SCHOOL OF ARCHITECTURE, SCIENCE AND TECHNOLOGY YASHWANTRAO CHAVAN MAHARASHTRA OPEN UNIVERSITY

Syllabus:

V131: M.Sc. (Physics)

{2021 Pattern}

2021

AST, YCMOU, NASHIK-422 222, MS, INDIA

Contents

Yashwantrao Chavan Maharashtra Open University

Vice-Chancellor: Prof. Dr. E. Vayunandan

School of Architecture, Science and Technology

Director (I/C) of the School: Dr. Sunanda More

School Council (2021-2023)

Dr Sunanda More Director(I/c) & Associate Professor, School of Architecture, Science & Technology, YCMOU, Nashik	Dr Manoj Killedar Associate Professor, School of Architecture, Science & Technology, YCMOU, Nashik	Dr Chetana Kamlaskar Assistant Professor, School of Architecture, Science & Technology, YCMOU, Nashik
Dr. Abhay Patil Assistant Professor, School of Health Science, YCMOU, Nashik	Mr. RajendraWagh Assistant Professor, School of Agricultural Science, YCMOU, Nashik	Mrs. Shubhangi Patil Assistant Professor, Student Service Devision, YCMOU, Nashik
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Prof. Dr. R. L. Shinde Professor & Head, Department of Statistics and Department of Actuarial Science and Director, School of Mathematical Sciences, North Maharashtra University, Umavi Nagar, Jalgaon 425001	Dr. M. D. Sonawane Associate Professor, Head, Department of Botany K.T.H.M. College, Nashik - 422002	Mr. Sudharm S. Hande, Study Centre Coordinator, (S.C. Code: 12207) Shri R R Lahoti College, Morshi 444905 Dist: Amravati

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- **Prepared by**:

Dr Sunanda More, Director, AST School, YCMOU, Nashik– 422222	Sweta Kapade Academic Coordinator, AST School, YCMOU, Nashik– 422222	Bharati Kolhe Academic Coordinator, AST School, YCMOU, Nashik– 422222

SYLLABUS FOR
V131: M.Sc. (PHYSICS){2021 PATTERN}

Programme Objective and Scope

This programme is designed to achieve following objectives and scope.

Objectives: After successful completion of this programme, students will be able to

1. Explain core concepts related to fundamental physics principles.
2. Explain how physics will help us in day-to-day life.
3. Discuss core concepts and methods of physical sciences and their application in problem-solving

Scope of the Physics programmes: After successful completion of this programme, students may get opportunities in various fields/sectors to work as

- Career opportunities in both private and government sector/ in India and abroad
- Job opportunities in allied sectors[High Tech Industries, Medical Labs, Government Hospitals, Medical Research Labs, Defense Services, Nuclear Power Plants, Aerospace Sector, Research Analyst, Space and Astronomy, Healthcare, Technology, Geophysics and meteorology, College Lecturer/ Professor Banking, Business/ Start-up
- Inculcation of research attitude
- Inculcation of entrepreneurship
- Perceive higher education and research in the same field

Mode of Education

This Programme will be offered in Open and Distance Learning (ODL) Mode as defined in "UGC Open and Distance Learning Programmes and Online Programmes Regulations, 2020" published in the gazette notification by dated 4th Sept 2020 by the UGC as specified below.

> *"Open and Distance Learning Mode means a mode of providing flexible learning opportunities by overcoming separation of teacher and learner using a variety of media, including print, electronic, online and occasional interactive face-to-face meetings with the learners or Learner Support Services to deliver teaching-learning experiences, including practical or work experiences"*

Mode of Examination

Continuous Assessment is conducted at recognized learner support centres/ study centres and End Examination for all type of courses is conducted at recognized Exam Centres of the University under supervision.

Basic Information

1. **Mode of Education**: Open and Distance Learning (ODL) Mode
2. **Minimum Programme Duration**: 2 years/ 4 semesters after Candidates with B.Sc. (PCM)/ B.Sc.(Phy)/ B.Sc.(Electronics)/ B.E./ B. Tech. Degree or Equivalent pass
3. **Learner Support Centers/ Study Centers:** University approved/ recognized Senior Science Colleges/ Institutes
4. **Medium of Instruction**: English
5. **Attendance**: Minimum 80% attendance for all type of courses.
6. **Minimum Programme Duration**: 2 years after Graduation
7. **Teaching-Learning**: 36 working weeks per year
8. **Total Teaching-Learning Support:** 960 Hours in each year
9. **Total Courses:** 16 courses (subjects) at year 01-02
10. **Total Credits:** 48 Credits. As per UGC norms 1 Credit means 30 hours of study efforts required to gain learning of particular content of each credit.
11. **Year Credits**: 24 Credits in each year (16 credits for Theory and 08 credits for Practical).
12. **Total Courses and Credit Points:**

Year	Theory	Practical	Credits
01	4	4	24
02	4	4	24
Total credits			**48**

13. **Passing:** Minimum 40% or better marks
14. **Credit Transfer:**
15. **Continuous Assessment:** Continuous Assessment conducted for Continuous evaluation during teaching-learning for 20%Weightage
16. **End Exam :**End Examination conducted for Summative evaluation of the student for 80% Weightage
17. **Degree Certification:** Aggregate performance and Class in the programme reported on the basis of performance.
18. **Curriculum Design:** Student centric curriculum is designed to enable professional ability, employability and skill enhancement.
19. **Approval/Equivalence Status**: UGC Approved. UGC-DEB Approval is available on UGC Website

Eligibility and Fees

<table>
<tr><th>Admission Eligibility</th><th>Certification Eligibility</th><th>Fees and Deposit / Year
UF is payable for a year to the university at the time of online admission</th></tr>
<tr><td>Candidates with B.Sc. (PCM)/ B.Sc.with Physics upto SY/ B.Sc.(Electronics)/ B.E./B. Tech. Degree or Equivalent pass</td><td>Min 40% or better marks, in all Theory type of courses, with total 48 credits at Year 01 to 02</td><td>
<table>
<tr><th>Description</th><th>INR ₹</th></tr>
<tr><td>University Fee (UF)</td><td>8000</td></tr>
<tr><td>Study Center/ Learner Support Center Fee (LSCF)</td><td>12,000</td></tr>
<tr><td>Total ≈</td><td>20000</td></tr>
<tr><td>Refundable LD
(Payable only when student choose to avail Library Facility at the SC)</td><td>1,500</td></tr>
</table>
</td></tr>
</table>

Programme Structure

V131: M.Sc. (Physics) {2021Pattern}

Course ➔ / Year ↓	Course 01, 4 CR, T	Course 02, 4 CR, T	Course 03, 4 CR, T	Course 04, 4 CR, T
Year 01 24CR	**PHY011** Mathematical Physics and Classical Mechanics	**PHY012** Statistical Mechanics and Quantum Mechanics	**PHY013** Solid State Physics	**PHY014** Semiconductor Devices, Analog and Digital Electronics
	Course 05, 2 CR, P	Course 06, 2 CR, P	Course 07, 2 CR, P	Course 08, 2 CR, P
	PHY015 Heat and Acoustics	**PHY016** Optics	**PHY017** Basic Electronics	**PHY018** Digital Electronics and Computers Programming
Year 02 24 CR	Course 01, 4 CR, T	Course 02, 4 CR, T	Course 03, 4 CR, T	Course 04, 4 CR, T
	PHY021 Nuclear Physics and Analytical Techniques	**PHY022** Electromagnetic Theory and Spectroscopy	**PHY023** Memory Devices and Microprocessors	**PHY024** Microwave Devices and Communication Systems
	Course 05, 2 CR, P	Course 06, 2 CR, P	Course 07, 2 CR, P	Course 08, 2 CR, P
	PHY025 Spectroscopy	**PHY026** Modern Physics	**PHY027** Memory Devices and Microprocessors	**PHY028** Microwave Devices and Communication Systems

Teaching-Learning Scheme:

Description	Total 08 (Eight) Theory Courses in Programme Total 08 (Eight)Practical Courses in Programme
Face-to-face Counselling Sessions for interaction, problem solving and conduction of practical activities at Study Centre	12 hrs each of 01 clock hour duration for each Theory Course of 4 Credits, Study Hours – 60
	12 hrs each of 02 clock hour duration for each Practical/ Activity Course of 2 Credits, Study Hours– 60
Delivery of Information	(1) Books in SLM format: 30Hours/ for each
Self-Study, Learning Evaluation and Feedback	(1) Solving Problems, Self-Tests, SAQs and Exploring more Details on Text-Book: 30 Hours
Total Study Hours	(08 x 60 = **480** Hours + 08 x 60 = **480** Hours) = 960 Hours

Semesters and Courses

SN	Code	Name	CA	EE	TM	Type	CR	Grade Point
Year 01 : 24 Credits								
01	PHY011	Mathematical Physics and Classical Mechanics	20	80	100	T	4	4
02	PHY012	Statistical Mechanics and Quantum	20	80	100	T	4	4
03	PHY013	Solid State Physics	20	80	100	T	4	4
04	PHY014	Semiconductor Devices, Analog and Digital Electronics	20	80	100	T	4	4
05	PHY015	Heat and Acoustics (Practical)	10	40	50	P	2	4
06	PHY016	Optics (Practical)	10	40	50	P	2	4
07	PHY017	Basic Electronics (Practical)	10	40	50	P	2	4
08	PHY018	Digital Electronics and Computers (Practical)	10	40	50	P	2	4
Year 02 : 24 Credits								
01	PHY021	Nuclear Physics and Analytical Techniques	20	80	100	T	4	4
02	PHY022	Electromagnetic Theory and Spectroscopy	20	80	100	T	4	4
03	PHY023	Memory Devices and Microprocessors	20	80	100	T	4	4
04	PHY024	Microwave Devices and Communication Systems	20	80	100	T	4	4
05	PHY025	Spectroscopy (Practical)	10	40	50	P	2	4
06	PHY026	Modern Physics (Practical)	10	40	50	P	2	4
07	PHY027	Memory Devices and Microprocessors (Practical)	10	40	50	P	2	4
08	PHY028	Microwave Devices and Communication Systems (Practical)	10	40	50	P	2	4

Grading system

1. "Absolute Grading": the marks are converted to grades based on pre-determined class intervals.

2. "Letter Grade": It is an index of the performance of students in a said programme. Grades are denoted by letters O, A+, A, B+, B, C, P and F.

Letter Grade	Grade Point	Class
O	10	Outstanding
A+	9	Excellent
A	8	Very Good
B+	7	Good
B	6	Above Average
C	5	Average
P	**4**	**Pass**
F	**0**	**Fail**
Ab	**0**	**Absent**

3. "Grade Point": It is a numerical weight allotted to each letter grade on a 10-point scale. Grade Point shall be"0 (Zero)"for Letter Grade "Ab" and "F". The marks scored by the examinee shall be converted into grade points by dividing the marks scored in the aggregate and dividing the resulting number by maximum marks, multiplying the result by ten, retaining the integer part (ignore the fractional part).Thus if a person has secured 56 marks out of 100 marks in aggregate for a course, we get (56/100) x 10 which is5.6.Ignoring the fraction, we get 5 as the grade point.

1. "**Credit Point**": It is the product of grade point and number of credits for a course.
2. "**Cumulative Grade Point Average (CGPA)**": It is a measure of overall cumulative performance of a student overall Year. The CGPA is the ratio of total credit points secured by a student in various courses in all Year and the sum of the total credits of all courses in all the Years. It is expressed up to two decimal places.
3. "**Transcript or Grade Card or Certificate**": Based on the grades earned, a grade certificate shall be issued to all the registered students after every Year. The grade certificate will display the course details (code, title, number of credits, grade secured) along with CGPA earned till that Year.

Evaluation Pattern

Separate and independent passing @ 40% in EE and (CAT+EE) shall be essential for Theory and Practical component of each course. "CA, EE and Total marks" shall be separately reported for each course in the transcript or mark-statement.

1. **Only 1 attempt** for EE for **each** course shall be allowed in **each** Year. **Maximum 1 attempt**, for CAT for **each** course, shall be allowed in **each** Year.
2. Only best of past performance shall be reported in transcript or mark statement.
3. **Total student evaluation for**
    a. **Each** Year shall be for **600** marks.
    b. **Each** regular PG degree shall be for **1200** marks.

SN	Type of Course	Continuous Assessment	End Examination
1	Theory (T)	"Continuous Assessment (**CA**)" of total **20** 4SAQs, each of 5marks, 1 SAQ on **each** CR in a **Single attempt only**	"End Examination (**EE**)" of total **80** Marks and **16** "Short Answer Questions (SAQs)"**each** of **05** marks (**4 out of 5 SAQs on each Credit**), during **150** Minutes
2	Practical (P)	Student is required to submit "Activity Report" of total 10 Marks and total 2 Activities, each of 5 Marks on **each** CR in a **Single Attempt only**	External and internal examiners shall assess each student based on for total 40 Marks: Conduct of One Randomly Selected Practical Activity – 10 Marks Viva-Voice – 10 Marks Journal (Workbook) - 10 Marks and Report of Practical Activity – 10 Marks **Duration**: 120 minutes

Evaluation Pattern Of Practical Type Courses of 2 CR

SN	Description	Internal Examiner	External Examiner	Total Marks
	Duration of End Exam: 120 minutes(2hrs) Batch size: ≈ 15 students			
a	Actual Conduct of 1 randomly selected practical activity	04 Marks	06 Marks	10
b	Viva-Voice	03 Marks	07 Marks	10
c	Workbook	04 Marks	06 Marks	10
d	Report of Practical Activity with Diagram, synoptic Answers, Graph/Observation and Conclusion	04 Marks	06 Marks	10
Total		**15 Marks**	**25 Marks**	**40 Marks**

Successful Completion of Course or Programme

1. "Successful Completion of the Course" means - either course is exempted or student gets minimum specified or better grade, either in end examination of that course or by credit transfer. A student obtaining grade "F" shall be considered failed and will be required to reappear in the examination. The student obtained minimum "P" (Pass) letter grade required for successful completion of the each course.
2. "Successful Completion of the Programme" means – all courses at all year are successfully completed either in end examination of that course or by credit transfer and the student obtained "P" (Pass) letter grade for all courses at all years along with minimum specified CGPA.

Year 01

PHY011: Mathematical Physics and Classical Mechanics

Course Information

Year	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
01	PHY011	Mathematical Physics and Classical Mechanics	4	8	120	20	80	100	T

Presumed Knowledge and Learning Objectives

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: • Eligibility criteria required for admission to this PG Course	After successful completion of this course, student should be able to • apply the mathematical skills to solve quantitative problems in the study of physics. • apply the Variation principles to real physical problems

Units and Detailed Syllabus

UN	Detailed Syllabus of the Unit	CR
1-1	**Legender's Polynomials**: Aims and Objectives, Introduction, Legendre's Differential Equation and Its Solution, Associated Legendre's Polynomial, Generating Function, Rodrigue's Formula, Orthogonal Properties of $P_n(x)$, Recurrence Formulae, Summary, and Model Examinations Questions.	CR 01
1-2	**Bessel Functions**: Aims and Objectives, Introduction, Bessel's Differential Equation and Solution , Generating Function For $J_n(x)$, Recurrence Formulae For $J_n(x)$,Orthogonal Property , Summary , Model Examinations Questions	
1-3	**Hermite Polynomials**: Aims and Objectives, Introduction, Hermite Differential Equation and Solution , Hermite Polynomials , Generating Function of Hermite Polynomials, Recurrence Formulae , orthogonality of Hermite Polynomials ,Rodrigre's Formulae , Summary , Model Examinations Questions	
1-4	**Laplace Equation and Wave Equation**: Aims and Objectives, Introduction , Solution of laplace Equation in Cartesian Coordinates , Application of Wave Equation (Vibration of Rectangular Membrane , Vibration of Circular membrane , Summary , Model Examinations Questions	

2-1	**Fourier Transforms and Applications**:. Aims and Objectives, Introduction , Nomenclature and Definition of Fourier Transforms , Relationship Between Fourier Transforms and Laplace Transforms , Linearity Property , Scaling Property , Time shifting Property, Frequency Shifting Property , Integration Property , Time Convolution Property , Frequency Convolution Property , Parseval's theorem Fourier Transform For Dirac Delta Function , Examples , Finite fourier Sine Transform of F(x) , Finite fourier cosine Transform of F(x) , some Operational Properties of Finite sine and Cosine Transforms , Summary , Model Examinations Questions , References.	
2-2	**Laplace Transforms and Applications:** Aims and Objectives, Introduction , Definition of Laplace Transform , Some Properties of Laplace Transform (Linearity Property , First shifting(Translation) property , Second Shifting (Translation) property , Change of Scale Property) , Laplace Transform of Derivatives ,Derivatives of Laplace Transform , integral of Laplace Transform , Laplace Transform of Periodic Function , Laplace Transform of convolution Integral , Initial Value Theorem , Final Value Theorem , Behavior of f(S) as $S \to 0$ ans $S \to \infty$, Laplace Transform Of Some Special Functions, The Gamma Function , The Bessel Function , Error Function ,Dirac Delta Function , Evaluation of certain Integrals by Laplace Transform , Application of Partial Differential Equations partial Fractions, electric Circuits, A Short Table Of Laplace Transform , Summary , Model Examinations Questions , References.	
3-1	**Tensor Algebra:** Aims and Objectives , Introduction, Transformation of coordinates and summation convention , contravariant Vector , scalar Invariant and covariant Vector, Definition of Tensor, Tensor of Second Order and Any Order , Symmetric and skew Symmetric Tensors ,Open and Outer Product of two Tensors , Contraction of Tensors , Inner Product or compounding of Two Tensors , Quotient Law Conjugate or Reciprocal Symmetric Tensors , Tensors In Elasticity (Strain Tensor , Physical Significance Of strain Tensor, Stress Tensor), Simple rule Regarding Indices, Summary , Model Examinations Questions , References	**CR 02**
3-2	**Metric Tensor and Chrioffel Symbols** : Aims and Objectives , Introduction, Fundamental Tensor , Magnitude of Vector, Associate Covariant and Contravariant Vectors ,Cristoffel Symbols , Law Of Transformation for Cristoffel Symbols ,Covariant Derivatives of Covariant Vectors, Covariant Derivatives of Scalar Invariant ,Curl of Vectors , Covariant Derivatives of Contravariant Vectors , Covariant Derivatives of Second Order Covariant Tensor , Divergence of Vectors , Laplacian of Scalar Invariant , Summary , Model Examinations Questions , References	

4-1	**Lagrangian Mechanics:** Aims and Objectives, Introduction, Mechanics of Particle, mechanics of Constraints, Principles of Virtual Work, D- Alembert's system of particles, Generalized co-ordinates, Principle, Worked Example , Model Examination Questions	CR 03
4-2	**Lagrange's Equations:** Aims and Objectives, Introduction, Lagrange's Equations from D-Alembert's Principle, Applications of Lagrange's Equations , Velocity-Depends Potentials and the Dissipation Function , Model Questions	
4-3	**Hamilton's Principle:** Aims and Objectives, Introduction, Hamilton's Principle , Lagrange's Equation From Hamilton's Principle , Lagrange's Equation for Non-Conservative and Non-Holonomic System , Model Examination Questions.	
4-4	**Hamilton's Mechanics:** Aims and Objectives, Introduction, Hamilton's Equation of Motion, Cyclic Co-ordinates , physical Significance of Hamiltonian Or The time independent Hamiltonian, Principle of Least action, Model Questions	
4-5	**Canonical Transformation and Hamilton- Jacobi Theory:** Aims and Objectives, Introduction, Canonical Transformations, Examples of Canonical Transformation, Conditions for a Transformations To be Canonical , Hamilton- Jacobi Equations , Harmonic Oscillator problem by Hamilton- Jacobi Method ,Model Questions	
4-6	**Poissons Brackets:** Aims and Objectives, Introduction **,** Poissons Brackets , Invariant of Poisson Brackets under Canonical Transformations , Hamilton's Equation in Poissons Brackets Nation, Model Questions , Reference Books.	
5-1	**Numerical Interpolation:** Aims and Objectives, Introduction **,**Numerical Interpolation, Finite Differences and Interpolation(Forward Differences ,Backward Differences, The Shift Operators and the Difference Operators, Differences of Polynomial), Interpolation Using Forward Differences ,Newton's Backward Difference Interpolation , Lagrange's Polynomial Interpolation(Inverse Interpolation , Summary , Model Questions, Answers to Model Questions.	CR 04
5-2	**Numerical Differentiation :** Aims and Objectives and Introduction ,Differentiation Based on Equal Interval Interpolation , Derivatives using Newton's Forward Difference Formula **,**derivatives using Newton's Backward Difference Formula, Differentiation Based on lagrange's Interpolation Formula, Summary, Model questions , Answers to Model Questions	
5-3	**Numerical Integration :** The General Quadrature Formula For Equidistant Ordinates(The Trapezoidal Rule, Geometric Interpretation of the Trapezoidal rule, Simpson's One Third Rule, Graphical illustration of the Application of Simpson's 1/3rd Rule, Simpson's Three Eight's Rule, Graphical illustration of the Application of Simpson's 3/8 Rule), The Gaussian Quadrature Formula	

5-4	**Solution Of Equations:** Solutions of Nonlinear Equation(The Bisection Method, The Newton-Raphson Method), Systems of Linear Equations(The Gauss Elimination Method, The Triangularisation Method), Matrix Methods to Solve Linear Equations, Finding the Inverse of a Matrix by Compact Schemes(The Gauss-Jordan Method), Jacobi's Iterative Method (The Gauss-Seidel Method)	
5-5	**Numerical Solutions Of Ordinary Differential Equations:** Initial Value Problems, The Taylor Series Method (Merits and Demerits of Taylor's Series Method), Euler,s Method (Modified Euler's Method), Runge- Kutta Methods(Runga-Kutta second order method, Runga-Kutta fourth Order methods).	

Learning Resource Details

LR Code	Title Author	Edition Year	ISBN Publisher
Text-Books			
PHY011	Mathematical Physics and Classical Mechanics - Dr. P. Babu Rao - Prof. G. T. Naidu - Prof. G. Satyanandam - Dr. V. V. Subrahmanya Sharma	2006	BRAOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
PHY011 –RB1			
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
PHY011 -CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
PHY011-WL1			

PHY012: Statistical Mechanics and Quantum Mechanics

Course Information

Year	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
01	PHY012	Statistical Mechanics and Quantum Mechanics	4	8	120	20	80	100	T

Presumed Knowledge and Learning Objectives

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: • BSc with Physics or Mathematics or equivalent from a recognized University/Board.	After successful completion of this course, student should be able to • Explore the concepts of Phase space, Macro and Microstate • Interpret thermodynamic probability • Illustrate Maxwell-Boltzmann law - distribution of velocity • Investigate the basic concepts of quantum statistics • Validate Fermi-Dirac distribution law - electron gas and Bose-Einstein distribution law - photon gas

Units And Detailed Syllabus

UN	Detailed Syllabus of the Unit	CR
1-1	**Statistical Mechanics - Thermodynamics:** Macroscopic and Microscopic States, Phase space (Division of phase space into cells, volume in phase space), Constraints.	CR 01
1-2	**Ensembles:** Definition of an Ensemble, Different types of Ensembles (Micro Canonical, Canonical, Grant Canonical), Uses of Ensembles.	
1-3	**Density Distribution- Liouville's Theorem:** Density of distribution in phase space, Liouville's Theorem, Density of phase point in a canonical ensemble.	
1-4	**Postulate of Classical Statistical Mechanics:** Postulate of equal a priori probability, Statistical equilibrium, Thermal equilibrium, Mechanical equilibrium, and Particle equilibrium, Connection between statistical and thermodynamic parameters.	
1-5	**Micro Canonical Ensemble:** Definition and explanation of micro canonical ensemble, perfect gas in micro canonical ensemble, Gibb's paradox, Resolving the paradox,	

	Partition function and Thermodynamics functions.	
1-6	**Maxwell- Boltzmann Statistics:** Maxwell- Boltzmann Statistics, Maxwell- Boltzmann distribution of velocities, Boltzmann equipartition theorem.	
1-7	**Canonical And Grand Canonical Ensembles:** Canonical Ensemble, Thermodynamics Parameters, Ideal gas in Canonical ensemble, Grand Canonical ensemble, Thermodynamic parameters with grand canonical ensemble, Ideal gas in grand canonical ensembles, Fluctuations.	
2-1	**Postulate of Quantum Statistical Mechanics:** Postulate of quantum statistical mechanics, Density matrix Liouville's theorem, Micro canonical ensemble, Canonical ensemble, Grand canonical ensembles.	
2-2	**Quantum Statistics- B.E. and F.D. Statistics:** The three statistics, Distribution function, B.E. distribution function, F.D. Statistics function, Comparison of the three statistics.	
3-1	**Birth of Quantum Mechanics:** Necessity of Quantum Mechanics, Postulates of Quantum Mechanics, Wave function and operators, Hermitian operators and their properties, Wave function and its interpretation, Conditions on the wave functions, Superposition principle and wave packet, Completeness.	**CR 02**
3-2	**Eigen Value and Eigen Functions:** Eigen values and Eigen functions, Degenerate Eigen functions and degree of degeneracy, Orthonormality of Eigen functions.	
3-3	**Dirac's Bra And Ket Vectors:** Dirac's Bra and Ket notation, Expectation value and Dynamical variable and operators, Ehrenfest Theorem.	
3-4	**Eigen Functions and Uncertainty Principle:** Eigen functions of commuting operators, Theorems, Uncertainty principle.	
4-1	**Schrodinger Wave Equation:** Time dependent wave equation, Time independent wave equation, Stationary states, Free particle solutions, Dirac delta normalization.	
4-2	**Applications of Schrodinger Equations one Dimensional Problem:** Solutions of wave equations for a particle moving in one dimension in potential step, Solutions in potential well with finite and infinite walls, Square well potential with finite wall.	**CR 03**
4-3	**Angular Momentum:** Angular momentum-Commutation relations for angular momentum operator, Eigen value problem for L^2 and L_z Linear harmonic oscillator.	
4-4	**Application of Schrodinger Equation To Three Dimensional problems:** A Particle moving in three dimensional boxes in a constant potential field with finite walls, Rigid Rotator.	

4-5	**Hydrogen Atom:** Schrodinger Wave equation for the Hydrogen Atom, Solution of ø equation, Solution of Θ equation, Solution of radial part, Normalization for the function R(ρ).	
4-6	**Spin Angular Momentum:** Spin operators and Eigen values, Pauli spin matrices for electron, Commutation relations of spin operators, Two component wave functions, Pauli's eigen values and eigen functions, Electron spin functions.	
4-7	**Addition Angular Momenta Clebsch-Godvan Coefficients:** Clebsch-Gordan Coefficients, Calculation of Clebsch-Gordan coefficients for p-state of electron, Scalar operators,vector operators, spherical harmonics, Rotations, Transformation properties of angular momentum eigen functions under rotations, Connections between spherical harmonics and the functions, Euler's theorem, Wiegner- Eckart theorem.	
5-1	**Time Independent Perturbation Theory:** Time independent perturbation theory (First order perturbation theory, Higher order perturbations), Helium atom, Degenerate perturbation theory, Stark effect in Hydrogen atom.	
5-2	**Variation Method:** Variation Method, Application to ground state of Helium atom, Application to harmonic oscillator, Application to excited states of Harmonic oscillator and hydrogen atom, WKB Approximation method, Connecting formulae, Application to potential well, Application to α-decay Time independent perturbation theory.	
5-3	**Time Dependent Perturbation Theory:** Time dependent perturbation theory, Fermi Golden Rule, Harmonic perturbation, Adiabatic and Sudden Approximation, Einstein Transition coefficient.	**CR 04**
6-1	**Kelvin Gordon Relativistic equation and Application:** Kelvin Gordon Relativistic equation, Probability and current density, Application of K.G. equation to Hydrogen atom, Inadequacies of K.G. Equation.	
6-2	**Dirac's Relativistic equation and Application:** Dirac's relativistic equation, Dirac's matrices and free particle solution, Probability and current densities, Spin of a dirac particle, Dirac's equation in the presence of electromagnetic field, Negative energy state.	

Learning Resource Details

LR Code	Title Author	Edition Year	ISBN Publisher
Text-Books			
PHY012-T01	Statistical Mechanics and Quantum Mechanics - Prof. K. Ravindra Prasad	2006	BRAOU

	- Prof. D. Punya Seshudu - Prof. D. Raja Reddy		
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
PHY012 –RB1			
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
PHY012 -CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
PHY012-WL1			

PHY013: Solid State Physics

Course Information

Year	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
01	PHY013	Solid State Physics	4	8	120	20	80	100	T

Presumed Knowledge and Learning Objectives

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: • BSc with Physics or Mathematics or equivalent from a recognized University/Board.	After successful completion of this course, student should be able to • The students will be able to understand the Various Crystal structure. • The students will be able to understand the magnetic properties of crystal.

Units And Detailed Syllabus

UN	Detailed Syllabus of the Unit	CR
1-1	**Crystalline State of Crystal Structure:** Crystal, The Language of crystals, Crystal structure, Crystal symmetry, Translational symmetry operation, Point symmetry operations, point Groups, Bravais Lattices and crystal systems, Space groups, Miller Indices, Inter planer Spacing- separation between lattice planes, Atomic packing in crystals, Important crystal structures.	CR 01
1-2	**Non Crystalline State:** Distinction between crystalline and non-crystalline states, Glass characterizing Properties, Distinction between amorphous solids and glasses, Glass formation, Composition of oxide glasses, Glass Transition, Various definition of Glass, Liquid to crystal transition Vs Liquid to Glass Transition, Kinetic Nature of the Glass Transition, Types of Glasses, Methods of preparation of Glasses.	
1-3	**Element of X-Ray Diffraction:** Bragg's Law, Diffraction Directions, Laue treatment of X-Ray diffraction, Intensity of diffracted beam, Reciprocal Lattice, Application to some cubic lattices, Ewald Construction- Bragg's law in terms of reciprocal lattices vectors, Brillouin Zones.	
1-4	**Experimental Techniques For Structure Determination:** Experimental methods of X-Ray diffraction, Laue Method, The powder method, The Powder diffractometer, application, Limitation, Conclusions, Electron Diffraction, Neutral Diffraction.	
2-1	**Imperfections In Crystals:** Classification of Imperfections, Thermodynamical Consideration for the existence of defects, Schottky defects in metals, Frenkel defects in	

	metals, Schottky defect in ionic crystals, Frenkel defect in ionic crystals, Extrinsic defects, Color centers.	
2-2	**Diffusion:** Diffusion Mechanisms, Steady state Diffusion- fick's first law, Non- steady state diffusion- Fick's second law, Coefficient of diffusion, Chemical diffusion- Kirkendall effect, Ionic conduction, Einstein's Relation, Ionic conduction in alkali halides.	**CR 02**
2-3	**Dislocation:** Line defects, Edge dislocations, Screw dislocation, Energy of a dislocation, Mixed dislocation, Observation of dislocation, Grain boundaries, Dislocation multiplication.	
3-1	**Free Electron Theory:** Important properties of metals, Theories of metals, the Drude model, Lorentz modification of the Drude model, Sommerfeld model, Parameter of free electron gas, Effect of temperature on the parameters of free electron gas, Heat capacity, Drawbacks of Sommerfeld theory.	
3-2	**Band Theory of Solids:** Formation of energy bands in crystals, Bloach theorem, Kronig Penney model,, Distinction between metals, Insulators and Semiconductors	
3.3	**Semiconductors:** Different varieties of semiconductors, Classification of semiconductors, Band structure in semiconductors, Energy gap, Fermi level and Fermi function, Conductivity of Intrinsic semiconductor, Carrier concentration of charge carriers in extrinsic semiconductors, Hall effect in semiconductors.	
3.4	**Solid State LASERs:** Principle of LASER Emission, Popular Inversion, Laser Oscillations, Properties of a LASER light, Solid state LASERs, Ruby LASER, Nd-YAG LASER, GaAs based semiconductor LASERs, Application of LASERs.	
4-1	**Elastic Waves In Solids:** One-dimensional chain of identical atoms, Characteristics of the dispersion curve, The Brillouin Zones, Diatomic linear chain of atoms, Vibrational modes of diatomic linear lattice, Properties of acoustic and branches.	
4-2	**Infrared Absorption In Ionic Crystal:** Infra-red adsorption in ionic crystals, Phonons, Verification of dispersion relation in crystal lattices.	
4-3	**Lattice Heat Capacity:** Einstein Model, Debye Model, Thermal conductivity, phonon Mean Free Path, Thermal expansion, Gruneisen Parameter.	**CR 03**
5-1	**Microscopic Description of Dielectrics:** Induced Dipole in dielectrics, Polarization charge density, Macroscopic theory of dielectric constant, Properties of E and D, Microscopic view f dielectrics, Local fields in dielectrics, Polarizability, Electronic Polarizability, Ionic Polarization, Orientation Polarization.	
5-2	**Measurement of Dielectric Constant:** Measurement of dielectric constant, Schearing	

	Bridge, Resonance Bridges, Auto-balancing bridge, Clausius-Mossoti relation, Lorentz-Lorentz relation, Frequency dependence of electronic Polarizability, Breakdown of dielectrics, Mechanism of Breakdown, Dielectric Materials.	
5-3	**Ferroelectrics:** General characteristics of ferroelectrics, Classification of ferroelectrics, Theories of Ferro electricity, Application of ferroelectric materials.	
6-1	**Magnetism:** Diamagnetism, Larmor- Langevin theory, Quantum Theory of diamagnetism, Paramagnetism Paramagnetic cooling.	
6-2	**Spontaneous Magnetization:** Ferromagnetism, Molecular field- Weiss-domain model, Curie- Weiss law, Heisenberg Exchange Interaction, Ferromagnetic domains, Hysteresis loop, Anti-ferromagnetism, Bloch's theory of anti-ferromagnetism, Ferrimagnetism theory, Application of ferrites.	
6-3	**Occurrence of Superconductivity:** Experimental observations, Superconductivity and Transition temperature, Zero resistance, Effect of magnetic field on superconductivity, Meissner effect, Persistent currents, type I Type II superconductors, isotope effect, Entropy, Specific heat Energy gap and its nature, Thermal conductivity, Absorption of electromagnetic radiation.	**CR 04**
6-4	**Superconductivity- Theoretical Explanations:** London Equations, Flux Quantization, BCS theory, Tunneling effects in superconductors- Giaever tunneling, Josephson effect, Elements of high temperature superconductors, Applications.	

Learning Resource Details

LR Code	Title Author	Edition Year	ISBN Publisher
Text-Books			
PHY013-T01	Solid State Physics - Prof. Bhima Shankaram - Prof. M. Lakshmipati Rao - Dr. G. Prasad	2017	BRAOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
PHY013 –RB1			
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
PHY013 -CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
PHY013-WL1			

PHY014: Semiconductor Devices Analog and digital electronics

Course Information

Year	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
01	PHY014	Semiconductor Devices Analog and Digital Electronics	4	8	120	20	80	100	T

Presumed Knowledge and Learning Objectives

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: • BSc with Physics or Mathematics or equivalent from a recognized University/Board.	After successful completion of this course, student should be able to • Distinguish between conductor, insulator and semiconductor. • Explain the intrinsic and extrinsic semiconductor. • Differentiate the intrinsic and extrinsic semiconductor

Units and Detailed Syllabus

UN	Detailed Syllabus of the Unit	CR
1-1	**Semiconductor Diodes:** Basic concept of p-n junction diode, Types of Diodes, Photo Diode, Solar Cell, LED, Varactor Diode, Zener Diode, Silicon Controlled Rectifier, Photo Transistor.	CR 01
1-2	**Transistors:** Construction and V-I characteristics of BJT, Construction and V-I characteristics of UJT, Construction and V-I characteristics of JFET, Construction and V-I characteristics of MOSFET.	
1-3	**Power Supplies:** Rectifiers, Voltage regulator, Zener Diode Regulated Power Supply, Electronic series regulated power supply, IC voltage regulator, Switching mode power supplies.	
1-4	**Feedback Amplifier:** Concept of feedback, Feedback Amplifier, Advantages of Negative feedback Amplifier, General characteristics of negative feedback amplifier, Classification of feedback amplifiers.	
1-5	**RC Coupled Amplifier and its frequency Response:** Types of Amplifiers, Transistor as an Amplifier, Single Stage RC Coupled Transistor Amplifier, Frequency response, Applications of RC coupled Amplifier.	
1-6	**Oscillators(Using Transistors):** Oscillatory Circuit, Positive feedback amplifier-Oscillator mechanism, Bark Hausen criterion, Classification of Transistor oscillators, Phase Shift	

	Oscillator, Colpitt's Oscillator, Hartley Oscillator.	
1-7	**Multivibrators (Using transistor):** Astable Multivibrator, Frequency of Oscillations, collector coupled astable multivibrator, gated astable multivibrator, Schmitt Trigger, Application of Schmitt Trigger.	
2-1	**Operational Amplifier and It's Characteristics Parameters:** Operational feedback, Block Diagram of Op-Amp, Characteristics of Op-Amp, Op-Amp Parameter and specification.	
2-2	**Operational Amplifier Configurations:** inverting configuration, The Miller effect, Non-inverting configuration, comparison between the two configurations.	
2-3	**Operational Amplifier – Frequency:** Open- loop Frequency response, Closed loop frequency response, Stability of Op-Amp.	**CR 02**
2-4	**Operational Amplifier- Linear Application:** Summing Amplifier, Integrator, Differentiator, Basic Comparator, Solving of second order differential equation.	
2-5	**Operational Amplifier- Non-Linear Applications:** Half-Wave Precision rectifier, Full-Wave Precision Rectifier, Logarithmic Amplifier, Exponential Amplifier, Differential Amplifier.	
2-6	**Operational Amplifier- Waveform Generators:** Sine Wave Generator, Square Wave Generator, Triangular Wave Generator.	
3-1	**Introduction To Digital Electronics and Logic Gates:** Boolean Algebra, Logic system, De'Morgan's Theorem/Laws, Duality Theorem, NAND gate, NOR gate, Universal Building Blocks, The exclusive- OR gate.	
3-2	**Application of Exclusive-OR Gate:** Half-Adder, Full-Adder, Parallel Adder, Subtractors, Adders/ Subtractor, Parity checker/ Generator, Binary-Gray code converters.	
3-3	**De-Morgan's Theorem, Fundamental Products, K-Map:** Postulate of Boolean Algebra, De-Morgan's Theorems, Fundamental Products and fundamental sums, Canonical form, Standard forms, Karnaugh Map, K-Map simplification.	**CR 03**
3-4	**Flip-Flops:** Types of Flip-Flops, RS Flip-Flops, Clocked RS Flip-Flop, D- Flip-Flop, JK Flip-Flop, T- Flip-Flop.	
3-5	**Shift Registers:** serial-in/Serial-out Register, Parallel-In-Serial-Out Shift register using D flip-flops, Serial-In-Parallel-Out Shift register, Parallel-In-Parallel-Out register, Ring Counter, Applications.	
3-6	**Counters:** Ripple counters, MOD-8 counter, MOD-7 counter, MOD-5 counter, Mod-3	

	counter, Mod-16 counter, MOD-10 counter.	
3-7	**Multiplexers and Demultiplexer:** Multiplexer, Demultiplexer, BCD to &-segment displays, Binary Coded Decimal, BCD to &-segment decoders, BCD to Decimal decoders, Binary decoders.	
4-1	**Digital-to-Analog (D/A) Converters:** D/A converters, Variable Resistor Network, Binary Ladder network, Resolution, Accuracy, Linearity, Setting Time**.**	**CR 04**
4-2	**Analog-to-Digital (A/D) Converters:** A/D converters, Quantization, Flash method, Counter method, Dual-Slope technique, Successive Approximation converter, Accuracy, Resolution.	

Learning Resource Details

LR Code	Title Author	Edition Year	ISBN Publisher
Text-Books			
PHY014-T01	Semiconductor Devices Analog and Digital Electronics - Prof. G. T. Naidu - Dr. B. Rama Murthy - Mrs. V. Rama - Mr. L. Anjaneyulu - Dr. G. Pushpa Chakrapani	2017	BRAOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
PHY014 –RB1			
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
PHY014-CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
PHY014-WL1			

PHY015: Heat and Acoustics

Course Information

Year	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
01	PHY015	Heat and Acoustics	2	8	120	10	40	50	P

Presumed Knowledge and Learning Objectives

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: • BSc with Physics or Mathematics or equivalent from a recognized University/Board.	After successful completion of this course, student should be able to • Understand the various concept of Heat and thermodynamic • Understand the various concept of Acoustics

Units and Detailed Syllabus

UN	Detailed Syllabus of the Unit	CR
1-1	**Errors:** In this experiment we will learn about errors in measurements and also estimate the best value of a quantity measured.	CR 01
1-2	**Thermal conductivity of a bad conductor- Lee's Method:** To determine the coefficient of thermal conductivity of a bad conductor using Lee's Method.	
1-3	**Determination of melting point of Wax – thermo E. M. F. diagram Potentiometer:** To determine determination of melting point of Wax using thermo E. M. F. diagram with help of a Potentiometer.	
1-4	**Study of Variation of Specific Heat of Graphite with Temperature:** To study the Variation of specific heat of graphite with Temperature.	
1-5	**Stefan's Constant:** To determine the Stefan's Constant.	
1-6	**Coefficient of Viscosity – Meyer's Formula:** To determine the Coefficient of Viscosity of liquid (say water) by oscillating disc method using Meyer's Formula.	
2-1	**Elastic Constants of the Material of a Spiral Springs:** To determine the elastic constants of the material of a spiral springs.	CR 02
2-2	**Energy Gap of a Semi-Conductor:** To determine the energy gap of a semi-conductor.	
2-3	**Ultrasonic Velocity in Liquids Debye – Sears Method:** To determine the Velocity	

	Ultrasonic waves in different Liquids by Debye – Sears Method.
2-4	**Ultrasonic Velocity in Liquids Ultrasonic Interferometer Method:** To determine the velocity of ultrasonic waves in different liquids and liquids mixtures using ultrasonic interferometer method.
2-5	**Fibre Optics – Determination of Numerical Aperture and Losses:** To determine the numerical aperture of the optical fibre and the losses in optical fibre due to cable, coupling, bending, air gap, etc.,
2-6	**Fibre Optics – Conversion of Electrical to Optical and to Electrical Signal:** To study the relationship between LED DC forward current and LED optical output power and determine the linearity of the LED.

Learning Resource Details

LR Code	Title Author	Edition Year	ISBN Publisher
Text-Books			
PHY015-T01	Heat and Accoustics - Dr. B. Appa Rao - Prof K. Gnana Prasuna - Dr. V. V. Subrahmanya Sharma	2009	BRAOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
PHY015 –RB1			
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
PHY015 -CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
PHY015-WL1			

PHY016: Optics

Course Information

Year	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
01	PHY016	Optics	2	8	120	10	40	50	P

Presumed Knowledge and Learning Objectives

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: • BSc with Physics or Mathematics or equivalent from a recognized University/Board.	After successful completion of this course, student should be able to • Obtain the interference pattern of light experimentally by using Young's double slit, Bi-prism, Lloyd's mirror • Demonstrate different methods to obtain steady interference pattern. • Understand the term monochromatic, coherence, coherent sources, incoherent sources, coherent waves, incoherent waves.

Units And Detailed Syllabus

UN	Detailed Syllabus of the Unit	CR
1-1	**Biprism – λ of Sodium Light:** To determine the wavelength λ of a sodium light using biprism.	CR 01
1-2	**Biprism – Thickness of a Thin Mica Sheet:** To determine the thickness of a Thin Mica Sheet using Biprism arrangement.	
1-3	**Cauchy's Constant:** To study the variation of refractive index of the material of the prism with wavelength and to verify Cauchy's dispersion relation.	
1-4	**Determination of Wavelength and Difference in Wavelength of Sodium Source using Michelson Interferometer:** To determine the wavelength of sodium light using Michelson Interferometer.	
1-5	**Y – of a Glass Plates – Newton's Rings' Method:** To determine the Young's modulus of the glass (taken in the form of a bar) using Newton's Rings' Method.	
1-6	**Determination of Photoelastic Constant of Transparent Material:** To study the Photoelasticity of a Transparent Material.	

2-1	**Study of Dispersion Spectra - Double Refraction:** To study the Dispersion Spectra of a prism made of double refracting material such as quartz or calcite.	**CR 02**
2-2	**Verification of Malus Law:** To verify Malus Law.	
2-3	**Determination of Wavelength of Laser Using Diffraction Grating:** To determine the wavelength of a given Laser Using Diffraction Grating.	
2-4	**Hart Mann's Dispersion Formula:** To verify Hartmann's Dispersion Formula using constant deviation spectrometer or ordinary spectrometer.	
2-5	**Study of Led Characteristics And Determination of Plank's Constant:** study of I-V Characteristics of light emitting diode (LED) and determination of Planck's constant (h).	
2-6	**Determination of Rydberg Constant:** To find the Rydberg Constant using sodium emission lines.	

Learning Resource Details

LR Code	Title Author	Edition Year	ISBN Publisher
Text-Books			
PHY016-T01	Optics - Dr. B. Appa Rao - Dr. G. Bhikshamaiah - Dr. V. V. Subrahmanya Sharma	2008	BRAOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
PHY016 -RB1			
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
PHY016 -CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
PHY016-WL1			

PHY017: Basic Electronics

Course Information

Year	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
01	PHY017	Basic Electronics	2	8	120	10	40	50	P

Presumed Knowledge and Learning Objectives

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: • BSc with Physics or Mathematics or equivalent from a recognized University/Board.	After successful completion of this course, student should be able to • Explain the construction of transistor. • Recall the characteristics of transistor.

Units and Detailed Syllabus

UN	Detailed Syllabus of the Unit	CR
1-1	**Power Supplies:** To construct a dc power supply using half wave, full wave and bridge rectifiers.	CR 01
1-2	**Zener Diode As A Voltage Regulator:** To construct an inexpensive Voltage Regulator with a Zener Diode and study its line and load regulation.	
1-3	**RC – Coupled Amplifier:** To construct RC – Coupled Amplifier (CE configuration) and study its frequency response for different collector (load) resistance. Plot the response curve and estimate gain, band-width product.	
1-4	**RC - Phase Shift Oscillator:** To construct a RC - Phase Shift Oscillator and study its frequency of oscillations.	
1-5	**Colpits Oscillator:** To construct and study the Colpits Oscillator and its frequency response for various values of d & L of the 'tank' circuit of the oscillator.	
1-6	**Operational Amplifier (OP – AMP) Characteristics:** To study the Characteristics of an Operational Amplifier (OP – AMP).	
2-1	**Operational Amplifier (OP – AMP) As An Inverting And Non – Inverting Amplifier:** To study the Operational Amplifier as an inverting & Non – Inverting Amplifier.	CR 02
2-2	**Wein Bridge Oscillator:** To construct a Wein Bridge Oscillator and study its response by changing its resistance and capacitance Values of the Bridge.	

2-3	**Triangular Wave Generator:** To construct a Triangular Wave Generator using Operational Amplifier IC 741	
2-4	**Schmitt Trigger Using IC 741 (OP – AMP):** To measure the Upper triggering point (UTP) and Lower triggering point (LTP) of an OP – AMP Schmitt Trigger.	
2-5	**Astable Multivibrator Using IC 555:** To construct an Astable Multivibrator Using IC 555(timer) and calculate its frequency and percentage of duty cycle.	
2-6	**Monostable Multivibrator Using IC 555:** To construct a Monostable Multivibrator Using IC 555 and generate different pulse widths.	

Learning Resource Details

LR Code	Title Author	Edition Year	ISBN Publisher
Text-Books			
PHY017-T01	Basic Electronics - Dr. B. Rama Murthy - Dr. N. Lalithakumari - Ms. V. Rama		BRAOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
PHY017 –RB1			
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
PHY017 -CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
PHY017-WL1			

PHY018: Digital Electronics and Computers

Course Information

Year	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
01	PHY018	Digital Electronics and Computers	2	8	120	10	40	50	P

Presumed Knowledge and Learning Objectives

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: • BSc with Physics or Mathematics or equivalent from a recognized University/Board.	After successful completion of this course, student should be able to • Explain methods of analogue and digital measurement. • Distinguish between analogue circuit and digital circuit. • Recall the general number system.

Units and Detailed Syllabus

UN	Detailed Syllabus of the Unit	CR
1-1	**Verification of Boolean And Demorgan Theorem:** To verify Boolean And De-morgan's laws using IC's.	CR 01
1-2a	**Half Adder / Half Subtractor:** To construct an Half Adder / Half Subtractor circuit and test it.	
1-2b	**Full – Adder:** To construct a full Adder circuit and test it.	
1-3	**Verification of Flip – Flops:** To verify (a) S-R latch using NAND gates, (b) D flip-flop, (c) Master- Slave J-K flip-flop.	
1-4	**Implementation of Ring Counter And Johnson Counter:** To verify Ring Counter And Johnson Counter using IC 7474 (D flip-flops)	
1-5	**Counter (Part – A):** To construct an asynchronous (Ripple) counter using IC 7493, Mod 16 and Mod 8 counters.	
1-6	**Decade Counter:** To design a circuit to display the number from 0-9on seven segment display by using Ic7447 & IC 7490.	
1-7	**Digital to Analog Converter:** To design a circuit to convert Digital information into Analog information using IC 0808/IC 0800.	

2-1	**Crystal Oscillator:** To design a circuit diagram and to obtain frequency 200KHz and 20KHz from 2MHz crystal.	**CR 02**
2-2	**History of The 'C' Programing Language.**	
2-3	**Evaluation of Function:** Programme to find evaluation of Function Sin(x), Cos(x), and log(x).	
2-4	**Evaluation of Determinant of Matrix:** Programme to find determinant of Matrix and Matrix multiplication.	
2-5	**Solution of Non – Linear Equations:** Programme to implement Newton Raphson Algorithm to find the root of the equation.	
2-6	**Numerical Integration:** Programme to implement Trapezoidal method and Simpson's rule.	
2-7	**Solution For Differential Equations:** Programme to solve the ordinary Differential Equation for a particular value of x by EULERS METHOD.	
2-8	**Solutions TO System of Linear Equations:** Programme to find solution of system of linear Equation by GAUSS- ELIMINATION METHOD.	

Learning Resource Details

LR Code	Title Author	Edition Year	ISBN Publisher
Text-Books			
PHY018-T01	Digital electronics and computers - Prof. K. Madhukar - Dr. B. B. Rama Murthy - Dr. N. Lalithakumari - Ms. V. Rama	--	BRAOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
PHY018 –RB1			
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
PHY018 -CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
PHY018-WL1			

Year 02

PHY021: Nuclear Physics and analytical techniques

Course Information

Year	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
02	PHY021	Nuclear Physics and Analytical Techniques	4	8	120	20	80	100	T

Presumed Knowledge and Learning Objectives

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: • BSc with Physics or Mathematics or equivalent from a recognized University/Board.	After successful completion of this course, student should be able to • Understand the various concept of nuclear physics. • Apply the different analytical techniques.

Units and Detailed Syllabus

UN	Detailed Syllabus of the Unit	CR
1-1	**Alpha Spectrum, Gamow's Theory of α- Decay:** Fine Structure of α- spectrum, Range of α-particles, Range- Energy (velocity) relationship, Geiger- Nuttal law, Gamow's theory of α-decay, α- particle energies and selection rules, Limitations in theory.	CR 01
1-2	**Beta Spectrum Neutrino Hypothesis, Fermi Theory of α- decay, Fermi- Kurie Plots, Selection rules for β- decay:** β- spectrum and features, Neutrino hypothesis, Fermi theory of β- decay, Fermi- Kurie plots, selection rules for β- decay.	
1-3	**Gamma Emission- Multiple Radiation- Selection rules for γ- decay:** Radiation transition in Nuclei, General features, Multipolarity in Gamma transitions, selection rules, Transition rate.	
1-4	**Classification of Elementary Particles- Fundamental Interactions- Conservation laws:** Discovery of Elementary particles, Fundamental Interactions, (Gravitational, Electromagnetic, Weak, Strong), Classification of elementary particles (Hadrons, Leptons, Photons), Conservation laws (Exact laws, Approximation laws).	
1-5	**Interaction of Charged Particles and Gamma Radiation with matter:** Interaction of charged particles with matter (Bohr's formula, Bethe's modification, Stopping power, Range- Energy relation, Straggling), Bremsstrahlung, Interaction of γ- radiation with matter (Photo- electric effect, Compton effect, Pair production).	
1-6	**Radiation Detectors:** Radiation detectors (Scintillation detectors, Solid state detectors,	

	Nuclear emulsion techniques).	
2-1	**Properties of Nucleus, Nuclear Radius, Nuclear Mass and Binding Energy, Angular Momentum, Nuclear Statistics, Parity and Symmetry, Magnetic Dipole moment, Electric Quadrupole moment:** Nuclear Radius, Nuclear mass and binding energy, Angular momentum, Nuclear statistics, Parity and symmetry, Magnetic dipole moment, Electric quadrupole moment.	**CR 02**
2-2	**Nature of Nuclear Forces, Two Body Problem, Bound and Spin States of Two Nucleons, Theory of Deuteron, Tensor Forces, Exchange Forces, Meson Theory of Nuclear Forces:** Nature of nuclear forces, Two body problem (Bound and Spin States of Two Nucleons, Theory of Deuteron), Tensor Forces, Exchange Forces, Meson Theory of Nuclear Forces.	
2.3	**Nuclear Model:** Liquid drop model, Semi empirical mass formula (Formula for the total binding energy of a nucleus, Weizsacher's semi empirical formula, Values of the empirical coefficients).	
2.4	**Shell Model:** Shell Model (Experimental evidence, Predictions, Achievements of the shell- model).	
3-1	**Types of Nuclear Reactions:** Types of nuclear reactions, Conservation laws, Kinematics of nuclear reaction (Expression for Q-value, Threshold energy and endoergic reaction, Double valued function of the projectile), Nuclear cross section, Compound nucleus, Discrete energy levels of nucleus; Breit –Wigner formula.	**CR 03**
3-2	**Basic Properties of Neutrons:** Basic properties of neutrons, Classification of neutrons, sloe=wing down of neutrons, Logarithmic decrement in energy, Moderating ratio, Neutron Diffusion- Neutron current density, Neutron leakage rate, Fermi age equation, Bohr and Wheeler theory of fission, Four-Factor formula.	
4-1	**Phase Contrast Microscopy, Scanning Electron Microscope, Transmission Microscope:** Phase contrast microscopy introduction, Principle, Theory, Instrumentation, Applications, Electron microscopy, Principle, Scanning Electron Microscope, Transmission Electron Microscope, Application of Electron Microscopes, Advantages of SEM over TEM.	
4-2	**Thermogravimetric analyzer, Principle, Instrument Control, applications, Differential Scanning Calorimetry, Principle, Instrumentation, Power Compensated DSC, Heat flux DSC, Temperature control methods, The average Temperature control , Differential Temperature control :** Thermogravimetric analyzer (TGA), Principle, Instrumentation- the balance, the furnace, Instrument Control, applications, Differential Scanning Calorimetry (DSC), Principle, theory, Instrumentation, Power Compensated DSC, Heat flux DSC, Temperature control methods- The average Temperature control , Differential Temperature control, Application.	

4-3	**Theory of Mossbauer Effect: Recoil-less Emission and Absorption of Gamma Rays – Nuclear Resonance, Experimental Technique to Observe Mossbauer Effect, Mossbauer Nuclides:** Theory of Mossbauer Effect: Recoil-less Emission and Absorption of Gamma Rays – Nuclear Resonance, Experimental Technique to Observe Mossbauer Effect, Mossbauer Nuclides	
4-4	**Mossbauer Parameters – Isomer Shift, Quadrupole Splitting, Magnetic Hyperfine Splitting(Qualitative Treatment) Simple applications:** Isomer Shift and Application, Quadrupole Splitting and Application, Magnetic Hyperfine Splitting and applications.	
5-1	**NMR Theory – Simple and classical, Relaxation Mechanism – Spin – Spin and Spin – Lattice:** NMR Probes, Nobel Prizes and various branches of magnetic resonance, NMR Theory- Introduction, Simple treatment of Nuclear Magnetic Resonance, Classical treatment of Nuclear Magnetic Resonance, Relaxation Mechanism- Introduction, Spin – Lattice, Spin –Lattice Relaxation time, Spin – Spin, Line width of NMR Line, Application of T_1 &T_2 measurements.	CR 04
5-2	**Bloch Equations, Complex Susceptibility, NMR Instrumentation Related to Absorption and Induction Techniques, Chemical Shift, Spin – Spin Coupling, Ethyl and Methyl Alcohol NMR Spectra, Major Areas of NMR:** Bloch Equations, Bloch Complex Susceptibility, NMR Spectrometers**:** Introduction –(i) Absorption type and (ii) Induction Type, Chemical Shift, Spin – Spin Coupling: Introduction – Origin of Chemical Shift, Measurement of Chemical Shift - Ethyl and Methyl Alcohols, Contributions to screening constant, Spin – Spin Coupling- NMR Spectra of ethyl and Methyl Alcohol, Coupling between several hydrogen nuclei, Chemical exchange, Pure ethyl Alcohol Spectrum under High resolution, Methyl Alcohol and Acetaldehyde, Major Areas of NMR	
5-3	**Principles of ESR, Conditions For Resonance, ESR Spectrometer, Interpretation of Spectra, Hyperfine Interaction, Applications of ESR:** Origin of Electron Paramagnetism, Orbital magnetic moment, Spin Magnetic moment, Electron Spin Resonance Phenomenon, ESR Spectrometer- Working of the ESR Spectrometer, Fine Structure (Electron – Electron Coupling), Hyperfine Interaction – (i) Dipole – Dipole Interaction, (ii) Contact Hyperfine Interaction, Super Hyperfine Interaction, Nuclear Quadrupole moment effects, Variation of *g*- (a)Spin – Orbit Interaction, (b) Orbital hybridization, Some Applications of ESR	
5-4	**Nuclear Quadrupole moment, Electric field Gradients, Nuclear Quadrupole resonance, energy levels in Different EFG Symmetries, NQR Spectrometer, Applications, Review on NMR, ESR and NQR:** Nuclear Quadrupole moment, Electrified Gradients, Nuclear Quadrupole resonance, energy levels in Different EFG Symmetries, NQR Spectrometer, Applications, Review on NMR, ESR and NQR	

Learning Resource Details

LR Code	Title Author	Edition Year	ISBN Publisher

Text-Books			
PHY021-T01	Nuclear Physics and analytical Techniques - Dr. V. Komalamba - Prof. N. Manohara Murthy - Prof. C. Nageshwara Rao	2009	BRAOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
PHY021 –RB1			
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
PHY021 -CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
PHy021-WL1			

PHY022: Electromagnetic theory and spectroscopy

Course Information

Year	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
02	PHY022	Electromagnetic Theory and Spectroscopy	4	8	120	20	80	100	T

Presumed Knowledge and Learning Objectives

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: • BSc with Physics or Mathematics or equivalent from a recognized University/Board.	After successful completion of this course, student should be able to • Understand Electromagnetism. • Understand the different spectroscopic techniques.

Units and Detailed Syllabus

UN	Detailed Syllabus of the Unit	CR
1-1	**Electrostatic field:** Electrostatic field and potential, Poisson and Laplace Equation, Work & energy, Electrostatic field in matter	CR 01
1-2	**Magneto statics:** Magneto statics, Magneto Vector Potential, Magneto statics Boundary Conditions, Magnetic field in matter, Magneto statics Energy	
1-3	**Electro dynamics:** Maxwell's Equation in Vacuum, Maxwell's Equation in Conducting Media, Energy transport By EM waves, Poynting Theorem	
1-4	**EW waves in matter:** Propagation in Linear media, Reflection & Transmission at normal incidence, Reflection & Transmission at Oblique incidence, Polarization parallel to plane of incidence, Polarization normal to plane of incidence	
1-5	**Electromagnetic radiation:** Retarded Potentials, Radiation from an Oscillating Dipole- (i) Radiation Pattern- Intensity Profile, (ii) Magnetic Dipole Radiation, (iii) Electric Quadruple Radiation	
1-6	**Lienard - Wiechert potentials:** Radiation from Accelerated Charges, Fields of an Accelerated Point charge	
1-7	**Radiated power:** Power Radiated by a Charge, Radiation Resistance, Centre-led Linear Antennas	

2-1	**Fine structure:** Orbital magnetic dipoles, Spin magnetism, Spin – orbit coupling-(i) Spin – orbit coupling in the Bohr model (ii) Spin – orbit coupling beyond the Bohr model, The total angular momentum, Evaluation of the spin- orbit energy for the Hydrogen, Selection rule for the LS coupling, Spin – orbit coupling in alkali atoms, Nuclear effects in atoms- (i) Isotope Shifts, (ii) Hyperfine Sturecture	
2-2	**Zeeman , Paschen-back and Stark effects:** Zeeman effects, Paschen-back effects and Stark effects	**CR 02**
2-3	**Vector atom model L-S and J-J coupling of two electron states:** Vector atom model, The L-S and J-J coupling	
2-4	**Two electron system , Lande 'G' Factor:** Lande 'g' Factor in L-S coupling, Lande 'g' Factor in j-j coupling, Zeeman effect for two electron system,	
3-1	**Rotational spectra of diatomic molecules:** Rotational spectra, The molecule as a rigid rotator, Observed Rotational spectra and energy level, Isotopic effect of Rotational levels	
3-2	**Vibrational spectra:** Vibrational energy of a diatomic molecule, Observed Vibrational – Rotational spectrum, Vibrational Course structure, Vibrational analysis of band systems	
3-3	**Electronic spectra:** Electronic spectra, Resolution of the total energy, The Born – Oppenheimer Approximation, Vibrational Isotopic effect	**CR 03**
3-4	**Franck-Condon principle , dissociation Enalgies:** Rotational fine structure of Electronic spectra, the Fortrat Parabolae, Franck-condon principle, Dissociation energies, Deslandres Table of Vibrational Bands, Progressions & Sequences	
3-5	**Franck Condon principle:** Features of Electronic spectra, Electronic transitions, Intensity Distribution of spectra : Franck condon principle, dissociation Energies	
4-1	**Principle of IR spectroscopy , IR double beam spectrometer:** Principles of IR spectroscopy, IR Double beam spectrometer, Vibrations of Polyatomic molecules	
4-2	**Raman scattering:** Theory of Raman scattering, Classical Theory of Raman scattering, Quantum Theory of Raman scattering, Polarization of Raman scattered Light	**CR 04**
4-3	**Rotational and vibrational Raman spectra:** Rotational Raman spectra, vibrational Raman spectra, vibrational Raman spectra CO_2	
4-4	**Laser Raman spectrometer , differences between IR and Raman spectra:** Laser Raman spectrometer, differences between IR and Raman spectra	

Learning Resource Details

LR Code	Title Author	Edition Year	ISBN Publisher
Text-Books			
PHY022-T01	Electromagnetic Theory and Spectroscopy - Prof. B. K. Naidu - Prof. G. T. Naidu - Dr. G. Prasad	2010	BRAOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
PHY022 –RB1			
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
PHY022 -CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
PHY022-WL1			

PHY023: memory devices and microprocessors

Course Information

Year	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
02	PHY023	Memory Devices and Microprocessors	4	8	120	20	80	100	T

Presumed Knowledge and Learning Objectives

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: • BSc with Physics or Mathematics or equivalent from a recognized University/Board.	After successful completion of this course, student should be able to • Understand the different logic families and their application • Understand the function of Memory devices and Microprocessor

Units and Detailed Syllabus

UN	Detailed Syllabus of the Unit	CR
1-1	**Logic families and their performance characteristics:** Saturated and Unsaturated logic circuits, Performance characteristics, Resistance- Transistor logic circuit (RTL), Diode-Transistor Logic circuit (DTL), Transistor – Transistor Logic Circuit(TTL), Integrated Injection Logic (I^2L)	
1-2	**Emitter coupled logic (ECL , PMOs, CMOs logic and Tri state logic):** Emitter Coupled Logic (ECL), PMOS Logic, NMOS Logic, CMOS Logic, Tristate Logic	
1-3	**Comparisons of logic families:** Input and Output Logic level, Noise Immunity, Noise Margin, Fan Out, Propagation Delay, Comparison of Logic Families	**CR 01**
1-4	**Classification and characteristics of memories:** Memory Terminology, Memory Architecture, RAM (SRAM,DRAM), ROM (Diode ROM, PROM, EPROM, EEPROM, Flash Memory)	
1-5	**Memory organization and expansion:** Memory Organization and Expansion, 8155- RAM, 6116-RAM, 8355-ROM, 2716-EPROM	
2-1	**Micro Processor organization and architecture:** Evolution of Microprocessors, CPU(Central Processing Unit), Memory, Input Devices, Output Devices, Microprocessor Applications, Microprocessor (Intel 8085) Architecture	**CR 02**

2-2	**Pin configuration of Intel 8085 Microprocessor:** Pin Configuration of 8085 Microprocessor, Interrupts, Serial input and output	
2-3	**Timing diagrams:** Instruction Cycle (Fetch Operation, Execute Operation), Instruction and Data Flow, Timing Diagrams (Timing Diagram for Opcode Fetch Cycle, Memory Read, I/O Read, Memory Write, I/O write)	
2-4	**Addressing modes and instruction set of Intel 8085:** Instruction and Data Formats, Addressing modes (Direct Addressing, Register Addressing, Register Indirect Addressing, Immediate Addressing, Implicit Addressing), Symbol	
2-5	**Programming of Micro Processor Intel 8085:** Machine Language, Assembly Language, Assembly Language Programs(Simple Programs), Addition of two 8bit numbers, 8 bit subtraction, Decimal addition of two 8 bit numbers, Addition of 16 bit numbers, 8 bit decimal subtraction, one's compliment of 8 bit numbers, one's compliment of 16 bit numbers, making of LSBs of 8 bit numbers, Making of MSBs of 8 bit number, word Disassembly	
2-6	**Assembly language programming using loops:** To find the smaller of two numbers, To find the larger of two numbers, Block movement of data, Find the largest number in an array, To find the smallest number in an array, Sum of series of 8 bit numbers, sum of series of decimal numbers, multibyte addition	
3-1	**I/O interfacing & data transfer schemes:** Types of input/ output (I/O), Memory mapped, Isolated I/O, I/O Handshaking, Classification of data transfer methods/ schemes, Synchronous Data transfer scheme, Asynchronous transfer, Interrupt Driven data transfer, Direct Memory Access (DMA) data transfer scheme, serial data transfer	
3-2	**Intel 8053 programmable interval timer:** Pin diagram of 8253, Functional blocks of 8253, System interface, Programming the 8253, operating modes, Mode0 (Terminal count), Mode1(Programmable one shot), Mode2(rate generator/ Divide by n counter) , Mode3 (Square wave generator), Mode4 (Software trigger strobe), Mode5(Hardware Trigger Strobe)	**CR 03**
3-3	**Programmable peripheral interface (8255):** Pin diagram and description of signals, Functional blocks of 8255, Group A and Group B control, Operating modes of 8255, Special mode combination consideration	
3-4	**Priority interrupt controller(8259):** Pin description of 8259, Functional blocks of 8259, Interrupt sequence, Programming o 8259 (Initialization command words, Operation command word), reading the 8259 status	

4-1	**Intel 8086 microprocessor:** General organization of microcomputer, architecture of Intel 8086 Microprocessor, Programming model of 8086, Generating physical memory address	CR 04
4-2	**Addressing modes and instruction set of Intel 8086 microprocessor:** Addressing modes of 8086, Instruction set of 8086, Assembly Language programming Examples of 8086	
4-3	**Pin configuration of Intel 8086 microprocessor:** Pin configuration of 8086 Microprocessor, Maximum and minimum modes	
4-4	**Architecture of Micro Processor 80286, 80386 , 80486:** Architecture of 80286 Processor, Architecture of 80386 Processor, real address mode, Protected virtual address mode, paging mode, Virtual 8086 mode, Architecture of 80486 Processor	
4-5	**The Pentium microprocessor:** Architecture of Pentium processor, Architecture of Pentium pro microprocessor, Comparison of 80X86 Processor	

Learning Resource Details

LR Code	Title Author	Edition Year	ISBN Publisher
Text-Books			
PHY023-T01	Memory Devices and Microprocessors - Dr. B. Rama Murthy - Dr. Aruna Mani - Prof. K. Madhukar - Prof. B. Punya Sheshudu	2010	BRAOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
PHY023 –RB1			
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
PHY023 -CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
PHY023-WL1			

PHY024: Microwave Devices and Communication Systems

Course Information

Year	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
02	PHY024	Microwave Devices and Communication Systems	4	8	120	20	80	100	T

Presumed Knowledge and Learning Objectives

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: • BSc with Physics or Mathematics or equivalent from a recognized University/Board.	After successful completion of this course, student should be able to • Understand the basic concept of Microwave devices • Understand the various function and application of different communication systems

Units and Detailed Syllabus

UN	Detailed Syllabus of the Unit	CR
1-1	**Passive devices- wave guides:** Reflection of from a conducting plane, Parallel plane wave guide	CR 01
1-2	**Cut-off wave length:** Cut off wavelength, Group and phase velocities in waveguides	
1-3	**Rectangular wave guides:** Rectangular wave guides (Transverse magnetic waves, cut-off wavelength of TM mode, field pattern of TM waves, Transverse electric waves, Field pattern of TE waves), Circular waveguides (TM waves in cylindrical guide, field configuration of TM waves, TE waves in cylindrical waveguides, field configuration of TE waves), Application	
2-1	**Scattering matrix:** Need of S- parameters, Scattering matrix formulation, Properties of S-matrix, Scattering matrix for loss less junction, Scattering matrix for a two- port junction (Shunt element in a transmission line, S-matrix for series element in the transmission line)	
2-2	**s- matrix of e-plane H-plane and magic tee:** E-plane tee (series tee), scattering matrix of E plane tee, H-plane tee (shunt tee) junction, scattering matrix of H plane tee, Magic tee (Hybrid tee), scattering matrix of magic tee, Application of magic tee	

3-1	**Wave guide components:** Directional couplers (Two hole directional coupler, scattering matrix of a directional coupler), Hybrid rings, Terminations	CR 02
3-2	**Phase shifters:** Phase shifters (Rotary rotation and its applications), Faraday rotation and its applications (Gyrator, Isolator, Circulator)	
4-1	**Microwave semiconductor devices:** Negative Resistance devices (Tunnel diode, Avalanche transit- Time devices, IMPATT diodes, TRAPATT diodes, BARITT diodes)	
4-2	**Parametric devices:** Manley- Rowe power relations, Parametric Amplifier (Parametric up converter, parametric down converter)	
5-1	**Two cavity Klystron:** Two cavity klystron, Expression for velocity modulation, Bunching process, Output power and efficiency	CR 03
5-2	**Magnetron:** Introduction, Magnetron	
5-3	**Travelling wave tube (TWT):** Introduction, Travelling wave tube(TWT)	
6-1	**Modulation:** Usefulness of modulation, Amplitude modulation**(**AM**),** Linear modulation methods, Transistor collector modulation, Square law modulation methods, Frequency modulation(FM), frequency modulation theory, Generation of frequency modulation, Reactance tube method, Transistor reactance modulator, Comparison of frequency and amplitude modulation, Amplitude modulation, Frequency modulation	
6-2	**Demodulation:** Demodulation of amplitude modulated signals, square law detection, Linear detectors, Demodulation of FM signals slope detector, Stagger tuned discriminator, Foster seeley discriminator	
7-1	**Antenna fundamentals:** Antenna fundamentals, Antenna theorems, Radiation pattern, Directivity(D), Gain(G) of an Antenna, Antenna Impedance, Effective area (OR) Effective aperture (OR) Capture area, Effective length of an antenna	CR 04
7-2	**VHF antennas:** Reflector type antenna, Loop antenna, Radiation resistance of loop antenna, Helical antenna, Yogi- Uda antenna, Slot antenna	
7-3	**Microwave antennas:** Parabolic reflector, Focusing by a parabolic reflector, operation of parabolic reflector, beam width and directivity, Horn antennas, Lens antennas, Dielectric lenses, Metal lenses	
8-1	**Radars 184:** Basic RADAR system, RADAR Range equation	
8-2	**Types radar:** CW Radar, MTI Radar	

8-3	**Tracking radar:** Sequential lobing, Conical scan, Monopulse Tracking amplitude comparison mono pulse, Comparison of trackers	

Learning Resource Details

LR Code	Title Author	Edition Year	ISBN Publisher
Text-Books			
PHY024-T01	Microwave Devices and Communication Systems - Prof. M. Anjan Reddy - Prof. R. Sayanna - Prof. C. Vishnuvaradhan Reddy - Prof. D. Sureshbabu - Dr. Md. Shareefuddin	2010	BRAOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
PHY024 –RB1			
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
PHY024 -CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
PHY024-WL1			

PHY025: Spectroscopy

Course Information

Year	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
02	PHY025	Spectroscopy	2	8	120	10	40	50	P

Presumed Knowledge and Learning Objectives

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: • BSc with Physics or Mathematics or equivalent from a recognized University/Board.	After successful completion of this course, student should be able to • Understand the different spectroscopic techniques

Units and Detailed Syllabus

UN	Detailed Syllabus of the Unit	CR
1-1	**Study of The Band Spectra:** Aim is to photograph the band spectrum of aluminum oxide and to study the vibrational structure of the Al-O bands by constructing Deslander's tables.	CR 01
1-2	**Raman Effect:** To photograph the Raman spectra of organic liquids and to find out the Raman shifts in each case.	
1-3	**Zeeman Effect:** To photograph the Zeeman spectra.	
1-4	**Hall Effect:** To determine (a) Hall coefficient, (b) The carrier charge density, (c) whether the semiconductor is n- type or p- type.	
1-5	**Magnetic Susceptibility "Gouy's Method":** To determine Magnetic Susceptibility of given paramagnetic solid by Gouy's Method.	
1-6	**ESR Spectrometer:** To determine the Lande's g-factor using electron spin resonance.	
2-1	**Electrical Conductivity of a Solid Variation With Temperature (Four Probe Method):** To measure the resistance of semiconductor at various temperatures and to determine the energy band gap of the given semiconducting material.	CR 02
2-2	**Laue Spots:** To interpret Laue photograph and to index a given cubic crystal.	
2-3	**Powder Pattern:** To index the given x-ray powder diffraction pattern and to determine the unit cell dimensions, interpalnar spacing.	

2-4	**Study of B – H Curve:** To study the hysteresis loop and to determine the hysteresis loss of a ferrite.	
2-5	**Thermal Study Of Magnetic Permeability of Ferrite (Toroid):** To determine curie Temperature of a Ferrite in the shape of toroid.	
2-6	**Determination of Curie Temperature of Ferroelectric Material**: To determine Curie Temperature of $BaTiO_3$.	

Learning Resource Details

LR Code	Title Author	Edition Year	ISBN Publisher
Text-Books			
PHY025-T01	Spectroscopy - Dr. K. Gnana Prasuna	2013	BRAOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
PHY025 –RB1			
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
PHY025 -CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
PHY025-WL1			

PHY026: Modern physics

Course Information

Year	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
02	PHY026	Modern Physics	2	8	120	10	40	50	P

Presumed Knowledge and Learning Objectives

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: • BSc with Physics or Mathematics or equivalent from a recognized University/Board.	After successful completion of this course, student should be able to • Understand the different concept of Modern physics • Understand the various application of LASER

Units and Detailed Syllabus

UN	Detailed Syllabus of the Unit	CR
1-1	**Reciprocal Dispersion Curve:** To draw reciprocal dispersion curve.	CR 01
1-2	**Characteristics of a Solar Cell:** To draw various Characteristics curves of a Solar Cell.	
1-3	**G. M. Counter – Characteristics Curve:** To draw G.M. Counter Characteristics, to estimate plateau region and fix operating voltage.	
1-4	**Dead Time Determination:** To determine the Dead Time of the given G. M. Counter.	
1-5	**Range And End Point Energy of β – Ray Absorption:** To determine Range of beta rays and to find its Absorption coefficient.	
1-6	**Linear And Mass Attenuation Coefficient Using Gamma Ray Absorption:** To evaluate gamma ray linear and mass Coefficient.	
2-1	**Verification of Inverse Square Law of Gamma Ray:** To verify Inverse Square Law.	CR 02
2-2	**Half – Life of Uranium:** To determine Half – Life period of uranium.	
2-3	**Magnetic Susceptibility – Quick Tube Method:** To determine Magnetic Susceptibility of a material solution using Quick's Tube.	
2-4	**Study of Birefringence:** To determine refractive indices and polarization Characteristics of ordinary and extra ordinary rays using birefringent prism. To verify Brewster's law.	

2-5	**Babinet's Compensator:** To produce and analyze circularly and elliptically polarized light.	
2-6	**Thickness of Thin Wire By Diffraction:** To find thickness of a Thin Wire By Diffraction method.	
2-7	**Characteristics of Laser Diode:** To draw Laser Diode Characteristics.	

Learning Resource Details

LR Code	Title Author	Edition Year	ISBN Publisher
Text-Books			
PHY026-T01	Modern Physics - Dr. M. Purnanandam	--	BRAOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
PHY026 –RB1			
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
PHY026 -CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
PHY026-WL1			

PHY027: Memory Devices and Microprocessors

Course Information

Year	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
02	PHY027	Memory Devices and Microprocessors	2	8	120	10	40	50	P

Presumed Knowledge and Learning Objectives

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: • BSc with Physics or Mathematics or equivalent from a recognized University/Board.	After successful completion of this course, student should be able to • Understand the different Application of Memory Devices and Microprocessors

Units and Detailed Syllabus

UN	Detailed Syllabus of the Unit	CR
1-1	**Introduction To Microprocessors.**	CR 01
1-2A	**One's Compliment and Two's Compliment of a Number:** To determine One's and Two's Compliment of a given 8-bit Number.	
1-2B	**Mask Off Most Significant and Least Significant 4 – Bits of an 8 – Bit Data:** To Mask Off Most Significant and Least Significant 4 – Bits of an 8 – Bit Data.	
1-3	**Picking of Largest / Smallest of a Number From an Array of Number:** To Picking of Largest / Smallest of a Number From an Array of Number	
1-4	**Square of a Number using Look up table Technique:** To find Square of a Number (Decimal) using Look up table Technique.	
1-5A	**Addition of 8 – Bit Hexadecimal Data:** To perform the Addition of two 8 – Bit Hexadecimal Data and find the sum.	
1-5B	**Addition of 8 – Decimal Data:** To perform the Addition of two 8 – Bit decimal Data and find the sum.	
1-5C	**Subtraction of Two 8 – Bit Data:** To perform the Subtraction of two 8 – Bit Hexadecimal Data and find the difference.	
1-6A	**Addition 16 – Bit Data Using an Individual Registers:** To perform the Addition of two 16 – Bit Hexadecimal Data and find the sum.	

1-6B	**Addition 16 – Bit Data Using DAD Instruction:** To perform the Addition of two 16 – Bit Hexadecimal Data using DAD (Double addition) instruction and find the sum.	
1-7A	**Addition of a Number For 'N' Times:** To perform the Addition of an 8 – Bit Data for n times and find the sum.	
1-7B	**Multiplication:** To perform the Multiplication of two 8 – Bit Data and find the product.	
2-1A	**Division of Two 8– Bit Data and The Quotient and The Remainder Are Stored In Two Successive Memory Location:** To perform the Division of two 8 – Bit Data and find the quotient (without considering the decimal values) and the remainder.	
2-1B	**Division of Two 8– Bit Data and The Quotient Up To 'N' Decimal Values and The Remainder Are Stored In 'N + 1' Memory Locations:** To perform the Division of two 8 – Bit Data and find the quotient up to 'n' decimal values and the remainder are stored in 'n+1' memory locations.	
2-2	**Sum of Series Of 8– Bit Numbers:** To perform the Addition of an array of 8- bit Hex data stored at some memory location and find the sum.	
2-3	**Block Movement of Data In An Array:** To find an array of 8- bit Hex data stored at some memory location are transferred to the new memory locations defined by the programmer.	
2-4A	**Conversion Of ASCII To Binary:** To convert ASCII into packed BCD.	**CR 02**
2-4B	**Conversion of Binary To ASCII:** Conversion of packed Binary To ASCII characters.	
2-5	**Data Transformation Through 8255 (PPI) I/O Ports AND Generation of Time Delay Between The Data's:** To find out the Data Transformation Through 8255 PPI and To find out the Generation of Time Delay Between The Data's.	
2-6	**Displaying Traffic Lights At 8255 I/O Ports:** To interface the Traffic Lights and control the vehicles.	
2-7	**4 – Bit / 8– Bit Digital To Analog Converter (DAC):** To convert the 4 – Bit / 8– Bit Digital To Analog Converter (DAC) by using 8085 microprocessor.	
2-8	**Rotating The Shaft of a Stepper Motor With (i) Given Direction, (ii)Given Speed, (iii) Given Angle, (iv) Bidirectional Rotational :** To interface a stepper motor to the 8085 microprocessor system and write an 8085 assembly language program to control the stepper motor.	
2-9	**Displaying of A Number On 7 – Segment Display:** To interface the seven segments	

	Display to 8085 microprocessor to display number 1 to 9.	

Learning Resource Details

LR Code	Title Author	Edition Year	ISBN Publisher
Text-Books			
PHY027-T01	Memory Devices and Microprocessors I - Dr. N. Lalitha Kumari - Mr. V. Santosh Kumar	2013	BRAOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
PHY027 –RB1			
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
PHY027 -CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
PHY027-WL1			

PHY028: Microwave Devices and Communication Systems

Course Information

Year	Code	Course Name	CR	CST	ST	CA	EE	TM	Type
02	PHY028	Microwave Devices and Communication Systems	2	8	120	10	40	50	P

Presumed Knowledge and Learning Objectives

Presumed Knowledge	Learning Objectives
For successful completion of this course, student should have successfully complete: • BSc with Physics or Mathematics or equivalent from a recognized University/Board.	After successful completion of this course, student should be able to • Understand the basic concept of Microwave devices • Understand the various function and application of different communication systems

Units and Detailed Syllabus

UN	Detailed Syllabus of the Unit	CR
1-1	**Microwaves**: Introduction To Microwaves.	CR 01
1-2	**Reflex Klystron Characteristics:** To study the characteristics of Reflex Klystron.	
1-3	**Gunn Diode Characteristics:** To study the I-V Characteristics of Gunn Diode.	
1-4	**Directional Coupler Characteristics:** To find the Coupling factor and Directivity of a given Directional Coupler.	
1-5	**Waveguide Parameters Measurement:** To determine the Waveguide Parameters in rectangular Waveguide working in TE_{10} mode.	
1-6	**Scattering Matrix of Isolator And Circular:** To obtain Scattering Matrix of Isolator And Circular.	
1-7	**Scattering Matrix of Magic Tee:** To obtain the Scattering Matrix of Magic Tee.	
1-8	**Amplitude Modulation:** To study the process of Amplitude Modulation and demodulation of a signal and calculate the depth of modulation and modulation index.	
2-1	**Frequency Modulator And Demodulator:** To study the Frequency Modulator And	CR 02

	Demodulator and calculate the modulation index.	
2-2	**Balanced Modulator:** To study the performance of the Balanced Modulator.	
2-3	**Pre Emphasis And DE – Emphasis:** To study Frequency response of pre – emphasis and de- emphasis circuit trainer.	
2-4	**Amplitude Shift Keying:** To generate and demodulate the Amplitude Shift Keying (ASK) signal.	
2-5	**Pulse Amplitude Modulation And Demodulation:** To study the Pulse Amplitude Modulation And Demodulation.	
2-6	**Pulse Position Modulation (PPM):** To study the Pulse Position Modulation and demodulation.	
2-7	**Pulse Width Modulation And Demodulation:** To study the process of Pulse Width Modulation And Demodulation.	
2-8	**Analog Signal Sampling And Reconstruction:** To study the Analog Signal Sampling And Reconstruction.	

Learning Resource Details

LR Code	Title Author	Edition Year	ISBN Publisher
Text-Books			
PHY028-T01	Microwave Devices and Communication Systems - Prof. G. Pushpa Chakrapani - Dr. N. Lalitha Kumari - Mr. A Gopal	2013	BRAOU
Reference-Books: Explore additional details and reinforce learning, with this optional learning resource!			
PHY028 –RB1			
CD / DVD: Explore additional details and reinforce learning, with this optional learning resource!			
PHY028 -CD1			
Web Links: Explore additional details and reinforce learning, with this optional learning resource!			
PHY028-WL1			

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