

# ADIKAVI NANNAYA UNIVERSITY

## RAJAMAHENDRAVARAM

### CBCS / Semester System

(W.e.f. 2016-17 Admitted Batch)

#### I Semester Syllabus

#### PHYSICS

(For Mathematics Combinations)

#### PAPER I: MECHANICS & PROPERTIES OF MATTER

Work load: 60 hrs per semester

4 hrs/week

#### UNIT-I

(10 hrs)

##### 1. Vector Analysis

Scalar and vector fields, gradient of a scalar field and its physical significance. Divergence and curl of a vector field with derivations and physical interpretation. Vector integration (line, surface and volume), Statement and proof of Gauss and Stokes theorems.

#### UNIT-II

(10 hrs)

##### 2. Mechanics of particles

Laws of motion, motion of variable mass system, Equation of motion of a rocket. Conservation of energy and momentum, Collisions in two and three dimensions, Concept of impact parameter, scattering cross-section, Rutherford scattering-derivation.

#### UNIT-III

(16 hrs)

##### 3. Mechanics of Rigid bodies

Definition of rigid body, rotational kinematic relations, equation of motion for a rotating body, angular momentum, Euler equations and its applications, precession of a top, Gyroscope, precession of the equinoxes.

##### 4. Mechanics of continuous media

Elastic constants of isotropic solids and their relations, Poisson's ratio and expression for Poisson's ratio in terms of  $\nu$ ,  $n$ ,  $k$ . Classification of beams, types of bending, point load, distributed load, shearing force and bending moment, sign conventions.

#### UNIT-IV

(12hrs)

##### 5. Central forces

Central forces, definition and examples, characteristics of central forces, conservative nature of central forces, conservative force as a negative gradient of potential energy, equation of motion under a central force. Derivation of Kepler's laws. Motion of satellites, idea of Global Positioning System (GPS).

## UNIT-V

(12 hrs)

### 6. Special theory of relativity

Galilean relativity, absolute frames. Michelson-Morley experiment, negative result. Postulates of special theory of relativity. Lorentz transformation, time dilation, length contraction, addition of velocities, mass-energy relation.

### REFERENCE BOOKS:

1. B. Sc. Physics, Vol.1, Telugu Academy, Hyderabad
2. Fundamentals of Physics Vol. I - Resnick, Halliday, Krane, Wiley India 2007
3. Unified Physics, Vol. 1, S.L. Gupta & S. Gupta, Jai Prakash Nath & Co, Meerut.
4. College Physics-I. T. Bhimasankaram and G. Prasad. Himalaya Publishing House.
5. University Physics-FW Sears, MW Zemansky & HD Young, Narosa Publications, Delhi
6. Mechanics, S.G. Venkatachalapathy, Margham Publication, 2003.

### Practical paper 1: Mechanics & Properties of Matter

Work load: 30 hrs per semester

2 hrs/week

#### Minimum of 6 experiments to be done and recorded

1. Viscosity of liquid by the flow method (Poiseuille's method)
2. Young's modulus of the material of a bar (scale) by uniform bending
3. Young's modulus of the material a bar (scale) by non- uniform bending
4. Surface tension of a liquid by capillary rise method
5. Determination of radius of capillary tube by Hg thread method
6. Viscosity of liquid by Searle's viscometer method
7. Bifilar suspension –moment of inertia of a regular rectangular body.
8. Determination of moment of inertia using Fly-wheel
9. Determination of the height of a building using a sextant.
10. Rigidity modulus of material of a wire-dynamic method (torsional pendulum)

#### Suggested student activities

Student seminars, group discussions, assignments, field trips, study project and experimentation using virtual lab

#### Examples

Seminars	- A topic from any of the Units is given to the student and asked to give a brief seminar presentation.
Group discussion	- A topic from one of the units is given to a group of students and asked to discuss and debate on it.
Assignment	- Few problems may be given to the students from the different units and asked them to solve.
Field trip	- Visit to Satish Dhawan Space Centre, Sriharikota / Thermal and hydroelectric power stations / Science Centres, any other such visit etc.
Study project	- Web based study of different satellites and applications.

**Domain skills:**

Logical derivation, experimentation, problem solving, data collection and analysis, measurement skills

**\*\*\* Documental evidence is to be maintained for the above activities.**

**NOTE: Problems should be solved at the end of every chapter of all Units.**

1. Each theory paper is of 100 marks and practical paper is also of 50 marks.  
Each theory paper is 75 marks University Exam (external) + 25 marks mid Semester Exam (internal). Each practical paper is 50 marks external
2. The teaching work load per week for semesters I to VI is 4 hours per paper for theory and 2 hours for all laboratory (practical) work.
3. The duration of the examination for each theory paper is 3.00 hrs.
4. The duration of each practical examination is 3 hrs with 50 marks, which are to be distributed as  
30 marks for experiment  
10 marks for viva  
10 marks for record

<b><u>Practicals</u></b>	<b>50 marks</b>
Formula & Explanation	6
Tabular form +graph +circuit diagram	6
Observations	12
Calculation, graph, precautions & Result	6
Viva-Voce	10
Record	10

**\*\*\*NOTE: Practical syllabus is same for both Mathematics and Non Mathematics combinations**

**ADIKAVI NANNAYA UNIVERSITY**  
**CBCS/ SEMESTER SYSTEM**  
**SEMESTER II : B.Sc Physics**  
**(for 2016-17 Admitted Batch)**

**Paper II:Waves & Oscillations**  
**(For Maths Combinations)**

**Work load: 60 hrs per semester**

**4 hrs/week**

**UNIT-I (12 hrs)**

**1. Simple Harmonic oscillations**

Simple harmonic oscillator and solution of the differential equation-Physical characteristics of SHM, torsion pendulum-measurements of rigidity modulus, compound pendulum-measurement of 'g', Principle of superposition, beats, combination of two mutually perpendicular simple harmonic vibrations of same frequency and different frequencies. Lissajous figures.

**UNIT-II (12 hrs)**

**2. Damped and forced oscillations**

Damped harmonic oscillator, solution of the differential equation of damped oscillator. Energy considerations, comparison with un-damped harmonic oscillator, logarithmic decrement, relaxation time, quality factor, differential equation of forced oscillator and its solution, amplitude resonance and velocity resonance.

**UNIT-III (10 hrs)**

**3. Complex vibrations**

Fourier theorem and evaluation of the Fourier coefficients, analysis of periodic wave functions-square wave, triangular wave, saw tooth wave, simple problems on evolution of Fourier coefficients.

**UNIT-IV (17hrs)**

**4. Vibrating strings: 8 hrs**

Transverse wave propagation along a stretched string, general solution of wave equation and its significance, modes of vibration of stretched string clamped at ends, overtones and harmonics. Energy transport and transverse impedance.

**5. Vibrations of bars: 9 hrs**

Longitudinal vibrations in bars-wave equation and its general solution. Special cases (i) bar fixed at both ends (ii) bar fixed at the midpoint (iii) bar fixed at one end. Tuning fork.

**UNIT-V (9 hrs)**

**6. Ultrasonics: 9hrs**

Ultrasonics, properties of ultrasonic waves, production of ultrasonics by piezoelectric and magnetostriction methods, detection of ultrasonics, determination of wavelength of ultrasonic waves.Applications of ultrasonic waves.

**REFERENCE BOOKS:**

1. BSc Physics Vol.1, Telugu Academy, Hyderabad.
2. Waves and Oscillations. N. Subramanyam and Brijlal, Vikas Pulications.

3. Unified Physics Vol., Mechanics, Waves and Oscillations, Jai Prakash Nath&Co.Ltd.
4. Fundamentals of Physics. Halliday/Resnick/Walker ,Wiley India Edition 2007.
5. Waves & Oscillations. S.Badami, V. Balasubramanian and K.R. Reddy,Orient Longman.
6. College Physics-I. T. Bhimasankaram and G. Prasad. Himalaya Publishing House.
7. Science and Technology of Ultrasonics- Baldevraj, Narosa, New Delhi,2004
8. Introduction to Physics for Scientists and Engineers. F.J. Buche. McGraw Hill.

### **Practical Paper II: Waves & Oscillations**

**Work load: 30 hrs per semester**

**2 hrs/week**

**Minimum of 6 experiments to be done and recorded**

1. Volume resonator experiment
2. Determination of 'g' by compound/bar pendulum
3. Simple pendulum normal distribution of errors-estimation of time period and the error of the mean by statistical analysis
4. Determination of the force constant of a spring by static and dynamic method.
5. Determination of the elastic constants of the material of a flat spiral spring.
6. Coupled oscillators
7. Verification of laws of vibrations of stretched string –sonometer
8. Determination of frequency of a bar –Melde's experiment.
9. Study of a damped oscillation using the torsional pendulum immersed in liquid-decay constant and damping correction of the amplitude.
10. Formation of Lissajous figures using CRO.

#### **Suggested student activities**

Student seminars, group discussions, assignments, field trips, study project and experimentation using virtual lab

#### **Examples**

- |                  |  |
|------------------|--|
| Seminars         | - A topic from any of the Units is given to the student and asked to give a brief seminar presentation.                                    |
| Group discussion | - A topic from one of the units is given to a group of students and asked to discuss and debate on it.                                     |
| Assignment       | - Few problems may be given to the students from the different units and asked them to solve.  |
| Field trip       | - Visit to Satish Dhawan Space Centre, Sriharikota / Thermal and hydroelectric power stations / Science Centres, any other such visit etc. |
| Study project    | - Web based study of different satellites and applications.  |

#### **Domain skills:**

Logical derivation, experimentation, problem solving, data collection and analysis, measurement skills

**\*\*\* Documental evidence is to be maintained for the above activities.**

# ADIKAVI NANNAYA UNIVERSITY

## RAJAMAHENDRAVARAM

### CBCS / Semester System

(W.e.f. 2015-16 Admitted Batch)

#### III Semester Syllabus

#### PHYSICS

(For Mathematics Combinations)

#### WAVE OPTICS

**Work load:60 hrs per semester**

**4 hrs/week**

#### UNIT-I

**(8 hrs)**

##### **1. Aberrations:**

Introduction – monochromatic aberrations, spherical aberration, methods of minimizing spherical aberration, coma, astigmatism and curvature of field, distortion. Chromatic aberration-the achromatic doublet. Achromatism for two lenses (i)in contact and (ii) separated by a distance.

#### UNIT-II

**(14hrs )**

##### **2. Interference**

Principle of superposition – coherence-temporal coherence and spatial coherence-conditions for interference of light. Fresnel's biprism-determination of wavelength of light – change of phase on reflection. Oblique incidence of a plane wave on a thin film due to reflected and transmitted light (cosine law) – colors of thin films-

Interference by a film with two non-parallel reflecting surfaces (Wedge shaped film). Determination of diameter of wire, Newton's rings in reflected light. Michelson interferometer, Determination of wavelength of monochromatic light using Newton's rings and Michelson Interferometer.

#### UNIT-III

**(14hrs)**

##### **3. Diffraction**

Introduction,distinction between Fresnel and Fraunhofer diffraction, Fraunhofer diffraction –Diffraction due to single slit- Fraunhofer diffraction due to double slit- Fraunhofer diffraction pattern with N slits (diffraction grating).Resolving power of grating, Determination of wavelength of light in normal incidence and minimum deviation methods using diffraction grating,

Fresnel's half period zones-area of the half period zones-zone plate-comparison of zone plate with convex lens-difference between interference and diffraction.

#### UNIT-IV

**(10 hrs )**

##### **4. Polarisation:**

Polarized light: methods of polarization polarization by reflection, refraction, double refraction, scattering of light-Brewster's law-Mauls law-Nicol prism polarizer and analyzer-

Quarter wave plate, Half wave plate-optical activity, determination of specific rotation by Laurent's half shade polarimeter- Babinet's compensator - idea of elliptical and circular polarization

## UNIT-V

(14hrs)

### 5. Lasers and Holography

Lasers: introduction, spontaneous emission, stimulated emission. Population Inversion, Laser principle-Einstein coefficients-Types of lasers-He-Ne laser, Ruby laser- Applications of lasers. Holography: Basic principle of holography - Gabor hologram and its limitations, Applications of holography.

### 6. Fiber Optics

Introduction - different types of fibers, rays and modes in an optical fiber, fiber material, principles of fiber communication (qualitative treatment only), advantages of fiber optic communication.

## REFERENCE BOOKS:

1. BSc Physics, Vol.2, Telugu Akademy, Hyderabad
2. A Text Book of Optics-N Subramanyam, L Brijlal, S.Chand& Co.
3. Unified Physics Vol.II Optics & Thermodynamics – Jai Prakash Nath&Co.Ltd., Meerut
4. Optics,F..A. Jenkins and H.G. White, Mc Graw-Hill
5. Optics, AjoyGhatak,Tata Mc Graw-Hill.
6. Introduction of Lasers – Avadhanulu, S.Chand& Co.
7. Principles of Optics- BK Mathur, Gopala Printing Press, 1995

## Practical Paper III: Wave Optics

Work load:30 hrs

2 hrs/week

### Minimum of 6 experiments to be done and recorded

1. Determination of radius of curvature of a given convex lens-Newton's rings.
2. Resolving power of grating.
3. Study of optical rotation – polarimeter.
4. Dispersive power of a prism.
5. Determination of wavelength of light using diffraction grating-minimum deviation method.
6. Determination of wavelength of light using diffraction grating-normal incidence method.
7. Resolving power of a telescope.
8. Refractive index of a liquid-hallow prism
9. Determination of thickness of a thin wire by wedge method
10. Determination of refractive index of liquid-Boy's method.

### Suggested student activities

Student seminars, group discussions, assignments, field trips, study project and experimentation using virtual lab

### Examples

- |                  |   |
|------------------|---|
| Seminars         | - A topic from any of the Units is given to the student and asked to give a brief seminar presentation. |
| Group discussion | - A topic from one of the units is given to a group of students and asked to discuss and debate on it.  |
| Assignment       | - Few problems may be given to the students from the different units and asked them to solve.           |

- Field trip - Visit to Satish Dhawan Space Centre, Sriharikota / Thermal and hydroelectric power stations / Science Centres, any other such visit etc.
- Study project - Web based study of different satellites and applications.

**Domain skills:**

Logical derivation, experimentation, problem solving, data collection and analysis, measurement skills

**\*\*\* Documental evidence is to be maintained for the above activities.**

**NOTE: Problems should be solved at the end of every chapter of all Units.**

1. Each theory paper is of 100 marks and practical paper is also of 50 marks.  
Each theory paper is 75 marks University Exam (external) + 25 marks mid Semester Exam (internal). Each practical paper is 50 marks external
2. The teaching work load per week for semesters I to VI is 4 hours per paper for theory and 2 hours for all laboratory (practical) work.
3. The duration of the examination for each theory paper is 3.00 hrs.
4. The duration of each practical examination is 3 hrs with 50 marks, which are to be distributed as
  - 30 marks for experiment
  - 10 marks for viva
  - 10 marks for record

<u><b>Practicals</b></u>	<b>50 marks</b>
Formula & Explanation	6
Tabular form +graph +circuit diagram	6
Observations	12
Calculation, graph, precautions & Result	6
Viva-Voce	10
Record	10

**\*\*\*NOTE: Practical syllabus is same for both Mathematics and Non Mathematics combinations**



**ADIKAVI NANNAYA UNIVERSITY**  
**CBCS/SEMESTER SYSTEM**  
**IV SEMESTER: B.Sc PHYSICS**  
**W.E.FROM 2015-16 ADMITTED BATCH**

**Paper IV: Thermodynamics & Radiation Physics**  
**(For Maths Combinations)**

**Work load: 60 hrs per semester**

**4 hrs/week**

**UNIT-I (10 hrs)**

**1. Kinetic theory of gases**

Introduction –Deduction of Maxwell’s law of distribution of molecular speeds, experimental verification. Transport phenomena – Mean free path - Viscosity of gases-thermal conductivity-diffusion of gases.

**UNIT-II(12 hrs)**

**2. Thermodynamics**

Introduction- Isothermal and adiabatic process- Reversible and irreversible processes- Carnot’s engine and its efficiency-Carnot’s theorem-Second law of thermodynamics. Kelvin’s and Clausius statements-Entropy, physical significance –Change in entropy in reversible and irreversible processes-Entropy and disorder-Entropy of Universe– Temperature-Entropy (T-S) diagram and its uses - Change of entropy of a perfect gas-change of entropy when ice changes into steam.

**UNIT-III(12 hrs)**

**3. Thermodynamic potentials and Maxwell’s equations**

Thermodynamic potentials-Derivation of Maxwell’s thermodynamic relations-Clausius-Clayperon’s equation-Derivation for ratio of specific heats-Derivation for difference of two specific heats for perfect gas.Joule Kelvin effect-expression for Joule Kelvin coefficient for perfect and vander Waal’s gas.

**UNIT-IV(12 hrs)**

**4. Low temperature Physics**

Introduction-Joule Kelvin effect-Porous plug experiment - Joule expansion-Distinction between adiabatic and Joule Thomson expansion-Expression for Joule Thomson cooling-Liquefaction of helium, Kapitza’s method-Adiabatic demagnetization, Production of low temperatures -applications of substances at lowtemperature-effects of chloro and fluoro carbons on ozone layer.

**UNIT-V(14 hrs)**

**5. Quantum theory of radiation**

Blackbody-Ferry’s black body-distribution of energy in the spectrum of black body-Wein’s displacement law, Wein’s law, Rayleigh-Jean’s law-Quantum theory of radiation-Planck’s law-Measurement of radiation-Types of pyrometers-Disappearing filament optical pyrometer-experimental determination – Angstrompyrheliometer-determination of solar constant, Temperature of Sun.

## REFERENCE BOOKS:

1. BSc Physics, Vol.2, Telugu Akademy, Hyderabad
2. Thermodynamics, R.C.Srivastava, S.K.Saha& Abhay K.Jain, Eastern Economy Edition.
3. Unified Physics Vol.2, Optics & Thermodynamics, Jai Prakash Nath&Co.Ltd., Meerut
4. Fundamentals of Physics. Halliday/Resnick/Walker.C. Wiley India Edition 2007
5. Heat, Thermodynamics and Statistical Physics-N Brij Lal, P Subrahmanyam, PS Hemne, S.Chand& Co.,2012
6. Heat and Thermodynamics- MS Yadav, Anmol Publications Pvt. Ltd, 2000
7. University Physics, HD Young, MW Zemansky,FW Sears, Narosa Publishers, New Delhi

### Practical Paper IV: Thermodynamics & Radiation Physics

Work load: 30 hrs

2 hrs/week

#### Minimum of 6 experiments to be done and recorded

1. Specific heat of a liquid –Joule’s calorimeter –Barton’s radiation correction
2. Thermal conductivity of bad conductor-Lee’s method
3. Thermal conductivity of rubber.
4. Measurement of Stefan’s constant.
5. Specific heat of a liquid by applying Newton’s law of cooling correction.
6. Heating efficiency of electrical kettle with varying voltages.
7. Thermoemf- thermo couple - potentiometer
8. Thermal behavior of an electric bulb (filament/torch light bulb)
9. Measurement of Stefan’s constant- emissive method
10. Study of variation of resistance with temperature - thermistor.

#### Suggested student activities

Student seminars, group discussions, assignments, field trips, study project and experimentation using virtual lab

#### Examples

- |                  |  |
|------------------|--|
| Seminars         | - A topic from any of the Units is given to the student and asked to give a brief seminar presentation.                                    |
| Group discussion | - A topic from one of the units is given to a group of students and asked to discuss and debate on it.                                     |
| Assignment       | - Few problems may be given to the students from the different units and asked them to solve.  |
| Field trip       | - Visit to Satish Dhawan Space Centre, Sriharikota / Thermal and hydroelectric power stations / Science Centres, any other such visit etc. |
| Study project    | - Web based study of different satellites and applications.  |

#### Domain skills:

Logical derivation, experimentation, problem solving, data collection and analysis, measurement skills

\*\*\* Documental evidence is to be maintained for the above activities.

# AdiKavi Nanayya University::Rajamahendravaram

## III B.Sc.: Physics Semester V- Paper V Electricity, Magnetism and Electronics

Credits: 03

3Hour/Week

Total Hours : 45

### UNIT-I (9 hrs)

#### 1. Electric field intensity and potential:

Gauss's law statement and its proof- Electric field intensity due to (1) Uniformly charged sphere and (2) an infinite conducting sheet of charge. Electrical potential – equipotential surfaces- potential due to i) a point charge, ii) charged spherical shell .

#### 2. Dielectrics:

Electric dipole moment and molecular polarizability- Electric displacement D, electric polarization P –relation between D, E and P- Dielectric constant and susceptibility. Boundary conditions at the dielectric surface.

### UNIT-II (9 hrs)

#### 3. Electric and magnetic fields

Biot-Savart's law, explanation and calculation of B due to long straight wire, a circular current loop and solenoid – Hall effect – determination of Hall coefficient and applications.

#### 4. Electromagnetic induction

Faraday's law-Lenz's law- Self and mutual inductance, coefficient of coupling, calculation of self inductance of a long solenoid, energy stored in magnetic field. Transformer - energy losses - efficiency.

### UNIT-III (9 hrs)

#### 5. Alternating currents and electromagnetic waves

Alternating current - Relation between current and voltage in LR and CR circuits, vector diagrams, LCR series and parallel resonant circuit, Q –factor, power in ac circuits.

#### 6. Maxwell's equations

Idea of displacement current - Maxwell's equations (integral and differential forms) (no derivation), Maxwell's wave equation (with derivation). Poincaré theorem (statement), production of electromagnetic waves (Hertz experiment).

### UNIT-IV (9 hrs)

#### 7. Basic electronics:

PN junction diode, Zener diode, I-V characteristics, PNP and NPN transistors, CB, CE and CC configurations – Relation between  $\alpha$ ,  $\beta$  and  $\gamma$  - transistor (CE) characteristics , Transistor as an amplifier.

### UNIT-V: (9 hrs)

#### 8. Digital electronics

Number systems - Conversion of binary to decimal system and vice versa. Binary subtraction ( 2's complement methods).Laws of Boolean algebra - De Morgan's laws-statement and proof, Basic logic gates, NAND and NOR as universal gates, exclusive-OR gate, Half adder and Full adder.

### Textbooks

1. Modern Physics by R. Murugesan and Kiruthiga Siva Prasath – *S. Chand & Co.* for semi conductor & Digital Principles)
2. Fundamentals of Physics- Halliday/Resnick/Walker - *Wiley India Edition 2007.*
3. Berkeley Physics Course – Vol. II - Electricity and Magnetism – Edward M Purcell –*The McGraw-Hill Companies.*
4. Electricity and Magnetism – D.N. Vasudeva. *S. Chand & Co.*
5. Electronic devices and circuits – Millman and Halkias. *Mc.Graw-Hill Education.*
6. Electricity and Magnetism Brijlal and Subramanyam. *Ratan Prakashan Mandir.*
7. Digital Principles and Applications by A.P. Malvino and D.P. Leach. *McGraw Hill Education.*
8. Unified Physics Vol.3 – S.L. Gupta and Sanjeev Gupta – Jai Prakasah Nath & Co-Meerut.

---

### **Practical Paper V:Electricity, Magnetism & Electronics**

**Work load: 30 hrs**

**2 hrs/week**

**Minimum of 6 experiments to be done and recorded**

1. Figure of merit of a moving coil galvanometer.
2. LCR circuit series/parallel resonance, Q factor.
3. Determination of ac-frequency –sonometer.
4. Verification of Kirchoff's laws and maximum power transfer theorem.
5. Field along the axis of a circular coil carrying current.
6. PN Junction Diode Characteristics
7. Zener Diode Characteristics
8. Transistor CE Characteristics- Determination of hybrid parameters
9. Carey Foster's Bridge – measurement of specific resistance.
10. Impedance and Power factor of LR Circuit.

**AdiKavi Nanayya University::Rajamahendravaram**  
**III B.Sc.: Physics Semester V- Paper V**  
**Electricity, Magnetism and Electronics**  
**(Model Paper)**

**TIME: 3Hrs**

**Max. Marks: 75**

**SECTION-A**

**Answer any FIVE questions**

**5x5=25M**

1. Derive the relation among D, E and P.  
D, E మరియు P ల మధ్య సంబంధమును ఉత్పాదించుము.
2. Derive expression for the potential due to a point charge.  
ఏదైనా ఒక బిందువు వద్ద విద్యుత్ పోటన్షియల్ కు సమీకరణాన్ని ఉత్పాదించుము.
3. What is Hall Effect? Write the applications of Hall Effect.  
హాల్ ప్రభావం అనగానేమి? హాల్ ప్రభావానికి అనువర్తనాలు వ్రాయుము.
4. Derive an expression for the self inductance of a long solenoid.  
పోడవైన సోలనాయిడ్ యొక్క స్వయం ప్రేరకత్వమునకు సమీకరణంను ఉత్పాదించుము.
5. Write the integral and differential forms of Maxwell's equations.  
మాక్స్ వెల్ సమీకరణాల యొక్క సమాకలన మరియు అవకలన రూపాలను వ్రాయుము.
6. Calculate the resonance frequency of a LCR series circuit with a resistance  $10\Omega$ , inductance  $20\text{mH}$  and a capacitance of  $0.02\mu\text{F}$ .  
 $10\Omega$  ల నిరోధం, ల ఇండక్టెన్స్  $20\text{mH}$ , capacitance  $0.02\mu\text{F}$  గల LCR శ్రేణి వలయానికి అనునాద పౌనఃపున్యము కనుగొనుము.
7. For a transistor  $\alpha = 0.95$  and its emitter current is  $1\text{mA}$ . Find its base and collector currents.  
ట్రాన్సిస్టర్  $\alpha$  విలువ  $0.95$  మరియు ఎమిటర్ ప్రవాహం  $1\text{mA}$ . ఆ ట్రాన్సిస్టర్ బేస్ మరియు కలెక్టర్ ప్రవాహాలను కనుగొనుము.
8. Convert following Binary to Decimal.  
క్రింది సంఖ్యలను ద్విసంఖ్య మానం నుండి దశాంశమానం లోకి మార్చుము.  
(i)  $(10100)_2$                       (ii)  $(11001)_2$

**SECTION-B**

**Answer any FIVE questions**

**5x5=25M**

9. (a) State and prove Gauss's law.  
గౌస్ సూత్రాన్ని వ్రాసి నిరూపించుము.  
(or)  
(b) Explain the boundary conditions at the dielectric surface.  
రోధక ఉపరితలం వద్ద సరిహద్దు నియామాల గురించి వివరించుము.
10. (a) State and explain Biot - Savart's law. Derive an expression for the magnetic induction at a point on the axis of a current carrying solenoid.  
బయోట్-సావర్ట్ నియమమునకు తెలిపి, వివరించుము. విద్యుత్ ప్రవహిస్తున్న సొలనాయిడ్ అక్షము మీద ఆయస్మాంత ప్రేరణకు సమీకరణమును రాబట్టుము.

(or)

(b) Describe the construction and working of a transformer. Explain its energy losses.

పరివర్తకం యొక్క నిర్మాణమును, పనిచేయు విధానమును వర్ణించుము. దాని శక్తి నష్టాలను విశదపరుచుము.

11. (a) Describe the behavior of series LCR circuit when an alternating voltage is applied to it. Explain the condition for resonance.

ఒక LCR శ్రేణి వలయమునకు ఏకాంతర వోల్టేజిని అనువర్తింప చేసినప్పుడు దాని ప్రవర్తనను వివరించుము. దాని అను నాద షరతును వివరించుము.

(or)

(b) Derive the equation of electromagnetic wave and hence determine the velocity of propagation of electromagnetic wave in free space.

విద్యుదయస్కాంత తరంగ సమీకరణాన్ని ఉత్పాదించి, తద్వారా శూన్యంలో తరంగ వేగమునకు సమీకరణాన్ని ఉత్పాదించుము.

12. (a) What is transistor? Explain the working of PNP and NPN Transistor.

ట్రాన్సిస్టర్ అనగానేమి? PNP మరియు NPN ట్రాన్సిస్టర్లు పనిచేయు విధానమును వివరించుము.

(or)

(b) Explain the CE characteristics of a Transistor.

ట్రాన్సిస్టర్ CE అభిలక్షణాలను గురించి వివరించుము.

13. (a) Explain the functioning of a Half Adder and a Full Adder along with respective truth tables.

అర్థ సంకలని మరియు పూర్ణ సంకలని లు పనిచేయు విధానమును వాటికి సంబంధించిన సత్య పట్టికలతో సహా పట్టికల తో సహా వివరించుము.

(or)

(b) State and prove Demorgan's laws. Realize AND, OR and NOT gates from NAND logic.

డీమోర్గాన్ సిద్ధాంతములను పేర్కొని, నిరూపించుము. NAND లాజిక్ నుంచి AND, OR మరియు NOT ద్వారములను రాబట్టుము.

**AdiKavi Nanayya University::Rajamahendravam**  
**III B.Sc. Physics Semester-V**  
**Electricity, Magnetism and Electronics**

**Blue Print**

<b>Module</b>	<b>Essay Questions 10 marks</b>	<b>Short Questions 5 marks</b>	<b>Marks allotted</b>
1. Unit - I	2	2	30
2. Unit - II	2	2	30
3. Unit - III	2	1+1Problem	30
4. Unit -IV	2	1Problem	25
5. Unit - V	2	1	25
Total			140

**AdiKavi Nanayya University::Rajamahendravaram**  
**III B.Sc. : Physics Paper VI Semester-V**  
**Modern Physics**

**No. of Credits: 03**  
**3 Hour/Week**  
**Total Hours : 45**

**UNIT-I (9 hrs)**

**1. Atomic and molecular physics**

Introduction –Drawbacks of Bohr’s atomic model. Vector atom model and Stern-Gerlach experiment - quantum numbers associated with it. L-S and j- j coupling schemes. Zeeman effect(Definition only) -Raman effect, hypothesis, Stokes and Anti Stokes lines. Quantum theory of Raman effect. Experimental arrangement – Applications of Raman effect.

**UNIT-II (9 hrs)**

**2. Matter waves & Uncertainty Principle**

Matter waves, de Broglie’s hypothesis - wavelength of matter waves, Properties of matter waves - Davisson and Germer experiment – Heisenberg’s uncertainty principle for position and momentum (x and p) & Energy and time (E and t).

**UNIT-III (9 hrs)**

**3. Quantum (wave) mechanics**

Basic postulates of quantum mechanics-Schrodinger time independent and time dependent wave equations-derivations. Physical interpretation of wave function. Eigen functions, Eigen values. Application of Schrodinger wave equation to particle in one dimensional infinite box.

**UNIT-IV(9 hrs)**

**4. General Properties of Nuclei**

Basic ideas of nucleus -size, mass, charge density (matter energy), binding energy, magnetic moment, electric moments. Liquid drop model and Shell model (qualitative aspects only) - Magic numbers.

**5. Radioactivity decay**

Alpha decay: basics of  $\alpha$ -decay processes. Theory of  $\alpha$ -decay, Gamow’s theory, Geiger Nuttal law. $\beta$ -decay, Energy kinematics for  $\beta$ -decay, positron emission, electron capture, neutrino hypothesis.

**UNIT-V (9 hrs)**

**6. Crystal Structure**

Amorphous and crystalline materials, unit cell, Miller indices, reciprocal lattice, types of lattices, diffraction of X-rays by crystals, Bragg’s law, experimental techniques, Laue’s method.



## 7. Superconductivity

Introduction - experimental facts, critical temperature - critical field - Meissner effect – Isotope effect - Type I and type II superconductors - applications of superconductors.

### Textbooks

1. Modern Physics by G. Aruldhas & P. Rajagopal. *Eastern Economy Edition*.
  2. Concepts of Modern Physics by Arthur Beiser. *Tata McGraw-Hill Edition*.
  3. Modern Physics by R. Murugesan and Kiruthiga Siva Prasath. *S. Chand & Co.*
  4. Nuclear Physics by D.C. Tayal, *Himalaya Publishing House*.
  5. Molecular Structure and Spectroscopy by G. Aruldhas. *Prentice Hall of India, New Delhi*.
  6. Spectroscopy –Atomic and Molecular by Gurdeep R Chatwal and Shyam Anand – *Himalaya Publishing House*.
  7. Third Year Physics - *Telugu Academy*.  
Elements of Solid State Physics by J.P. Srivastava. (for chapter on nanomaterials)- *Prentice-hall of India Pvt. Ltd*
- 

### Practical Paper VI: Modern Physics

**Work load: 30 hrs**

**2 hrs/week**

#### **Minimum of 6 experiments to be done and recorded**

1.  $e/m$  of an electron by Thomson method.
2. Determination of Planck's Constant (photocell).
3. Verification of inverse square law of light using photovoltaic cell.
4. Study of absorption of  $\alpha$ -rays.
5. Study of absorption of  $\beta$ -rays.
6. Determination of M & H.
7. Energy gap of a semiconductor using junction diode.
8. Energy gap of a semiconductor using thermister.
9. Logic Gates- OR,AND,NOT and NAND gates. Verification of Truth Tables.
10. Verification of De Morgan's Theorems.
11. Verification of Truth Tables of Universal gates
12. Verification of truth tables of Half and Full adders.

**AdiKavi Nanayya University::Rajamahendravaram**  
**III B.Sc. : Physics Paper VI Semester-V**  
**Modern Physics**  
**Model Paper**

**TIME: 3Hrs**

**Max. Marks: 75**

**SECTION-A**

**Answer any FIVE questions**

**5x5=25M**

1. Explain L-S coupling and J-J coupling.  
L-S సమ్మేళనము మరియు J-J సమ్మేళనములను గూర్చి వివరించండి.
2. Explain Raman Effect and symmetry of Raman lines on the basis of quantum theory.  
క్వాంటం సిద్ధాంతము ఆధారంగా రామన్ ఫలితాన్ని రామన్ రేఖల సౌష్ఠ్యమును వివరించండి.
3. Explain liquid drop model.  
ద్రవ బిందు నమూనాను వివరించుము.
4. Explain miller-indices.  
మిల్లర్ సూచికలు గూర్చి వివరముగా తెల్పుండి.
5. Explain Basic Postulates of Quantum Mechanics.  
క్వాంటమ్ సిద్ధాంతము యొక్క ప్రతిపాదనను వివరించండి
6. Calculate the de-Broglie wave length associated with a proton moving with a velocity of 2200m\sec.( $h=6.625 \times 10^{-34} \text{J-S}$ ,  $m=1.6 \times 10^{-27} \text{kg}$ )  
2200m\sec వేగంతో చలిస్తున్న ప్రోటాన్ యొక్క డీబ్రోగ్లీ తరంగ దైర్ఘ్యంను లెక్కించుము.  
( $h=6.625 \times 10^{-34} \text{J-S}$ ,  $m=1.6 \times 10^{-27} \text{kg}$ )
7. A neutron breaks into a proton and an electron. Calculate the mass defect in the reaction. ( $m_p=1.6725 \times 10^{-27} \text{Kg}$ ,  $m_e =9 \times 10^{-31} \text{kg}$ ,  $m_n=1.6747 \times 10^{-27} \text{Kg}$ )  
ఒక కేంద్రక చర్యలో ఒక న్యూట్రాన్ ప్రోటాన్ మరియు ఎలక్ట్రాన్ గా విడిపోయింది. ద్రవ్యరాశి లోపం లెక్కించుము.  
( $m_p=1.6725 \times 10^{-27} \text{Kg}$ ,  $m_e =9 \times 10^{-31} \text{kg}$ ,  $m_n=1.6747 \times 10^{-27} \text{Kg}$ )
8. X-rays of wave length  $1.54 \text{Å}$  are diffracted by a crystal. The incident angle  $11^\circ$ , what is the lattice space distance.  
స్ఫటికం వలన తరంగ దైర్ఘ్యం  $1.54 \text{Å}$  కలిగిన X-  
కిరణాలు వివర్తనం చెందినది. పతనకోణం  $11^\circ$  జాలక అంతర దూరమును కనుగొనుము.

**SECTION-B**

**Answer any ALL questions**

**5x10=50M**

9. (a) Describe stern and Gerlach experiment. What is its importance?  
స్టెర్న్-గెర్లాక్ ప్రయోగాన్ని వివరించండి. ఆ ప్రయోగ ప్రాముఖ్యత ఏమిటి?  
(or)  
(b) What is Raman Effect? How it is experimentally studied.  
రామన్ ఫలితం అనగానేమి? దానిని ప్రయోగ పూర్వకంగా వివరించండి.

10. (a) Explain De-Broglie hypothesis for matter waves. Derive an expression for De-broglie wave length.

ద్రవ్య తరంగముల గురించి డీ బ్రోగ్లీ పరికల్పన వివరించండి. డీ-బ్రోగ్లీ తరంగ దైర్ఘ్యమునకు సమీకరణం ఉత్పాదించుము.

(or)

(b) Explain Devison and Germer experiment for detection of matter waves.

ద్రవ్య తరంగాలను శోధించుటకు డెవిజన్ గెర్మర్ ప్రయోగాన్ని వివరింపుము.

11. (a) Derive Schrödinger's time independent wave equation.

కాలం మీద ఆధార పడని ష్రోడింగర్ తరంగ సమీకరణమునకు ఉత్పాదించుము.

(or)

(b) Obtain an expression for the energy of a particle in one dimensional potential wall.

ఏక నిరూపక పోటెన్షియల్ కూపములోని కణము యొక్క శక్తికి సమీకరణము రాబట్టండి.

12. (a) Explain magic numbers using nuclear shell model.

కేంద్రక కర్పర సమానాను ఉపయోగించి మ్యాజిక్ సంఖ్యలను వివరించండి?

(or)

(b) Explain Gamow theory of  $\alpha$  -decay.

$\alpha$ -కణ క్షీణత విషయంలో గేమో సిద్ధాంతమును వివరించుము.

13. (a) Describe laue method for the study of crystal structure.

స్పటిక నిర్మాణంకు సంబంధించి లవే ప్రయోగాన్ని వర్ణించండి?

(or)

(b) What is super conductivity? Explain Meissner effect. Mention the properties of super conductivity.

అతి వాహకత్వం అనగానేమి? మిస్నర్ ఫలితాన్ని వివరింపుము. అతి వాహకాల ధర్మాలను తెల్పుము.

**AdiKavi Nanayya University::Rajamahendravaram**  
**III B.Sc. : Physics Paper VI Semester-V**  
**Modern Physics**  
**Blue Print**

<b>Module</b>	<b>Essay Questions 10 marks</b>	<b>Short Questions 5 marks</b>	<b>Marks allotted</b>
1. Unit - I	2	2	30
2. Unit - II	2	1Problem	25
3. Unit - III	2	1	25
4. Unit -IV	2	1+1Problem	30
5. Unit - V	2	1+1Problem	30
Total			140

**AdiKavi Nanayya University::Rajamahendravam**  
**III B.Sc. Physics Semester-VI**  
**Elective Paper –VII-(A):Analog and Digital Electronics**

**3 Hour/Week**  
**Total Hours: 45**

**w.e.f : 2017-2018**

**Unit-I (10 Hours)**

1. FET-Construction, Working, characteristics and uses; MOSFET-enhancement MOSFET, construction and working , drain characteristics of MOSFET, applications of MOSFET
2. Photo electric devices: Structure and operation, characteristics, application of LDR, LED

**Unit-II (9Hours)**

3. Operational Amplifiers: Characteristics of ideal and practical Op-Amp (IC 741), Basic differential amplifiers, Op-Amp supply voltage, IC identification, Internal blocks of Op-Amp, CMRR, slew rate, concept of virtual ground.

**Unit-III (8 Hours)**

4. Applications of Op-Amp: Op-Amp as, Inverting amplifier, Non-inverting amplifier, voltage follower, summing amplifier, difference amplifier, comparator, integrator, differentiator.

**Unit-IV(9 Hours)**

5. Data processing circuits: Multiplexers, De-multiplexers, encoders, decoders, Characteristics for Digital ICs -RTL, DTL, TTL, (NAND & NOR Gates).
6. IC 555 Timer -Its pin diagram, internal architecture, Application as astable multi vibrator and mono stable multi vibrator.

**Unit-V (9 Hours)**

7. Sequential digital circuits: Flip-flops, RS, Clocked SR, JK, D, T, Master-Slave, Flip-flop,.
8. Code Converters: Design of code converter, BCD to 7 segment, binary/BCD to gray, gray to binary/BCD.

**Reference Books**

1. Digital Electronics by G.K.Kharate Oxford University Press
  2. Unified Electronics by Agarwal and Agarwal.
  3. Op- Amp and Linear ICs by Ramakanth A Gayekwad, 4<sup>th</sup> edition PHI
  4. Digital Principles and Applications by Malvino and Leach, TMH, 1996, 4<sup>th</sup> edition.
  5. Digital Circuit design by Morris Mano,PHI
  6. Switching Theory and Logic design by A.AnandKumar ,PHI
  7. operations amplifier by SV Subramanyam.
-

**AdiKavi Nanayya University::Rajamahendravam**  
**III B.Sc. Physics Semester-VI (Model Paper)**  
**Elective Paper –VII-(A):Analog and Digital Electronics**

**No. of Credits: 03**

**Note:-** Set the question paper as per the blue print given at the end of this model paper.

**Time: 3 Hrs.**

**Max. Marks: 75M**

**Section – A**

**Answer any FIVE questions**

**5x5= 25M**

1. Draw the symbols of LED, LDR, photo diode, diode and their typical applications.
2. Define CMRR and slew rate.
3. Explain the concept of virtual ground.
4. Draw and explain how the op-Amp acts as voltage follower.
5. Compare different logic families.
6. Calculate  $V_0$  for the circuit below for  $V_1=5v$  and  $V_2=2v$ .
7. Draw and explain the pin diagram of IC555.
8. Design 2 bit Binary to gray convertor.

**Section – B**

**Answer ALL questions.**

**5x10=50M**

9. (a) Explain the operation of enhancement MOSFET and draw its drain characteristics.  
(or)  
(b) Explain the operation of LED and draw its characteristics and state its applications.
10. (a) Explain the block diagram of Op-Amp and differentiate. Ideal and practical characteristics of Op-Amp.  
(or)  
(b) Explain the characteristics of Op-Amp IC 741.
11. (a) Explain the following applications of Op-Amp.
  - i. Inverting amplifier.
  - ii. Summing amplifier.(or)  
(b) Explain the op-amp as comparator.
12. (a) State and explain internal architecture of IC 555 and explain its applications as astable multivibrator.  
(or)  
(b) Explain about TTL NAND and NOR gates.
13. (a) Explain conversion of JK flip flop to D flip flop.  
(or)  
(b) Explain the design of code convertor

**AdiKavi Nanayya University::Rajamahendravam**  
**III B.Sc. Physics Semester-VI (Model Paper)**  
**Elective Paper –VII-(A):Analog and Digital Electronic**

**Blue Print**

Module	Essay Questions 10 marks	Short Questions 5 marks	Marks allotted
1. FET & photo electronic devices	2	1	25
2. Operational amplifier	2	2	30
3. Applications of Op-Amps	2	1+1Problem	30
4. Data processing circuits, IC555 Timers	2	2	30
5. Sequential digital circuits, code convertors	2	1	25
Total			140

**AdiKavi Nanayya University::Rajamahendravam**  
**III B.Sc. Physics Semester-VI**  
**Elective Paper-VII(A) Practical: Analog and Digital Electronics**

**Credits: 02**  
**2hrs/Week**

**Minimum of 6 experiments to be done and recorded**

- 1) Characteristics of FET
- 2) Characteristics of MOSFET
- 3) Characteristics of LDR
- 4) Characteristics of Op-amp.(IC741)
- 5) Op-Amp as amplifier/inverting amplifier
- 6) Op-Amp as integrator/differentiator
- 7) Op-Amp as summing amplifier/difference amplifier
- 8) IC 555 as astable multivibrator
- 9) IC 555 as monostable amplifier
- 10) Master slave flip flop