics; irradiation, temperature, band gap and parasitic resistance, Depletion approximation, Calculation of carrier and carrier densities, General solution for J (V), p-n junction in dark and under illumination

Tutorials (10 hrs)

Examples and problems from Text books will be listed in the Lecture schedule as Tutorials and assignments

Text books:

3. S. O. Kasap; Optoelectronics and Photonics: Principles and Practices, Pearson 2009
4. Donald A. Neamen and Dhrubes Biswas; Semiconductor Physics and Devices, 4th edition, McGraw Hill, 2003.
5. Jenny Nelson; The Physics of Solar Cells, 1st edition, Imperial College press, 2003.

Reference books:

6. S.M. Sze; Semiconductor Device Physics and Technology, John Wiley and Sons, 2002.
7. Ben. G. Streetman and Sanjay K. Banerjee, Solid Sate Electronics Devices, 7th edition, PHI, 2014.
8. T. Markvart and L. Castaner; Solar Cells: Materials, Manufacture and Operations, Elsevier, 2005.

M1PHY03-CT03: Quantum Mechanics-I

*(**Note**: At the beginning of the semester, students must be provided: Detailed Lecture schedule of topics to be covered in each lecture, tutorial topics, clearly defining chapters/sections of reference books followed, link to web resources etc. Examiners are expected to take into consideration the lecture schedule while setting the question papers to ensure questions are set within scope of the syllabus)*

External: 80 Marks **Internal:** 20 marks

Lectures: 40hrs **Tutorials**: 10 hrs

Additional Contact Hours : 10 (seminars, quiz, assignments, group discussion etc.)

Note: Candidates whose attendance is less than 75% will be awarded zero marks in the Internal

UNIT-I

Introduction, Linear Vector Space, Dual space and representation theory: **5L**

Hamilton's principle. Schrödinger equation, Normalisation, probability interpretation of ψ, Admissible wave functions.

Linear Vectors Space: Definition and properties, examples, norm of a vector, orthonormality and linear independence, Basis and dimensions, Completeness (Closure property), Hilbert space, subspace, Inequalities.

Operators: Equality, product, sum, power, function, inverse of operators, eigenvalues and eigenvectors of an operator, Positive definite, continuous and bounded operators, Linear operators, Hermitian operators, Unitary operators, Projection operators.

Dirac Space and Representation Theory: **3L**

Completeness of eigenfunctions, Bra and Ket notation for vectors, Dirac-Delta function, Matrix elements of change of basis, Unitary transformation. Representation theory, Coordinate and momentum representations.

UNIT-II

Postulates of Quantum Mechanics & Uncertainty Relations: **3L**

Postulates of Quantum mechanics, Uncertainty relations, States with minimum uncertainty product, Commutators, Theorem of simultaneous eigenfunctions,

Quantum Dynamics: **3L**

The equations of motion, Schrodinger picture, Heisenberg picture, Linear Harmonic Oscillator: Solutions from Schrodinger and Heisenberg Pictures, the method of second quantization

The Hydrogen Atom: **3L**

Two body equation, Separation of variables for spherically symmetric potential, Radial wave equation, Radial wavefunctions and energy states.

UNIT –III

Quantisation of Angular Momentum: **4L**

Definition, angular momentum of a system of particles, Matrix representation, Pauli matrices, the spin eigenvectors. Orbital angular momentum: Solutions, Spherical harmonics and properties, addition theorem (no proof).

Addition of angular momenta: **3L**

Clebsch-Gordan coefficients, the selection rules, properties of CG coefficients (without proof): symmetry, orthogonality and recursion relations.

UNIT –IV

Perturbation Theory (Non-degenerate case): **5L**

Basic formulation of the method and applications: Anharmonic oscillator (x^4), linear harmonic oscillator, infinite square well.

Degenerate case: **3L**

Formulation and applications: Stark and Zeeman effects in H, Infinite cube well, Relativistic correction.

UNIT –V

Path Integrals in Quantum Theory: **4L**

Interaction picture, Path Integral-Perspective and the recipe, Approximation to the U(t) for a free particle, Path integral evaluation of the free particle propagator, Equivalence to the Schrodinger equation. Potentials of the form $V=a+bx+cx^2+d(dx/dt)+ex(dx/dt)$.

Derivation of Path Integrals: **4L**

Configuration space path integrals (no application), Phase space path integral (No application), Coherent state path integral (No application), Path integral of the imaginary time propagator. Illustrative example of simple harmonic oscillator.

Textbooks:

1. Quantum Mechanics, V.K. Thankappan, Wiley Eastern Ltd. (1986).
2. Principles of Quantum Mechanics, R. Shankar, Plenum Press, New York (1994) (for V Unit)

Reference books:

1. Introduction to Quantum Mechanics, D.J. Griffiths, Pearson Education Inc. (2005).
2. Modern Quantum Mechanics, J.J. Sakurai, Addison and Wesley (1994).

M2PHY06-CP04 : Computational Physics Laboratory

Internal Assessment: 20 marks **External Assessment**: 80 marks

External Assessment: Section-A: 30 marks, Section-B: 25 marks, Viva-Voce: 15 marks, Practical Record: 10 marks

Note: Students are required to perform at least 10 experiments from each section. In Section A any five should be in C and any five in Fortran language.

SECTION A: PROGRAMMING IN C/FORTRAN

1. Gauss elimination Method
2. Gauss Seidel Method
3. Bisection Method
4. False Position Method
5. Newton Raphson Method
6. Roots of Quadratic equation
7. Matrix Addition, Matrix Subtraction and Matrix Multiplication
8. Matrix Inverse
9. Change a square matrix into a upper and lower triangular matrix
10. Area and volume of any given geometric shape
11. Temperature Conversion
12. Fibonacci series
13. Determination of maximum and minimum from a set of given numbers
14. Determine the factorial of a given number
15. Determine whether a given number is a prime number or not

SECTION B: INTRODUCTION TO MATLAB

1. Find minima and maxima of curve
2. Plotting bisection and regula falsi
3. Solving Differential and Integral equation
4. Curve plotting
5. Fast Fourier transform (FFT) and Discrete Fourier Transform (DFT)
6. Linear Interpolation
7. Multiple interpolation
8. Sample three different parabolic functions at the points defined in x
9. Vectors and Matrices operation
10. Curve fitting
11. Interpolation and Extrapolation
12. Least squares fitting
13. Cubic spline interpolation

14. Spline interpolation

Reference Books :

1. Computer Oriented Numerical Methods, V. Rajaraman
2. Computer Programming in Fortran 77, V. Rajaraman
3. Matlab: An Introduction With Applications, Amos Gilat
4. Matlab: A Practical Introduction to Programming and Problem Solving, Stormy Attaway