TELANGANA UNIVERSITY

DEPARTMENT OF PHYSICS

M. Sc (PHYSICS)
SYLLABUS
2017-2018
## DEPARTMENT OF PHYSICS
TELANGANA UNIVERSITY, NIZAMABAD – 503 322

M.Sc. (PHYSICS)
SCHEME OF INSTRUCTION AND EXAMINATION
2017-18
SEMESTER I

<table>
<thead>
<tr>
<th>Paper</th>
<th>Code</th>
<th>Subject</th>
<th>Instruction Hrs/Week</th>
<th>Duration of Exam In Hrs</th>
<th>Max. Marks</th>
<th>Credits</th>
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<tbody>
<tr>
<td>I</td>
<td>PHY 101</td>
<td>Mathematical Physics and Numerical methods</td>
<td>4</td>
<td>3</td>
<td>70+30*</td>
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<td>II</td>
<td>PHY 102</td>
<td>Classical Mechanics</td>
<td>4</td>
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<tr>
<td>III</td>
<td>PHY 103</td>
<td>Electromagnetic Theory</td>
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<td>Electronics</td>
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### THEORY

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<tbody>
<tr>
<td>V</td>
<td>PHY 151</td>
<td>Heat &amp; Acoustics</td>
<td>6</td>
<td>3</td>
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<tr>
<td>VI</td>
<td>PHY 152</td>
<td>Computer Programming</td>
<td>6</td>
<td>3</td>
<td>70+30*</td>
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**Seminar**

| Total | 28+2   | 600   | 22   |

### PRACTICALS

### Note:
- * Internal Assessment (20 Marks for CBT and 10 Marks for seminar)
- ‡ Internal Practical exam
Semester I
Paper I (PHY 101) - Mathematical Physics and Numerical Methods

UNIT – I


UNIT – II


UNIT – III


Numerical Differentiation: Forward Difference Quotient – Central Difference Quotient – First and higher order derivatives – Errors in derivatives.

Numerical Integration: Newton-Cotes methods, Simpson’s One third and three eighth methods – Gaussian Quadrature methods.


UNIT – IV

Reference Books:

7. Mathematical physics including Classical Mechanics by Satya Prakash
8. Tensor Analysis – By Schaum series
Semester I
Paper II (PHY 102) - Classical Mechanics

UNIT-I

Newtonian Formalism: Inertial frames and Galilean transforms, Non-inertial frames, pseudo forces, rotational frames, rotational transforms and conservation theorems. Description of rotations in terms of Euler angles, Euler equations of motion for a rigid body, Minkowski space, Space-time diagrams, world point and world line- Relativistic motion and Lorentz transforms as rotations in four-space, Four Velocity, Energy- Momentum vectors with few examples.

UNIT-II


UNIT-III


UNIT-IV

Hamilton – Jacobi theory and Theory of Small Oscillations:
The Hamilton-Jacobi equation for Hamilton's principle function, the harmonic oscillator problem, Hamilton – Jacobi equation from Hamilton's characteristic function, Action-angle variables, the Kepler problem in action angle variables. Analysis of the free vibrations of a linear triatomic molecule - Eigen value equation - Principal axis transformation - frequencies and normal coordinates,

Reference Books:

1. Classical Mechanics : By Goldstein, Poole & Safko (Pearson 2002)
2. Classical Mechanics: By Rana & Joag (TMH)
3. Introduction to Classical Mechanics: Takwale & Puranik (TMH)
7. Lagrangian Dynamics : Dave Wells (Schaum series 1967)
8. Classical mechanics of particles and rigid bodies : Kiran C Gupta (New Age International Publishers)
Semester I
Paper III (PHY 103) - Electromagnetic Theory

UNIT -I

Electro-Static Potentials And Maxwell’s Field Equations: Special techniques for calculating electrostatic potential: Poisson’s and Laplace’s equations - Solutions of Laplace’s equations for electrostatic potential in cartesian, spherical and cylindrical coordinates, Multipole expansion of the energy of a system of charges in an electrostatic field-The scalar and vector magnetic potentials. Derivation of Maxwell’s equations-General wave equation-Gauge transformations-Lorentz and Coulomb gauges, Momentum, angular momentum and free energies of electromagnetic field, Poynting Theorem (Work energy theorem in electrodynamics).

UNIT-II:


UNIT-III

Interaction of Electromagnetic Waves With Matter: Propagation of EM waves in bounded media-Boundary conditions for E, D, B and H - Reflection and Refraction of plane EM waves at plane interface between two dielectrics-Laws of reflection and refraction-Fresnel’s relations - Reflection(R) and Transmission(T) coefficients-Brewster’s angle-Total internal reflection-Reflection and Refraction of plane EM waves at plane interface between non-conducting and conducting medium-Metallic reflection and its applications-Dispersion in non-conductors-Normal and anomalous dispersion.

UNIT-IV


Reference Books:

Semester I
Paper IV (PHY 104) – Electronics-I

UNIT – I

**Semiconductor Devices:** Characteristics of Tunnel Diode, Photo diode, BJT, JFET, MOS, CMOS, UJT, SCR, DIAC and TRIAC.

**Opto-electronic Devices:** Solar cells, Photo-detectors, LEDs.

UNIT – II

**Regulated Power Supply:** Basic Principles of Zener regulated, Transistorized Series regulated (Circuits using 723, 78XX) and Switching Mode Power Supplies (SMPS).

**Wave Shaping:** Integration and differentiation using passive elements. Clipping and Clamping circuits using diodes.

**Amplifiers:** h-parameter model of BJT, Biasing of Transistor, Self-bias, Single Stage RC coupled amplifier and its frequency response (using hybrid π model)

UNIT – III

**Feedback Amplifiers:** Classification of Amplifiers, The concept of feedback, Positive and Negative feedback. Advantages of Negative feedback. Emitter follower and Darlington pair.

**Sinusoidal Oscillators (Using BJT's):** Criterion for oscillations, Phase shift, Wein bridge, Hartley and Colpitts Oscillators, Crystal Oscillator.

Collector coupled Astable, Monostable, Bistable multivibrator and Schmitt trigger.

UNIT – IV

**Modulation and Detection:** Amplitude Modulation – Frequency components in an AM signal, Balanced Amplitude Modulator, Envelope and square law detectors. Frequency Modulation – Frequency components in FM signal, Basic Reactance modulator, FM discriminator. Phase Modulation.

**Reference Books**

1. Integrated Electronics by Millman and Hallkias
2. Pulse Digital & Switching Waveforms by Millman and Taub
3. Microelectronics by Millman & Grabel.
4. Fundamentals of electronics by J.D. Ryder
Practical Paper – V (PHY 151) – HEAT & ACOUSTICS

1. Determination of Stefan’s constant.
2. Study of variation of specific heat of graphite with temperature.
3. Temperature variation of resistance of a thermistor.
4. Coefficient of linear expansion of given material by Fizeau’s method.
5. Estimation of errors.
    b). Calculation of compressibility.
10. Y and η of flat spiral spring.
1. Evaluation of functions \( \sin x, \cos x, \log x \) etc.
2. Evaluation of determinant of a matrix and matrix multiplication.
3. Evaluation of the values of first order Bessel function.

**Solution of non-linear equations**

5. Bisection method.

**Numerical Integration**

6. Trapezoidal rule.
7. Simpson's 1/3 and 3/8 rule.
9. Euler's method.
11. Lagrange's interpolation.
12. Polynomial curve fitting method Solution of system of linear equations.
# DEPARTMENT OF PHYSICS
TELANGANA UNIVERSITY, NIZAMABAD – 503 322

**M.Sc. (PHYSICS)**  
SCHEME OF INSTRUCTION AND EXAMINATION  
2017-2018  
SEMESTER II

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<thead>
<tr>
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<tr>
<td>I</td>
<td>PHY 201</td>
<td>Solid State Physics-I</td>
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<td>Quantum Mechanics-I</td>
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<td>Statistical Mechanics</td>
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<td>IV</td>
<td>PHY 204</td>
<td>Electronics-II</td>
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<tr>
<td>V</td>
<td>PHY 251</td>
<td>Optics</td>
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**Seminar**  
2

**Total**  
28+2  
600  
22

**Note**:  
* Internal Assessment (20 Marks for CBT and 10 Marks for seminar)  
* Internal Practical exam

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CHAIRMAN BOS  
Department of Physics
Semester II  
**Paper I (PHY201) – Solid State Physics - I**

**UNIT - I**

**Crystalline state and Structural Studies:** Crystal translational vectors, unit cell, Bravais lattices; Crystal systems, Miller indices, symmetry operations, Point groups, Space groups and their notation. Crystal structures of fcc, bcc, hcp, CsCl, NaCl, ZnS and Diamond.


**UNIT-II**


**UNIT-III**

**Band Theory and Semiconductor Physics:** Failure of Free electron theory of metals. Bloch theorem, behavior of electron in periodic potentials, Kronig-Penney model, E vs K relation, density of states in a band, effective mass of electron, negative effective mass and concept of hole.

Distinction between metals, semiconductors and insulators. Intrinsic semiconductors, band model, Fermi level, expressions for electron and hole concentrations in intrinsic and extrinsic semiconductors. Hall effect in semiconductors.

**UNIT - IV**

**Crystal Growth and Imperfections:** Crystal growth from solution and melt, growth from vapour phase, Experimental techniques of growth from melt.

Classification of imperfections, Schottky and Frenkel defects, expressions for their equilibrium concentrations in metals and ionic crystals. Color centers and their models, Diffusion Mechanisms, Fick’s laws of diffusion, Kirkendal effect, Ionic conductivity, Dislocations – edge and screw dislocations, Dislocation multiplication, Grain boundaries.
Reference Books:

2. Introduction to Solid State Physics : C. Kittel
4. Elements of Solid State Physics : J.P.Srivastava
5. Elements of Solid state Physics : Ali Omar
Semester II
Paper II (PHY202) – Quantum Mechanics - I

UNIT – I


UNIT – II

Exactly Solvable problems: The Schrodinger, Heisenberg picture and interaction pictures. Linear harmonic oscillator-Solution to Schrodinger equation, Eigen values and Eigen functions, properties of stationary states. Linear harmonic oscillator- Solution by operators method. Raising and Lowering operators, the number operator. Hydrogen atom-solution of the radial part of the Schrodinger equations.

UNIT – III


UNIT – IV


Reference Books

1. Quantum Mechanics by LI Schiff
3. Quantum Mechanics by Ghatak and Lokanathan (Macmillian)
4. Quantum Mechanics by E Merzbacher (John Wiley)
5. Quantum Mechanics by Aruldhas (New Age International)
6. Modern Quantum Mechanics by Sakurai (Addison Wesley)
Semester II
Paper III (PHY203) – Statistical Mechanics

UNIT-I

Relation between thermodynamics and statistical mechanics, micro states and macro states of a system, phase space, ensembles, mean values and ensemble average, density distribution in phase space- Liouville’s theorem, Apriori probability postulate, micro canonical, canonical and grand canonical ensembles, quantization of phase space.

Entropy and probability, Equilibrium conditions- Thermal, mechanical and concentration equilibrium, Entropy of a perfect gas using micro canonical ensemble, Gibbs paradox, Sackur-Tetrode equation

UNIT-II


Partition function and thermodynamic quantities-transational, rotational and, vibrational partition functions - Specific heat of diatomic molecules.

UNIT - III: (13 Hrs)


Ideal Fermi-Dirac gas-Energy and pressure of the gas, electronic specific heat, thermionic emission, white dwarfs.

UNIT - IV: (13 Hrs)

Fluctuations, mean square deviation, fluctuations in energy, volume and concentration, Brownian motion, Classification of phase transitions, Phase transitions of first and second kind; Ising model., Bragg-Williams approximation,- one dimensional Ising model application to Ferro magnetic systems.-Order-Disorder transition.

Reference Books:

3. Statistical Mechanics by B.K.Agarwal and M.Eisner
4. Statistical mechanics and properties of matter by E.S.R.Gopal
5. Statistical Physics by Battachargee
6. Statistical Physics byTony Guenaut
7. Heat and Thermodynamics by Zeemansky
Semester II
Paper IV (PHY204) - Electronics-II

UNIT - I

Operational Amplifiers: Characteristics of Ideal operational Amplifier, Block diagram of an IC Op-Amp. Analysis of inverting amplifier, Non-inverting amplifiers, Integrator, Differentiator, summing amplifier, Difference amplifier, Comparator, Logarithm amplifier and exponential amplifier, Analog computation, Square wave, Rectangular wave, Triangular wave and Sine wave generators.

IC 555: Working of IC 555, Astable and Monostable Multivibrator circuits with 555.

UNIT - II

Logic Circuits: Boolean laws and theorems, SOP and POS representation, Min terms and Max terms, Karnaugh Maps (upto 4-variables), Tabulation method, Half adder and Full adder, Parity checker and Generator, Decoder/Demultiplexer, Data selector/Multiplexer, Encoder.

Flip-Flops: RS, D, JK and M/S JK flip flops.

Shift Registers: Types of registers, Serial in Serial out, Serial in Parallel out, Parallel in Serial out and Parallel in Parallel out Registers, IC 7496, Ring Counter.

UNIT - III

Counters: Ripple (Asynchronous) Counters, Divide by N Counter, Synchronous Counters, Decade Counter using Flip-Flops and ICs 7490, 7493.

D/A Converters: Variable Resistor Network type, R – 2R ladder type, 4 bit Binary Converter, D/A Accuracy and Resolution.


UNIT - IV

Microprocessor: Architecture of 8085 microprocessor, Introduction to Instruction set, Data transfer instructions, Arithmetic, Logic and Branch operations, Addressing modes, Assembly language programming-Examples.

Reference Books:

1. Integrated Electronics -- Millman and Halkies.
2. Microelectronics -- Millman & Grabel
3. Operational amplifier – Gawkward
6. Microprocessors Architecture, Programming and Application with the 8085/8080 – Goankar
Practical Paper – V (PHY 251) – OPTICS

1. The thickness of a film using Fresnel’s Bipism.
2. Determination of Cauchy’s constants by dispersion of light through a Prism.
3. Determination of wavelength and difference in the wavelength of the sodium light using Michelson interferometer.
4. Young’s modulus of the given glass plate using Newton’s ring method.
5. Poisson’s ratio of the given glass plate using Newton’s ring method.
6. Wavelength of the sodium light by studying the diffraction and interference pattern obtained with single and double slit.
7. Photo elastic constants of given material.
8. Variation of the birefringence of the given crystals with wave length.
10. Study of temperature variation of refractive index of air using Michelson’s interferometer.
11. Study of double refraction of quartz and calcite crystals using spectrometer.
12. Determination of birefringence of a uniaxial crystal using constant deviation spectrometer.
13. Study of characteristics of phototransistor and verification of Malus law.
1. Study of elliptically polarized light
15. Determination of wave length of He-Ne laser radiation using diffraction grating.
17. Study of characteristics of injection laser.
18. Study of characteristics of LED.
1. RC coupled transistor amplifier.
2. RS phase shift oscillator.
3. Colpitt’s oscillator.
4. Characteristics of OPAMP (IC741) and study inverting and non-inverting amplifiers.
5. Wein bridge oscillator.
7. Astable multivibrator (555).
8. Switch mode power supply.
9. Regulated power supply with 723.
10. Regulated power supply with 74xx.
11. Triangular and square wave generator (741).
12. Monostable multi vibrator (555).
15. Amplitude modulation and detection (555).
16. D/A converter.
17. A/D converter.
18. Construction and verification of the following
    a. Logic gates/circuits using NAND gates (7400)
    b. AND, OR, NOT, NAND, Ex-OR
19. Half adder and full adder.
20. Flip flops RS, JK, D types.
21. Construction and verification of the following counters
    a. Divide by 10 counter with 7490
    b. Divide by 16 counter with 749
    c. Divide by 12 counter with 7492
    d. Divide by N counter with 7476
22. Construction of shift registers.
23. Logic circuits with discrete components.
24. Demorgan’s laws.
25. Experiments using microprocessor (8085 kit).