

**GOVERNMENT COLLEGE [A]
RAJAMAHENDRAVARAM**



2017-18

**BOARD OF STUDIES MEETING
06 DECEMBER 2017**

GOVERNMENT COLLEGE (AUTONOMOUS):: RAJAMAHENDRAVARAM
(Re-Accredited by NAAC with grade "A")
DEPARTMENT OF PHYSICS

BOARD OF STUDIES MEETING: 06 DECEMBER 2017

The Board of studies meeting of **DEPARTMENT OF PHYSICS** was convened at 10.30 A.M on 06-12-2017 under the Chairmanship of **Dr. K. RAMACHANDRA RAO, In-charge** of the department. The members present discussed various aspects such as changes to be made in the Syllabi, Scheme of Evaluation and Blue print both for theory and practical papers for implementing them during the **II, IV and VI** semester of the academic year 2017-18 onwards. The following members were present.

S.No	Name	Designation	Signature
1	Dr.K. RAMACHANDRA RAO Lecturer in charge/HOD Department of physics Government College, RAJAMAHENDRAVARAM	Chairman	
2	1. Sri. P.V. Satyaji 2. Sri. Esub Basha Shaik 3. Dr. P.V.S.S.S Reddy 4. Sri. N. Venkanna Babu	Member (Faculty members of the Department)	1 2 3 4
3	Dr. M.V.K. Meher, Lecturer in Physics, Government College, Alamuru	Subject expert	
4	Sri. T. K. Visweswara Rao Lecturer in Physics, Government College (W), Nidadavole	Subject expert	
5	Dr. A.Nirmala Jyothsna Lecturer in Physics, Ch.S.D.St. Theresa's College for Women, Eluru	University Nominee	
6	Dr. K. BALAKRISHNA MURTHY, DE, POLAVARAM PROJECT	Subject expert (Industry)	
7	Dr.Ravikiran S. Yedidi TyiDE - Toronto employee	Certificate Course Employee	
8	Kumari. STL Poornima	Student	

The following documents are submitted to the Academic Coordinator and Controller of Examinations.

1. Resolutions of Board of Studies Meeting
2. Syllabi of II,IV, VI semesters
3. Model question papers of all semesters
4. Examiners list (Revised)
5. Any other new proposals

Date: 06 DECEMBER 2017

Chairman
Board of Studies
Department of PHYSICS

GOVERNMENT COLLEGE (AUTONOMOUS): RAJAHMUNDRY
(Re-Accredited by NAAC with grade "A")

DEPARTMENT OF PHYSICS

BOARD OF STUDIES MEETING ON 06 DECEMBER 2017

RESOLUTIONS:

1. It is resolved to approve the introduction of APSCHE recommended Choice Based Credit System [CBCS] to the II B.Sc., course from the academic year 2017-18. CBC system was implemented for the I B.Sc., course during the academic year 2016-17.
2. It is resolved to approve the syllabus designed under autonomy setup for III and IV Semesters of II B.Sc., considering the syllabus recommended by APSCHE, ANUR, local needs of Industry and students for the academic year 2017-18.
3. It is resolved to approve the prescribed books for the syllabus designed above.
4. It is resolved to assess the student's performance under Continuous Internal Assessment (CIA) and Semester End Examination (SEE) components at 40:60 ratio for the II B.Sc., course from the academic year 2017 -18 as was done for I B.Sc., course in the academic year 2016-17.
5. It is resolved to approve the Scheme of Examination and Blue print of Semester End Examination (SEE) for III and IV Semesters of II B.S., from the academic year 2017-18

Theory examination:

Scheme for Semester End Examination (SEE)

TYPE OF QUESTION	MARKS	SCHEME
<p>PART-A</p> <p>Essay Questions</p>	<p>Each question carries 8 Marks</p> <p>4x8 = 32 M</p>	<p>Answer all questions</p> <ol style="list-style-type: none"> 1. (A) & (B) - From Unit I 2. (A) & (B) – From Unit II 3. (A) & (B) - From Unit III 4. (A) from Unit IV and (B) from Unit V
<p>PART-B</p> <p>Short Answer Questions</p>	<p>Each question carries 4 Marks</p> <p>5x4= 20 M</p>	<p>Answer any 5 out of 8 questions</p> <p>5 } 6 } 7 } 4 Theoretical Questions 8 } Not more than one question from each unit.</p> <p>09 } 10 } 11 } 4 Numerical Questions 12 } Not more than one question from each unit.</p> <p>At least one theoretical/ numerical to be asked from each unit.</p>
<p>PART-C</p> <p>Very Short Answer Questions</p>	<p>Each question carries 2 Marks</p> <p>4x2 = 8 M</p>	<p>Answer any four questions</p> <p>13 } 14 } 15 } Not more than one question 16 } from each unit 17 }</p>

Practical examination:

Scheme of valuation for internal & external:

S.No	Description	Marks
1	Formula	05
2	Tabular Form & Readings	10
3	Calculations & Result (Including Graph)	15
4	Precautions & Units	05
5	Viva Voce	05
6	Record**	10
7	TOTAL	50
INTERNAL : 50 M EXTERNAL : 50 M TOTAL: 100 M		

**Award of marks for number of practicals recorded in the Record

- 05 PRACTICALS and above - 10
- 4 PRACTICALS - 08
- 3 PRACTICALS - 06
- 2 PRACTICALS - 05
- LESS THAN 2 - 00

6. It is further resolved to continue to offer two applied (Skill based) elective papers in semester VI for III B.Sc., in place of paper IV for the academic year 2017-18 also so as to enable the student to choose one of the two.

The elective papers are

- A1. Nuclear Physics**
- A2. Solid State Physics**
- A3. Properties and Characterization of Materials**

Lab Facility:

A Well Equipped laboratory in the PG Department is available.

7. It is resolved to offer two cluster elective papers in semester VI for III B.Sc., in place of paper IV for the academic year 2017-18 also so as to enable the student to choose one of the two.

The cluster electives papers are

B1: Fundamentals of Nano Science

B2: Synthesis and Characterization of Nano Materials

B3: Applications of Nano Materials and Devices

Justification for inclusion of the paper " Nano materials: Properties and Synthesis"

Objective:

To provide basic concepts of the nano materials, their properties and synthesis techniques

Importance of Nano Materials:

Novel Properties

Scientists have discovered that materials at small dimensions—small particles, thin films, etc—can have significantly different properties than the same materials at larger scale. There are thus endless possibilities for improved devices, structures, and materials if we can understand these differences, and learn how to control the assembly of small structures.

Career Opportunities:

Nanotechnology is the next technical revolution and products resulting from it will affect all areas of our economy and lifestyle. It is estimated that by 2015 this exciting field will need 7 million workers worldwide.

Electronics/semiconductor industry	Medical fields	Automobile industry
Pharmaceuticals including drug delivery, cosmetics, among others	Materials science including textiles, polymers, packaging, among other	Environmental monitoring and control
Biotechnology	Sports equipment	Optoelectronics
Forensics	Food science: quality / packaging	Aerospace industry
Military	National security	University and federal lab research

Lab Facility:

A well equipped Laboratory established with DST Major Project is already available in the department.

8. It is resolved to continue the examination pattern for the III year students same as that followed during the year 2015-16.
9. It is resolved to continue the scheme of paper setting for theory examinations for V and VI semester for a maximum of 75 marks for external and remaining 25 marks for internal assessment
10. It is resolved to continue the scheme of evaluation for practical examination for V and VI semester for a maximum of 75 marks for external and 25 marks for internal.
11. It is resolved to approve the revised list of examiners and paper setters for the academic year 2017-18. List annexed.
12. It is resolved to offer the certificate course entitled “**Household Electrical Wiring**” & **Bio Physics** for the academic year 2017-18.

Date: 07 April 2017

Chairman
Board of Studies
Department of PHYSICS

SYLLABI

GOVERNMENT COLLEGE (A) : RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
SYLLABUS FOR I B.Sc., PHYSICS
MODULE-II [WAVES & OSCILLATIONS]
SEMESTER II

(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-18)

UNIT I :

1. Simple Harmonic oscillations 12 Hrs

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

UNIT II:

2. Damped and forced oscillations 12 Hrs

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. *Power consideration, Sharpness of resonance, Quality factor, Band width of resonance.*

UNIT III:

3. Complex vibrations (10 Hrs)

Fourier theorem and evaluation of the Fourier coefficients, analysis of periodic wave functions-square wave, triangular wave, saw tooth wave

UNIT IV:

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 free at both ends iv) bar fixed at one end. Tuning fork.

UNIT V:

6. Ultrasonics:9 Hrs

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.

Note: Numerical problems to be solved at the end of the every chapter.

TEXT BOOKS

1. BSc Physics Vol.1, Telugu Academy, Hyderabad.
2. Waves and Oscillations. N. Subramanyam and Brijlal, Vikas Publishing House Private Limited.
3. Unified Physics Vol., Mechanics, Waves and Oscillations, Jai Prakash Nath&Co.Ltd. Meerut.
4. Mechanics of Particles, Waves and Oscillations. Anwar Kamal, New Age International.

REFERENCE BOOKS:

1. Fundamentals of Physics. Halliday/Resnick/Walker , Wiley India Edition 2007.
2. Waves and Oscillations. S. Badami, V. Balasubramanian and K. Rama Reddy, Orient Longman.
3. College Physics-I. T. Bhimasankaram and G. Prasad. Himalaya Publishing House.
4. Science and Technology of Ultrasonics- Bladevraj, Narosa, New Delhi, 2004
5. Introduction to Physics for Scientists and Engineers. F.J. Ruche. McGraw Hill.
6. Mechanics by D S Mathur.

**GOVERNMENT COLLEGE(A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS**

TOPICS INCLUDED UNDER AUTONOMOUS SET UP

CLASS :I B.Sc.,
SEMESTER :II
PAPER : I
TITLE OF THE PAPER: WAVES & OSCILLATIONS

ADDITIONAL TOPICS	JUSTIFICATION
1. Group velocity and phase velocity	1. To understand the difference between a wave and wave packet and physical significance of wave packet compared to a wave and also to get a clear idea of wave propagation in a given medium.
2 Power consideration, Sharpness of resonance, Quality factor , Band width of resonance.	2. To enrich idea on forced oscillations and to easily compare forced oscillations and damped oscillations.

GOVERNMENT COLLEGE (A): RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
PHYSICS PAPER -1
(WAVES AND OSCILLATIONS)
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-2018)

EVALUATION SCHEME

Examination	No. of Marks	Remarks
Semester end examination	60	Model of examination pattern furnished below
Internal examination	40	

MODEL OF SEMESTER END EXAMINATION QUESTION PAPER [THEORY]

SECTION	DESCRIPTION	MARKS
A	Essay type questions- Four questions to be asked with internal choice in each question (A or B) from each unit. Student has to answer four questions choosing one (A or B) from each question. Each question carries 8 marks.	4x8 =32
B	Short answer type questions - Eight questions are to be asked (4 theory + 4 numerical). Student has to answer any five questions. Each question carries 4 marks	5x4 = 20
C	Very short answer type questions - Five questions are to be asked covering the entire syllabus. Student has to answer any four questions. Each question carries 2 Marks	4x2 =08
	TOTAL MARKS	60

GOVERNMENT COLLEGE (A): RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
BLUE PRINT FOR II - SEMESTER END EXAMINATION

MODULE - II: WAVES & OSCILLATIONS

Time: 3 Hours

Max. Marks: 60

Marks	Pattern	Type of Question
PART-A (4x8 = 32 M)	<p>Answer all questions</p> <ol style="list-style-type: none"> 1. (A) & (B) - From Unit I 2. (A) & (B) - From Unit II 3. (A) & (B) - From Unit III 4. (A) from Unit IV and (B) from Unit V 	Essay Questions
PART-B (5x4= 20 M)	<p>Answer any 5 out of 8 questions</p> <p>5 } 6 } 7 } 4 Theoretical Questions 8 } Not more than one question from each unit.</p> <p>09 } 10 } 11 } 4 Numerical Questions 12 } Not more than one question from any unit.</p> <p>At least one theoretical/numerical to be asked from each unit.</p>	Short Answer Questions
PART-C (4x2 = 8 M)	<p>Answer all questions</p> <p>13 } 14 } 15 } Not more than one question 16 } from each unit. 17 }</p>	Very Short Answer Questions

GOVERNMENT COLLEGE (A) : RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
PRACTICAL MODULE -1 (I B.Sc.,)
(MECHANICS & OSCILLATIONS LAB)
LIST OF EXPERIMENTS

(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-18)

Practical paper II: Waves & Oscillations

Work load: 30 hrs per semester 2 hrs/week

Minimum of 6 experiments to be done and recorded

LIST OF EXPERIMENTS

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, assignment

Note: Student has to do any six experiments at the end of each I and II semester.
In total 12 at the end of the academic year.

**GOVERNMENT COLLEGE (AUTONOMOUS): RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS**

**BOARD OF STUDIES MEETING ON 06 DECEMBER 2017
SEMESTER END PRACTICAL EXAMINATIONS
I B.Sc., PHYSICS**

SCHEME OF VALUATION

S.No	Description	Marks
1	FORMULA	05
2	TABULAR FORM & READINGS	10
3	CALCULATIONS & RESULT (Including Graph)	15
4	PRECAUTIONS & UNITS	05
5	VIVA VOCE	05
6	RECORD**	10
7	TOTAL	50
INTERNAL : 50 M EXTERNAL : 50 M TOTAL: 100 M		

**Award of marks for number of practicals recorded in the Record

- 05 PRACTICALS and above - 10
- 04 PRACTICALS - 08
- 03 PRACTICALS - 06
- 02 PRACTICALS - 05
- LESS THAN 02 - 00

GOVERNMENT COLLEGE (A):: RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
SYLLABUS FOR II B.Sc., PHYSICS
MODULE-IV [THERMODYNAMICS]
SEMESTER IV

(As Approved in the BOS meeting held on 06 DECEMBER 2017 W.E.F 2016-17)

UNIT - I

1. Kinetic theory of gases: (8)

Introduction - Deduction of Maxwell's law of distribution of molecular speeds, Experimental verification Toothed Wheel Experiment, Transport Phenomena - Viscosity of gases - thermal conductivity - diffusion of gases.

2. Statistical Mechanics: (10)

Introduction to statistical mechanics, concept of ensembles, Phase space, Maxwell-Boltzmann's distribution law, Molecular energies in an ideal gas, Bose-Einstein Distribution law, Fermi-Dirac Distribution law, comparison of three distribution laws.

UNIT-II

3. Quantum theory of radiation: (10)

Black body-Ferry's black body - distribution of energy in the spectrum of Black body - Wien's displacement law, Wien's law, Rayleigh-Jean's law - Quantum theory of radiation - Planck's law - deduction of Wien's law, Rayleigh-Jeans law, Wien's displacement law from Planck's law - Measurement of radiation -Earth as a blackbody - Types of pyrometers - Disappearing filament optical pyrometer - experimental determination - Angstrom pyroheliometer - determination of solar constant, effective temperature of sun.

UNIT -III

4. Thermodynamics: (12)

Introduction - Reversible and irreversible processes - Carnot's engine and its efficiency - Carnot's theorem - Second law of thermodynamics, Kelvin's and Clausius statements - Thermodynamic scale of temperature - Entropy, physical significance - Change in entropy in reversible and irreversible processes - Entropy and disorder - Entropy of universe - Temperature-Entropy (T-S) diagram - Change of entropy of a perfect gas-.

UNIT -IV

5. Thermodynamic potentials and Maxwell's equations: (10)

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 Vanderwaal's gas.

Unit - V

6. Low temperature Physics: (10)

Introduction - Joule Kelvin effect - liquefaction of gas using 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 - Principle of refrigeration, vapour compression type. Working of refrigerator and Air conditioning machines. Effects of chloro fluoro carbons on ozone layer

NOTE: Problems should be solved at the end of every chapter of all units

Textbooks

1. **Second Year Physics** - *Telugu Academy*
2. **Fundamentals of Physics.** Halliday/Resnick/Walker.C. *Wiley India Edition 2007*

Reference Books

1. **Modern Physics** by R. Murugesan and Kiruthiga Siva Prasad (for statistical Mechanics), *S. Chand & Co.*
2. **Modern Physics** by G. Aruldas and P. Rajagopal, *Eastern Economy Education.* Berkeley Physics Course. Volume-5.
3. **Statistical Physics** by F. Reif. *The McGraw-Hill Companies.*
4. **An Introduction to Thermal Physics** by Daniel V. Schroeder. *Pearson Education Low Price Edition.*
5. **Thermodynamics** by R.C. Srivastava, Subit K. Saha & Abhay K. Jain *Eastern Economy Edition.*

Government College (A) :: RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
MODULE IV :: SEMESTER IV (PAPER II)
THERMODYNAMICS

EVALUATION SCHEME

Examination	No. of Marks	Remarks
Semester end examination	60	Model of examination pattern furnished below
Internal examination	40	

MODEL OF SEMESTER END EXAMINATION QUESTION PAPER [THEORY]

SECTION	DESCRIPTION	MARKS
A	Essay type questions- Four questions to be asked with internal choice in each question (A or B) from each unit. Student has to answer four questions choosing one (A or B) from each question. Each question carries 8 marks.	4x8 =32
B	Short answer type questions - Eight questions are to be asked (5 theory + 4 numerical). Student has to answer any five questions. Each question carries 4 marks	5x4 = 20
C	Very short answer type questions - Five questions are to be asked covering the entire syllabus. Student has to answer any four questions. Each question carries 2 Marks	4x2 =08
	TOTAL MARKS	60

GOVERNMENT COLLEGE (A): RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
BLUE PRINT FOR IV - SEMESTER END EXAMINATION

MODULE - IV: THERMODYNAMICS

Time: 3 Hours

Max. Marks: 60

Marks	Pattern	Type of Question						
PART-A (4x8 = 32 M)	<p>Answer all questions</p> <ol style="list-style-type: none"> 1. (A) & (B) - From Unit I 2. (A) & (B) - From Unit II 3. (A) & (B) - From Unit III 4. (A) from Unit IV and (B) from Unit V 	Essay Questions						
PART-B (5x4= 20 M)	<p>Answer any 5 out of 8 questions</p> <table style="border: none; margin-left: 20px;"> <tr> <td style="vertical-align: middle;">5 6 7 8</td> <td style="font-size: 3em; vertical-align: middle; padding: 0 10px;">}</td> <td style="vertical-align: middle;">4 Theoretical Questions Not more than one question from each unit.</td> </tr> <tr> <td style="vertical-align: middle; margin-top: 20px;">09 10 11 12</td> <td style="font-size: 3em; vertical-align: middle; padding: 0 10px;">}</td> <td style="vertical-align: middle; margin-top: 20px;">4 Numerical Questions Not more than one question from each unit.</td> </tr> </table> <p>At least one theoretical/ numerical to be asked from each unit</p>	5 6 7 8	}	4 Theoretical Questions Not more than one question from each unit.	09 10 11 12	}	4 Numerical Questions Not more than one question from each unit.	Short Answer Questions
5 6 7 8	}	4 Theoretical Questions Not more than one question from each unit.						
09 10 11 12	}	4 Numerical Questions Not more than one question from each unit.						
PART-C (4x2 = 8 M)	<p>Answer all questions</p> <table style="border: none; margin-left: 20px;"> <tr> <td style="vertical-align: middle;">13 14 15 16 17</td> <td style="font-size: 3em; vertical-align: middle; padding: 0 10px;">}</td> <td style="vertical-align: middle;">Not more than one question from any unit</td> </tr> </table>	13 14 15 16 17	}	Not more than one question from any unit	Very Short Answer Questions			
13 14 15 16 17	}	Not more than one question from any unit						

GOVERNMENT COLLEGE (A):: RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
PRACTICAL MODULE - II (II B.Sc.,)
(OPTICS & THERMODYNAMICS LAB)
LIST OF EXPERIMENTS

Practical Paper IV: Thermodynamics & Radiation Physics

Work load: 30 hrs 2hrs/ 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. Thermo emf - 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

GOVERNMENT COLLEGE (AUTONOMOUS): RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
BOARD OF STUDIES MEETING ON 06 DECEMBER 2017
SEMESTER END PRACTICAL EXAMINATIONS
B.Sc., PHYSICS

SCHEME OF VALUATION

S.No	Description	Marks
1	FORMULA	05
2	TABULAR FORM & READINGS	10
3	CALCULATIONS & RESULT (Including Graph)	15
4	PRECAUTIONS & UNITS	05
5	VIVA VOCE	05
6	RECORD**	10
7	TOTAL	50
INTERNAL : 50 M EXTERNAL : 50 M TOTAL: 100 M		

**Award of marks for number of practicals recorded in the Record

- 05 PRACTICALS and above - 10
- 04 PRACTICALS - 08
- 03 PRACTICALS - 06
- 02 PRACTICALS - 05
- LESS THAN 02 - 00

**GOVERNMENT COLLEGE(A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS**

TOPICS INCLUDED UNDER AUTONOMOUS SET UP

**CLASS :II B.Sc.,
SEMESTER :IV
PAPER : II
TITLE OF THE PAPER: THERMODYNAMICS**

S.No	Paper	Unit	Topics included	justification
1	HEAT AND THERMODYNAMICS (SEMESTER IV)	1. Kinetic theory of gases. 2. Statistical Mechanics 3. Thermodynamics 4. Quantum theory of radiation.	1. Experimental verification Toothed Wheel Experiment 1. Introduction to statistical mechanics, concept of ensembles, Phase space, Maxwell-Boltzmann's distribution law, Molecular energies in an ideal gas, Bose-Einstein Distribution law, Fermi-Dirac Distribution law, comparison of three distribution laws. 1. Change of entropy of a perfect gas 1. Wien's displacement law from Planck's law 2. Earth as a blackbody	1. A complete new chapter included as suggested by the university nominee, useful at post graduation level and is research oriented. 1. Useful in various PG CETS and various competitive examinations. 1. Useful in calculating Solar energy levels and hence industry oriented

GOVERNMENT COLLEGE (A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
SYLLABUS FOR III B.Sc., PHYSICS (w.e.f.2017-2018)
SEMESTER VI - PAPAER III
COREIII - ELECTROMAGNETIC WAVE THEORY & ELECTRONICS
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-2018)

1. Varying and alternating currents (11 Periods): CR circuits - LR circuits - Growth and decay of currents. Alternating current, relation between current and voltage in pure R, C and L, Vector diagrams. LCR circuit series and parallel resonant circuit- power factor, Q factor.

2. Maxwell's equations and electromagnetic waves (13 periods): A review of basic laws of electricity and magnetism- displacement current- Maxwell's equation in differential form. Maxwell's wave equations. Plane electromagnetic waves- Transverse nature of electromagnetic waves, Poynting theorem, production and detection of electromagnetic waves (Hertz experiment).

3. Basic Electronics and Special Semi conductor devices (13 Periods): P-N junction diode, Zener diode, Half wave rectifier, Full wave rectifier and filter, ripple factor (quantitative) - PNP and NPN transistors. Current components CB, CE, CC configurations, Transistor hybrid parameters - determination of hybrid parameters from transistor characterization- transistor as an amplifier- concept of feedback. Barkhausen condition, phase shift oscillator (qualitative) - **Photo conductive cells, Solar cells, light emitting diode, laser diode, varactor diode, tunnel diode Basic principles only**

4. Digital Principles (8 Periods): Binary number system, converting Binary to Decimal and vice versa. Binary addition and subtraction (1's and 2's complement methods). Hexadecimal number system. Conversion from Binary to Hexadecimal vice versa and Decimal to Hexadecimal and vice versa. Logic gates: OR, AND, NOT gates, truth tables, realization of these gates using discrete components. NAND, NOR as universal gates, Exclusive -OR gate, DeMorgan's laws - statement and proof, Half and Full adders.

Note: Problems should be solved at the end of every chapter of all units.

Reference Books:

1. Electronic devices and Circuits - GK Mithal
2. Physics Vol III - Halliday and Resnick
3. Electronic devices and Circuits - Milliman and Halkies
4. Electricity and Electronics- Tayal
5. Digital electronics - Malvino
6. Electricity and Magnetism with Electronics - K.K Tewari (R.Chand)
7. Third year Physics - Telugu Academy.

GOVERNMENT COLLEGE(A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
TOPICS INCLUDED UNDER AUTONOMOUS SET UP

CLASS : III B.Sc.,
SEMESTER : VI
PAPER : III
TITLE OF THE PAPER : EM THEORY AND ELECTRONICS

ADDITIONAL TOPICS	JUSTIFICATION
1.Special semi conductor devices- Photo conductive cells, Solar cells, Light emitting diode, Laser diode, Varactor diode, Tunnel diode (Basic principles only)	Wide range of applications in industry and job oriented.

Government College (A) :: RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
MODULE V :: SEMESTER VI(PAPER III)
EM THEORY & ELECTRONICS

SCHEME OF EVALUATION

Examination	Marks	Remarks
Semester end examination	75	
Internal examination	25	Written examination : 10 Viva-voce : 5 Group Seminar : 5 Assignment : 5

PATTERN OF SEMESTER END THEORY EXAMINATION

Section	Description	Marks
A	Essay type questions- Four questions are to be asked with internal choice in each question (A or B). Student has to answer four questions. Each question carries 10 Marks	$4 \times 10 = 40$
B	Short answer type questions - Eight questions are to be asked including four problems. Student has to answer any five questions. Each question carries 3 Marks	$5 \times 3 = 15$
C	Very Short answer type questions - Ten questions are to be asked. Student has to answer all ten questions. Each question carries 2 Marks	$10 \times 2 = 20$
	TOTAL MARKS	75

GOVERNMENT COLLEGE(A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
SEMESTER - VI (PAPER - III)
EM THEORY & ELECTRONICS
BLUE PRINT FOR SEMESTER END EXAMINATION

SECTION - A **4 x 10 = 40 M**

1. (a) or (b) Unit - I
2. (a) or (b) Unit - II
3. (a) or (b) Unit - III
4. (a) or (b) Unit - IV

SECTION - B **5 x 3 = 15 M**

THEORETICAL QUESTIONS	9. Problem - Unit - I
5. Unit - I	10. Problem - Unit - II
6. Unit - II	11. Problem - Unit - III
7. Unit - III	12. Problem - Unit - IV
8. Unit - IV	

SECTION - C **10 x 2 = 20 M**

Ten questions are to be chosen randomly as per the weightage of the chapters.

GOVERNMENT COLLEGE(A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
(EM THEORY & ELECTRONICS)
PHYSICS PRACTICALS - PAPER III

- 1) RC circuit (frequency response)
- 2) LR circuit (frequency response)
- 3) LCR series circuit resonance, Q -factor
- 4) Power factor of an AC circuit
- 5) Determination of AC - frequency by Sonometer
- 6) Characteristics of a Junction Diode
- 7) Characteristics of Zener Diode
- 8) Characteristics of Transistor
- 9) Verification of Logic gates OR, AND, NOT, X-OR , NOR, NAND gates
- 10). Realization of basic logic gates by NAND and NOR gates
- 11). Verification of De-Morgan's theorems.
- 12). Verification of truth tables for half adder and full adders

Note: One has to complete a minimum of 06 experiments.

GOVERNMENT COLLEGE (A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
SYLLABUS FOR III B.Sc., PHYSICS (w.e.f.2017-2018)
SEMESTER VI
CLUSTER ELECTIVE - (A) - PAPER IV
A1: NUCLEAR PHYSICS
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-2018)

Unit - I

Nuclear Structure (10 hours)

Basic properties of nucleus - Nucleus magnetic dipole moment and electric quadrupole moment. Binding energy of nucleus, deuteron binding energy, p-p and n-p scattering (concepts), nuclear forces. Nuclear models - liquid drop model, shell model.

Unit - II

Alpha and Beta Decays (10 hours): Range of alpha particles, Geiger - Nuttall law. Gamow's theory of alpha decay. Geiger - Nuttall law from Gamow's theory. Beta spectrum - neutrino hypothesis, Fermi's theory of β -decay (qualitative).

Unit - III

Nuclear Reactions (10 hours) : Types of nuclear reactions, channels, nuclear reaction kinematics. Compound nucleus, direct reactions (concepts).

Unit - IV

Nuclear Detectors (10 hours) - GM counter, proportional counter, scintillation counter, Wilson cloud chamber and solid state detector

Elementary Particle Physics (5 hours) : Particle interactions and families, conservation laws:

NOTE: Problems should be solved from every chapter of all units.

Reference books :-

1. Quantum mechanics-mathews and venkatesan
2. Introduction to quantum mechanics -Pauling and Wilson.
3. Nuclear physics -Tayal
4. Elements of modern physics -Patil.
5. Atomic and nuclear physics -T.A Little field as N.thorley
6. Quantum chemistry by Ira N.Levine (P.H.I)
7. Nuclear physics by somayajulu, varma, choudary
8. Organic spectroscopy - Kalsi, Pawe

GOVERNMENT COLLEGE(A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
EVALUATION SCHEME &
MODEL OF SEMESTER END EXAMINATION QUESTION PAPER [THEORY]
CLUSTER ELECTIVE -A1
(NUCLEAR PHYSICS)
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-2018)
SCHEME OF EVALUATION

Examination	No. of Marks	Remarks
Semester end examination	75	Model of examination pattern furnished below
Internal examination	25	Written examination: 10 Viva-voce : 5 Seminar:5 Assignment:5

MODEL OF SEMESTER END EXAMINATION QUESTION PAPER [THEORY]

SECTION	DESCRIPTION	MARKS
A	Essay type questions- Four questions to be asked with internal choice in each question (A or B) from each unit. Student has to answer four questions choosing one (A or B) from each question. Each question carries 10 marks.	4x10 = 40
B	Short answer type questions - Eight questions are to be asked (4 theory + 4 numerical). Student has to answer any five questions. Each question carries 3 marks	5x3 = 15
C	Very short answer type questions - Ten questions are to be asked covering the entire syllabus. Student has to answer all ten questions. Each question carries 2 Marks	10x2 =20
	TOTAL MARKS	75

GOVERNMENT COLLEGE(A):RAJAMAHENDRAVARAM

**DEPARTMENT OF PHYSICS
SEMESTER - VI
CLUSTER ELECTIVE -A1
(NUCLEAR PHYSICS)
SEM END EXAM BLUE PRINT**

SECTION - A 4 x 10 = 40 M

1. (a) or (b) Unit - I
2. (a) or (b) Unit - II
3. (a) or (b) Unit - III
4. (a) or (b) Unit - IV

SECTION - B 5 x 3 = 15 M

THEORETICAL QUESTIONS	9. Problem - Unit - I
5. Unit - I	10. Problem - Unit - II
6. Unit - II	11. Problem - Unit - III
7. Unit - III	12. Problem - Unit - IV
8. Unit - IV	

SECTION - C 10 x 2 = 20 M

Ten questions are to be chosen randomly as per the weightage of the chapters.

**GOVERNMENT COLLEGE (A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
SYLLABUS FOR III B.Sc., PHYSICS (w.e.f.2017-2018)
SEMESTER VI
CLUSTER ELECTIVE - (A) - PAPER IV
A1: NUCLEAR PHYSICS
PRACTICAL/PROJECT WORK
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-2018)**

PROJECT WORK HAS BEEN PROPOSED

GOVERNMENT COLLEGE (A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
SYLLABUS FOR III B.Sc., PHYSICS (w.e.f.2017-2018)
SEMESTER VI
CLUSTER ELECTIVE - (A) - PAPER IV
A2: SOLID STATE PHYSICS
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-2018)

Unit - I

Crystal Structure (15 hours) : Crystalline nature of matter. Crystal lattice, Unit Cell, Elements of symmetry. Crystal systems, Bravais lattices. Miller indices. Simple crystal structures (S.C., BCC, CsCl, FCC, NaCl diamond and Zinc Blend)
Concept or reciprocal lattice vector and Brillouin Zone (Basic ideas only)

Unit - II

X-ray Diffraction (10 hours) : Diffraction of X -rays by crystals, Bragg's law, and Experimental techniques - Laue's method and powder method.
Nanomaterials: Introduction, nanoparticles, metal nanoclusters, semiconductor nanoparticles, carbon clusters, carbon nanotubes, quantum nanostructures - nanodot, nanowire and quantum well. Fabrication of quantum nanostructures.

Unit - III

Bonding in Crystals (10 hours) : Types of bonding in crystals - characteristics of crystals with different bindings. Lattice energy of ionic crystals - determination of Madelung constant for NaCl crystal, calculation of Born coefficient and repulsive exponent. Born - Haber cycle.

Unit - IV

Superconductivity (10 hours) : Basic experimental facts - zero resistance, effect of magnetic field, Meissner effect, persistent current, Isotope effect
Thermodynamic properties, specific heat, entropy. Type I and Type II superconductors.

Elements of BCS theory-Cooper pairs. Applications. High temperature superconductors (general information)

NOTE: Problems should be solved from every chapter of all units.

Reference books :-

1. SOLID STATE PHYSICS - C.KETTELE
2. SOLID STATE PHYSICS - A.J. WAHAB
3. SOLID STATE PHYSICS - ALI OMAR
4. UNIFIED PHYSICS VOLUME - IV
5. SOLID STATE PHYSICS - S.O. PILLAI

GOVERNMENT COLLEGE(A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
EVALUATION SCHEME &
MODEL OF SEMESTER END EXAMINATION QUESTION PAPER [THEORY]
CLUSTER ELECTIVE -A2
(SOLID STATE PHYSICS)
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-2018)
SCHEME OF EVALUATION

Examination	No. of Marks	Remarks
Semester end examination	75	Model of examination pattern furnished below
Internal examination	25	Written examination: 10 Viva-voce : 5 Seminar:5 Assignement:5

MODEL OF SEMESTER END EXAMINATION QUESTION PAPER [THEORY]

SECTION	DESCRIPTION	MARKS
A	Essay type questions- Four questions to be asked with internal choice in each question (A or B) from each unit. Student has to answer four questions choosing one (A or B) from each question. Each question carries 10 marks.	4x10 = 40
B	Short answer type questions - Eight questions are to be asked (4 theory + 4 numerical). Student has to answer any five questions. Each question carries 3 marks	5x3 = 15
C	Very short answer type questions - Ten questions are to be asked covering the entire syllabus. Student has to answer all ten questions. Each question carries 2 Marks	10x2 =20
	TOTAL MARKS	75

GOVERNMENT COLLEGE(A):RAJAMAHENDRAVARAM

DEPARTMENT OF PHYSICS

SEMESTER - VI

**CLUSTER ELECTIVE -A2
(SOLID STATE PHYSIS)**

SEM END EXAM BLUE PRINT

SECTION - A 4 x 10 = 40 M

1. (a) or (b) Unit - I
2. (a) or (b) Unit - II
3. (a) or (b) Unit - III
4. (a) or (b) Unit - IV

SECTION - B 5 x 3 = 15 M

THEORETICAL QUESTIONS	9. Problem - Unit - I
5. Unit - I	10. Problem - Unit - II
6. Unit - II	11. Problem - Unit - III
7. Unit - III	12. Problem - Unit - IV
8. Unit - IV	

SECTION - C 10 x 2 = 20 M

Ten questions are to be chosen randomly as per the weightage of the chapters.

GOVERNMENT COLLEGE (A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
SYLLABUS FOR III B.Sc., PHYSICS (w.e.f.2017-2018)
SEMESTER VI
CLUSTER ELECTIVE - (A) - PAPER IV
A2: SOLID STATE PHYSICS
PRACTICAL/ PROJECT
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-2018)

1. Energy gap of semiconductor using a junction diode
2. Temperature characteristics of a thermistor
3. Determination of Planck's constant (photo cell)
4. e/m of an electron by Thomson's method
5. Hysteresis curve of transformer core
6. Study of spectra of hydrogen spectrum (Determination of Rydberg constant)
7. Hall - Probe method for measurement of magnetic field

Note: One has to complete a minimum of 06 experiments.

GOVERNMENT COLLEGE (A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
SYLLABUS FOR III B.Sc., PHYSICS (w.e.f.2017-2018)
SEMESTER VI
CLUSTER ELECTIVE - (A) - PAPER IV
A3: PROPERTIES AND CHARACTERIZATION OF MATERIALS
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-2018)

UNIT - I

THERMAL PROPERTIES (10 hours):

An harmonic crystal interactions - thermal expansion, thermal conductivity, lattice thermal resistivity.

Optical properties:

Lattice vacancies, diffusion, Color centres - F centres, other centres in alkali halides, alloys.

UNIT - II

Magnetic Properties (10 hours) :

**Dia magnetism, para magnetism, Ferro magnetism, anti ferro magnetism
Langevin's theory of paramagnetism. Weiss' theory of ferromagnetism -
Concepts of magnetic domains, antiferromagnetism and ferrimagnetism ferrites
and their applications.**

UNIT - III

Di electric properties (10 hours) :

**Dielectric constant, di electric strength and dielectric loss, polarizability,
mechanism of polarization, factors affecting polarization, polarization curve and
hysteresis loop, types of dielectric materials, applications; ferroelectric,
piezoelectric and pyroelectric materials, clausius - mosotti equation.**

UNIT - IV

Electrical and magnetic characterization techniques (15 hours) :

**DC & AC Conductivity, Curie temperature, saturation magnetization and
susceptibility**

Optical Spectroscopy:

Fundamentals of Infra - red spectroscopy and Applications:

REFERENCE BOOKS:

- 1. SOLID STATE PHYSICS - C. KITTEL**
- 2. FUNDAMENTALS OF MOLECULAR SPECTROSCOPY CN BANWELL**

GOVERNMENT COLLEGE(A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
EVALUATION SCHEME &
MODEL OF SEMESTER END EXAMINATION QUESTION PAPER [THEORY]
CLUSTER ELECTIVE -A3
(PROPERTIES AND CHARACTERIZATION OF MATERIALS)
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-2018)
SCHEME OF EVALUATION

Examination	No. of Marks	Remarks
Semester end examination	75	Model of examination pattern furnished below
Internal examination	25	Written examination: 10 Viva-voce : 5 Seminar:5 Assignement:5

MODEL OF SEMESTER END EXAMINATION QUESTION PAPER [THEORY]

SECTION	DESCRIPTION	MARKS
A	Essay type questions- Four questions to be asked with internal choice in each question (A or B) from each unit. Student has to answer four questions choosing one (A or B) from each question. Each question carries 10 marks.	4x10 = 40
B	Short answer type questions - Eight questions are to be asked (4 theory + 4 numerical). Student has to answer any five questions. Each question carries 3 marks	5x3 = 15
C	Very short answer type questions - Ten questions are to be asked covering the entire syllabus. Student has to answer all ten questions. Each question carries 2 Marks	10x2 =20
	TOTAL MARKS	75

GOVERNMENT COLLEGE(A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
SEMESTER - VI
CLUSTER ELECTIVE -A3
(PROPERTIES AND CHARACTERIZATION OF MATERIALS)

SEM END EXAM BLUE PRINT

SECTION - A 4 x 10 = 40 M

1. (a) or (b) Unit - I
2. (a) or (b) Unit - II
3. (a) or (b) Unit - III
4. (a) or (b) Unit - IV

SECTION - B 5 x 3 = 15 M

THEORETICAL QUESTIONS	
5. Unit - I	9. Problem - Unit - I
6. Unit - II	10. Problem - Unit - II
7. Unit - III	11. Problem - Unit - III
8. Unit - IV	12. Problem - Unit - IV

SECTION - C 10 x 2 = 20 M

Ten questions are to be chosen randomly as per the weightage of the chapters.

GOVERNMENT COLLEGE (A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
SYLLABUS FOR III B.Sc., PHYSICS (w.e.f.2017-2018)
SEMESTER VI
CLUSTER ELECTIVE - (A) - PAPER IV
A3: PROPERTIES AND CHARACTERIZATION OF MATERIALS
PRACTICAL/ PROJECT
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-2018)

1. The Frank - Hertz experiment
2. Band gap of a semi conductor (Two Probe Method)
3. Experiments with He - Ne Laser
 - (a). Polarization of laser light
 - (b). Divergence of laser beam and monochromaticity.
4. Band gap of a semiconductor (Four probe Method)
5. Dielectric constant as a function of temperature and determination of Curie temperature.
6. Hall Effect: Determination of Hall coefficient and estimation of charge carrier concentration and mobility.
7. Lattice Dynamics: Study of Phonon dispersion characteristics.
8. Coupled Oscillators: Study of the normal modes of vibrations of coupled pendulum, strength of the coupling constant and exchange energy.
9. Study of Magnetic Hysteresis loops of ferromagnetic materials (B - H Curve).

Note: One has to complete a minimum of 06 experiments.

GOVERNMENT COLLEGE (A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
SYLLABUS FOR III B.Sc., PHYSICS (w.e.f.2017-2018)
SEMESTER VI
CLUSTER ELECTIVE - (A) - PAPER IV
A3: PROPERTIES AND CHARACTERIZATION OF MATERIALS
PRACTICAL/ PROJECT
(As Approved in the BOS meeting held on 07 APRIL 2017 for 2017-2018)

GOVERNMENT COLLEGE (A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
SYLLABUS FOR III B.Sc., PHYSICS (w.e.f.2017-2018)
SEMESTER VI
CLUSTER ELECTIVE - (B) - PAPER IV
B1: FUNDAMENTALS OF NANO SCIENCE
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-2018)

UNIT - I

1. Back ground and history (9 hours) : Emergence of nanoscience with special reference to Feynman and Drexler; Role of particle size; Spatial and temporal scale; Concept of confinement, strong and weak confinement with suitable example; Development of quantum structures, Basic concept of quantum well, quantum wire and quantum dot.

Finite size Zero, One and Two dimensional Nano structures, Concept of surface and Interfacial energies. Physics of the solid state - size dependence of properties, crystal structures, Lattice vibrations, Energy bands:- Insulators, Semiconductors and conductors.

UNIT - II

2. Classification of Nanomaterials (9 hours): Inorganic Nanomaterials; carbon nano tubes and cones, Organic Nanomaterials: dendrimers, micelles, liposomes, block copolymers; Bionanomaterials: Biomimetic and nanotherapeutics; Nanomaterials for molecular electronics and optoelectronics.

UNIT-III

3. Macromolecules (9 hours): Classification of polymers, chemistry of polymerization, chain polymerization, step polymerization, coordination polymerization. Molecular weight of polymers-number average and weight average molecular weight, degree of polymerization, determination of molecular weight of polymers by viscometry,

UNIT-IV

4.Molecular & Nanoelectronics(9 hours): Semiconductors, Transition from crystal technology to nanotechnology. Tiny motors, Gyroscopes and accelerometers. Nano

particle embedded wrinkle resistant cloth, Transparent Zinc Oxide sun screens.

5. Biomaterials (9 hours): Implant materials: Stainless steels and its alloys, Ti and Ti based alloys, Ceramic implant materials; Hydroxyapatite glass ceramics, Carbon Implant materials, Polymeric Implant materials, Soft tissue replacement implants, Sutures, Surgical tapes and adhesives, heart valve implants, Artificial organs, Hard Tissue replacement Implants, Internal Fracture Fixation Devices, Wires, Pins, and Screws, Fracture Plates.

Reference Books

1. T. Pradeep: Textbook of Nanoscience and Nanotechnology Chapter (McGraw-Hill Professional, 2012), Access Engineering.
2. C. N. R. Rao, A. Müller, A. K. Cheetham, "The Chemistry of Nanomaterials :Synthesis, Properties and Applications", Wiley-VCH, 2006.
3. C. Breachignac P. Houdy M. Lahmani, "Nanomaterials and Nanochemistry", Springer, 2006.
4. Guozhong Cao, "Nanostructures and Nanomaterials: Synthesis, Properties, and Applications", World Scientific Publishing Private, Ltd., 2011.
5. Zhong Lin Wang, "Characterization of Nanophase Materials", Wiley-VCH, 2004.
6. Carl C. Koch, "Nanostructured Materials: Processing, Properties and Potential Applications", William Andrew Publishing Norwich, 2006.

GOVERNMENT COLLEGE(A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
EVALUATION SCHEME &
MODEL OF SEMESTER END EXAMINATION QUESTION PAPER [THEORY]
CLUSTER ELECTIVE -B1
(FUNDAMENTALS OF NANOSCIENCE)
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-2018)
SCHEME OF EVALUATION

Examination	No. of Marks	Remarks
Semester end examination	75	Model of examination pattern furnished below
Internal examination	25	Written examination: 10 Viva-voce : 5 Seminar:5 Assignment:5

MODEL OF SEMESTER END EXAMINATION QUESTION PAPER [THEORY]

SECTION	DESCRIPTION	MARKS
A	Essay type questions- Four questions to be asked with internal choice in each question (A or B) from each unit. Student has to answer four questions choosing one (A or B) from each question. Each question carries 10 marks.	4x10 = 40
B	Short answer type questions - Eight questions are to be asked (4 theory + 4 numerical). Student has to answer any five questions. Each question carries 3 marks	5x3 = 15
C	Very short answer type questions - Ten questions are to be asked covering the entire syllabus. Student has to answer all ten questions. Each question carries 2 Marks	10x2 =20
	TOTAL MARKS	75

GOVERNMENT COLLEGE(A):RAJAMAHENDRAVARAM

**DEPARTMENT OF PHYSICS
SEMESTER - VI
CLUSTER ELECTIVE -B1
(FUNDAMENTALS OF NANOSCIENCE)
SEM END EXAM BLUE PRINT**

SECTION - A 4 x 10 = 40 M

1. (a) or (b) Unit - I
2. (a) or (b) Unit - II
3. (a) or (b) Unit - III
4. (a) or (b) Unit - IV

SECTION - B 5 x 3 = 15 M

THEORETICAL QUESTIONS	9. Problem - Unit - I
5. Unit - I	10. Problem - Unit - II
6. Unit - II	11. Problem - Unit - III
7. Unit - III	12. Problem - Unit - IV
8. Unit - IV	

SECTION - C 10 x 2 = 20 M

Ten questions are to be chosen randomly as per the weightage of the chapters.

GOVERNMENT COLLEGE (A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
SYLLABUS FOR III B.Sc., PHYSICS (w.e.f.2017-2018)
SEMESTER VI
CLUSTER ELECTIVE - (B) - PAPER IV
B1: FUNDAMENTALS OF NANOSCIENCE
PRACTICAL/ PROJECT
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-2018)

Minimum of 6 experiments to be done and recorded

1. Determination of the Band Gap of Semiconductor Nanoparticles.
2. Surface Enhanced Raman Scattering Activity of Silver Nanoparticles
3. Conversion of Gold Nano rods into Gold Nanoparticles
4. Bimetallic Nanoparticles
5. Processing and Development of Nano particle gas sensor
6. Magnetic separation/identification studies of nanoparticles
7. Harvesting light using nano-solar cells
8. Nano-Forensic analysis to identify, individualize and evaluate evidence using nano phase materials
9. Comparison of the performance of nanoparticles based conductive adhesives and conventional non conductive adhesives.
10. Electro deposition and corrosion behavior of nano structured composite film
11. Photo catalytic activity of nano materials

GOVERNMENT COLLEGE (A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
SYLLABUS FOR III B.Sc., PHYSICS (w.e.f.2017-2018)
SEMESTER VI
CLUSTER ELECTIVE - (B) - PAPER IV
B2: SYNTHESIS AND CHARACTERIZATION OF NANO MATERIALS
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-2018)

Unit-I (9 hours)

1. Nanomaterials synthesis: Synthesis and nanofabrication, Bottom-Up and Top-Down approach with examples. Chemical precipitation methods, sol-gel method, chemical reduction, hydrothermal, process. Physical Methods- ball milling, Physical Vapour deposition (PVD), Sputtering, Chemical Vapor deposition (CVD), pyrolysis,

Unit-II (9 hours)

2. Classification of materials: Types of materials, Metals, Ceramics (Sand glasses)

polymers, composites, semiconductors. Metals and alloys- Phase diagrams of single component, binary and ternary systems, diffusion, nucleation and growth.

UNITS-III (9 hours)

3. Glasses: The glass transition - theories for the glass transition, Factors that determine the glass-transition temperature. Glass forming systems and ease of glass formation, preparation of glass materials. Applications of Glasses: Introduction: Electronic applications, Electrochemical applications, optical applications, Magnetic applications.

UNITS-IV (18 hours)

4. Liquid Crystals: Mesomorphism of anisotropic systems, Different liquid crystalline phase and phase transitions, Thermal and electrical properties of liquid crystals, Types Liquid Crystals displays, few applications of liquid crystals.

5. Characterization Methods: XRD, SEM, TEM, AFM, XPS and PL characterization techniques for nano materials.

References books

1. Encyclopedia of Nanotechnology by M.Balakrishna Rao and K.Krishna Reddy, Vol.I to X, Campus books.
2. Nano: The Essentials-Understanding Nanoscience & Nanotechnology by T.Pradeep; Tata Mc. Graw Hill
3. Nanotechnology in Microelectronics & Optoelectronics, J.M Martine Duart, R.J Martin Palma, F. Agullo Rueda, Elsevier
4. Nanoelectronic Circuit Design, N.K Jha, D Chen, Springer
5. Handbook of Nanophysics- Nanoelectronics & Nanophotonics, K.D Sattler, CRC Press
6. Organic Electronics-Sensors & Biotechnology- R. Shinar & J. Shinar, McGraw-Hill

GOVERNMENT COLLEGE(A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
EVALUATION SCHEME &
MODEL OF SEMESTER END EXAMINATION QUESTION PAPER [THEORY]
CLUSTER ELECTIVE -B2
(Synthesis and Characterization of Nanomaterials)
(As Approved in the BOS meeting held on 07 APRIL 2017 for 2017-2018)
SCHEME OF EVALUATION

Examination	No. of Marks	Remarks
Semester end examination	75	Model of examination pattern furnished below
Internal examination	25	Written examination: 10 Viva-voce : 5 Seminar:5 Assignment:5

MODEL OF SEMESTER END EXAMINATION QUESTION PAPER [THEORY]

SECTION	DESCRIPTION	MARKS
A	Essay type questions- Four questions to be asked with internal choice in each question (A or B) from each unit. Student has to answer four questions choosing one (A or B) from each question. Each question carries 10 marks.	4x10 = 40
B	Short answer type questions - Eight questions are to be asked (4 theory + 4 numerical). Student has to answer any five questions. Each question carries 3 marks	5x3 = 15
C	Very short answer type questions - Ten questions are to be asked covering the entire syllabus. Student has to answer all ten questions. Each question carries 2 Marks	10x2 =20
	TOTAL MARKS	75

GOVERNMENT COLLEGE(A):RAJAMAHENDRAVARAM

DEPARTMENT OF PHYSICS

SEMESTER - VI

CLUSTER ELECTIVE -B2

(Synthesis and characterization of Nanomaterials)

SEM END EXAM BLUE PRINT

SECTION - A 4 x 10 = 40 M

1. (a) or (b) Unit - I
2. (a) or (b) Unit - II
3. (a) or (b) Unit - III
4. (a) or (b) Unit - IV

SECTION - B 5 x 3 = 15 M

THEORETICAL QUESTIONS	9. Problem - Unit - I
5. Unit - I	10. Problem - Unit - II
6. Unit - II	11. Problem - Unit - III
7. Unit - III	12. Problem - Unit - IV
8. Unit - IV	

SECTION - C 10 x 2 = 20 M

Ten questions are to be chosen randomly as per the weightage of the chapters.

GOVERNMENT COLLEGE (A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
SYLLABUS FOR III B.Sc., PHYSICS (w.e.f.2017-2018)
SEMESTER VI
CLUSTER ELECTIVE - (B) - PAPER IV
B2: SYNTHESIS AND CHARACTERIZATION OF NANOMATERIALS
PRACTICAL/ PROJECT
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-2018)

Minimum of 6 experiments to be done and recorded

1. Synthesis of nanocrystalline films of II-VI compounds doped with rare earths by chemical process.
2. Synthesis of Alkaline earth aluminates in nanocrystalline form by combustion synthesis.
3. Preparation of surface conducting glass plate by spray pyrolysis method
4. Preparation of surface conducting glass plate by chemical route
5. Fabrication of micro fluidic nanofilter by polymerisation reaction
6. Absorption studies on the nanocrystalline films and determination of absorption coefficient.
7. Determination of band gap from the absorption spectra using Tauc's plots.
8. Study of Hall effect in semiconductors and its application in nanotechnology.
9. Measurement of electrical conductivity of semiconductor film by Four Probe method and study of temperature variation of electrical conductivity.

GOVERNMENT COLLEGE (A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
SYLLABUS FOR III B.Sc., PHYSICS (w.e.f.2017-2018)
SEMESTER VI
CLUSTER ELECTIVE - (B) - PAPER IV
B3: APPLICATIONS OF NANO MATERIALS AND DEVICES
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-2018)

UNIT-I (9 hours)

1. **Optical properties:** Coulomb interaction in nanostructures. Concept of dielectric constant for nanostructures and charging of nanostructure. Quasi-particles and excitons. Excitons in direct and indirect band gap semiconductor nanocrystals. Quantitative treatment of quasi-particles and excitons, charging effects.

2. UNIT-II (9 hours)**2. Electrical transport:**

Carrier transport in nanostructures. Hall effect, termination of carrier mobility and carrier concentration; Coulomb blockade effect, thermionic emission, tunneling and hopping conductivity. Defects and impurities: Deep level and surface defects.

UNIT-III (9 hours)

3.Applications: Applications of nanoparticles, quantum dots, nanowires and thin films for photonic devices (LED, solar cells). Single electron transfer devices (no derivation). CNT based transistors. Nanomaterial Devices: Quantum dots heterostructures lasers, optical switching and optical data storage.

UNIT-IV(18 hours)

4. Nanoelectronics: Introduction, Electronic structure of Nanocrystals, Tuning the Band gap of Nanoscale semiconductors, Excitons, Quantumdot, Single electron devices, Nanostructured ferromagnetism, Effect of bulk nanostructuring of magnetic properties,

5. Nanobiotechnology and Medical application: Introduction, Biological building blocks-size of building blocks and nanostructures, Peptide nanowires and protein nanoparticles, DNA double nanowires, Nanomaterials in drug delivery and therapy, Nanomedicine, Targeted gold nanoparticles for imaging and therapy.

Reference books:

- 1.C.P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.).
- 2.S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publishing Company).
3. K.K. Chattopadhyay and A.N. Banerjee, Introduction to Nanoscience & Technology (PHI Learning Private Limited).
4. Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).

GOVERNMENT COLLEGE(A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
EVALUATION SCHEME &
MODEL OF SEMESTER END EXAMINATION QUESTION PAPER [THEORY]
CLUSTER ELECTIVE -B3
(Applications of Nano materials and Devices)
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-2018)
SCHEME OF EVALUATION

Examination	No. of Marks	Remarks
Semester end examination	75	Model of examination pattern furnished below
Internal examination	25	Written examination: 10 Viva-voce : 5 Seminar:5 Assignment:5

MODEL OF SEMESTER END EXAMINATION QUESTION PAPER [THEORY]

SECTION	DESCRIPTION	MARKS
A	Essay type questions- Four questions to be asked with internal choice in each question (A or B) from each unit. Student has to answer four questions choosing one (A or B) from each question. Each question carries 10 marks.	4x10 = 40
B	Short answer type questions - Eight questions are to be asked (4 theory + 4 numerical). Student has to answer any five questions. Each question carries 3 marks	5x3 = 15
C	Very short answer type questions - Ten questions are to be asked covering the entire syllabus. Student has to answer all ten questions. Each question carries 2 Marks	10x2 =20
	TOTAL MARKS	75

GOVERNMENT COLLEGE(A):RAJAMAHENDRAVARAM**DEPARTMENT OF PHYSICS****SEMESTER - VI****CLUSTER ELECTIVE -B3****(Applications of Nanomaterials and Devices)****SEM END EXAM BLUE PRINT****SECTION - A 4 x 10 = 40 M**

1. (a) or (b) Unit - I
2. (a) or (b) Unit - II
3. (a) or (b) Unit - III
4. (a) or (b) Unit - IV

SECTION - B 5 x 3 = 15 M

THEORETICAL QUESTIONS	9. Problem - Unit - I
5. Unit - I	10. Problem - Unit - II
6. Unit - II	11. Problem - Unit - III
7. Unit - III	12. Problem - Unit - IV
8. Unit - IV	

SECTION - C 10 x 2 = 20 M

Ten questions are to be chosen randomly as per the weightage of the chapters.

GOVERNMENT COLLEGE (A):RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
SYLLABUS FOR III B.Sc., PHYSICS (w.e.f.2017-2018)
SEMESTER VI
CLUSTER ELECTIVE - (B) - PAPER IV
B3: Applications of Nano materials and Devices
PRACTICAL/ PROJECT
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-2018)

Minimum of 6 experiments to be done and recorded

1. Synthesis of metal nanoparticles by chemical route.
2. Synthesis of semiconductor nanoparticles.
3. Surface Plasmon study of metal nanoparticles by UV-Visible spectrophotometer.
4. XRD pattern of nanomaterials and estimation of particle size.
5. To study the effect of size on color of nanomaterials.
6. Prepare a disc of ceramic of a compound using ball milling, pressing and sintering, and study its XRD.
7. Fabricate a thin film of nanoparticles by spin coating (or chemical route) and study transmittance spectra in UV-Visible region.
8. Fabricate a pn-diode by diffusing Al over the surface of n-type Si and study its I-V characteristics.

SCHEME OF EVALUATION FOR PRACTICAL EXAMINATION

Internal Examination	External Examination		Remarks	
25 Marks	75 Marks	Formula	10	
		Tabular form & Readings	20	
		Calculation & Result (Including Graphs)	20	
		Units & Precautions	05	
		Viva-voce	10	
		Record	10	<ul style="list-style-type: none"> • 10 Marks for 10 practicals and above • 08 marks upto 9 practicals • 06 marks upto 7 practicals • 05 marks upto 5 practical • NIL marks for less than 5 practicals

GOVERNMENT COLLEGE (A) : RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
SYLLABUS FOR CERTIFICATE COURSE
HOUSE HOLD ELECTRICAL WIRING
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-18)

UNIT- I**DOMESTIC WIRING (15hr)**

Various types of house wiring and basic requirement of various utilities, estimate and format of estimation, Materials and accessories used in domestic wiring and their cost, types of loads and sub circuits, Types of service mains ,Design of number of sub circuits and distribution boards ,preparation of wiring installation plan layout with light load, power load and control point.

UNIT- II**MAIN MAINTANANCE (10Hr)**

Selection of main switch cable, based on the load in circuit/sub circuits. Calculation of length of wiring cable and labour charges. Preparation of detailed estimate in standard Proforma. Estimation of wiring of small residential building, offices and Commercial establishments like shops, sales counter, stores.

UNIT- III**POWER WIRING (10hr)**

Discussion on various loads and wiring methods circuits and in small industries agriculture etc, materials and accessories used in motor installation and their cost. Designing of distribution boards, cable, motor control panel.

UNIT- IV**WIRE INSTALLATION (10Hr)**

Preparation of wiring installation plan and single line diagram, calculation of length of wiring cable and labour charges Detailed estimate in the standard proforma Related problems on installation of motors for small workshops and irrigation pump sets.

Text Books:

1. *Electrical Technology, chand publishers, New Dehli- B.L.Theraja.*
2. *Electrical Technology, ELBS Publications - Edward.*
3. *D.C Fundamentals, Delman Publications - Loper*
4. *A.C Fundamentals, Delman Publications - Loper*

GOVERNMENT COLLEGE (A): RAJAMAHENDRAVARAM
DEPARTMENT OF ELECTRONICS
BLUE PRINT FOR CERTIFICATE COURSE

Time: 3 Hours

Max. Marks: 50

TYPE OF QUESTION	MARKS	SCHEME
<p style="text-align: center;">SECTION-A</p> <p>Very Short Answer Questions</p>	<p>Each question carries 2 Marks</p> <p style="text-align: center;">10x2= 20 M</p>	<p>Answer ALL questions</p> <p>At least TWO questions to be asked from each/any unit</p>
<p style="text-align: center;">SECTION-B</p> <p>Short Answer Questions</p>	<p>SIX questions are to be answered out of EIGHT.</p> <p>Each question carries 6 Marks</p> <p style="text-align: center;">5x6 = 30 M</p>	<p>Answer any FIVE questions</p> <p>Not more than TWO question from each / any unit</p>

GOVERNMENT COLLEGE (A) : RAJAMAHENDRAVARAM
DEPARTMENT OF ELECTRONICS
PRACTICAL
LIST OF EXPERIMENTS
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-18)
Work load: 15 hrs

(Any Six Experiments should be done)

1. verification of ohms law by using ammeter, voltmeter in dc circuit or low voltage.
2. Verification of the characteristics of DC series circuits.
3. Verification of the characteristics of DC parallel circuits.
4. Verification of kirchhoff's law
5. Testing of lead acid battery by hydrometer and tongue tester on charging and discharging.
6. Testing of maintenance of free batteries.
7. Measurement of power by ammeter and voltmeter.
8. Verification of power factor by p.f.meter.
9. Verification of Faradays laws of electromagnetic induction.
10. Network theorems.

GOVERNMENT COLLEGE (A) : RAJAMAHENDRAVARAM
DEPARTMENT OF PHYSICS
SYLLABUS FOR CERTIFICATE COURSE
BIOPHYSICS
(As Approved in the BOS meeting held on 06 DECEMBER 2017 for 2017-18)

Syllabus: Contains six major units each containing multiple subunits.

Unit-I. Biophysical determination of macromolecular absorption.

1. Introduction to Biophysics and its applications.
2. Macromolecular structure and biophysical properties.
3. Estimation of DNA/RNA and proteins using spectrophotometer.
4. Protein structure and biophysical techniques used to determine protein structure.
5. Introduction to Circular dichroism and its applications.
6. Determination of secondary structure of proteins using CD.
7. Differential scanning fluorimetry vs. CD.
8. Dynamic light scattering and applications in protein aggregation.
9. FRET and its applications in biomedical research.

Unit-II. Nuclear Magnetic Resonance (NMR) Spectroscopy.

1. Introduction to NMR spectroscopy and its applications.
2. NMR spectra of small molecules and macromolecules.
3. Types of NMR spectra.
4. Protein isotopic labeling and natural abundance of heavy isotopes in small molecules.
5. NMR sample preparation and data acquisition.
6. Raw data, data processing and analysis.
7. Mapping the perturbations in chemical shifts on structures.
8. Practical case study: HIV-1 protease and ubiquitin.
9. Applications of NMR spectroscopy in pharmaceutical chemistry.
10. Applications of NMR spectroscopy in biomedical research and academia.

Unit-III. Electron Paramagnetic Resonance (EPR) Spectroscopy.

1. Introduction to Electron Paramagnetic Resonance spectroscopy.
2. Spin label molecules, pros and cons of spin labels.
3. Spin label attachment to proteins at cysteine.
4. Using Amber codons to incorporate spin labels into proteins.
5. Sample preparation, data acquisition, processing and analysis.
6. Rpn10-ubiquitin, practical case study-1.
7. Double Electron-Electron Resonance (DEER) spectroscopy and its applications.
8. EPR vs. DEER.
9. Prediction of spin label rotamers using molecular dynamics simulations.
10. DEER distances of lysozyme, practical case study-2.

Unit-IV. Chromatography and Mass Spectrometry.

1. Introduction to chromatography, industrial and biomedical applications.
2. Types of chromatography and their applications.
3. Small molecule chromatography vs. macromolecular chromatography.
4. Chromatograms: DNA sequencing, protein purification, peptides and small molecules.
5. Introduction to mass spectrometry, industrial and biomedical applications.
6. Analysis of mass spectra of small molecules and macromolecules.
7. Combined chromatography and mass spectrometry protocols and their applications.
8. Case study-1, LC-MS applications in Cancer Biology, analysis of patient samples.
9. Case study-2, LC-MS applications in proteomics and metabolomics.
10. Case study-3, LC-MS special applications in pharmaceutical chemistry/industry.

Unit-V. X-ray Crystallography.

1. Introduction to X-ray crystallography.
2. Crystallization of small molecules and macromolecules, the phase diagram.
3. X-ray sources, X-ray diffraction data collection and processing.
4. Solving the X-ray crystal structure of protein, introduction to the phase problem.
5. Stereo-chemical refinement of structure solutions, maximum-likelihood method.
6. Fourier synthesis-electron density maps and analysis.
7. Low vs. high resolution structures, temperature factors and occupancies of atoms.
8. Structural analysis, interfaces, interactions and introduction to the PISA server.
9. Introduction to the world wide protein databank (wwPDB).
10. Simulating the protein dynamics using X-ray crystal structure.

Unit-VI. Surface Plasmon Resonance (SPR) Spectroscopy & Isothermal titration calorimetry.

1. Introduction to SPR spectroscopy and its applications in both industry and academia.
2. Types of chemistry used for SPR chips.
3. Sample preparation, data collection, processing and analysis.
4. Drug binding curves using SPR and applications in drug discovery.
5. Practical case study-1, HIV-1 protease.
6. Introduction to Isothermal titration calorimetry (ITC) and thermodynamics.
7. Gibbs free energy, enthalpy, entropy and protein energy landscape.
8. Sample preparation, data acquisition, processing and analysis.
9. Isotherms and stoichiometric analysis of drugs.
10. Practical case study-2, HIV-1 protease.

Course design and student evaluation: This course is designed for first/second year undergraduate students with Science major and contains six major units spread over a period of one calendar year. The total instructional hours for this course will be 60 (45 theory + 15 practical) starting January-2018 and concluding in December-2018 with a final exam for 100 marks (50 theory + 50 practical). The theory part of the final exam contains 60 multiple choice questions out of which the students must answer at least 50. Similarly, the final practical exam contains 6 practical problems out of which the students must solve at least 5. This is a pass/fail course in which each student must obtain at least 25 marks in theory and 25 marks in practical exams in order to be considered as pass grade.

MODEL QUESTION PAPER (THEORY)**BIO PHYSICS****(TYIDE - TORONTO)**

Answer any 50 questions out of the 60 questions given below.
Pick the correct answer out of the multiple choice for each question.
Each question is worth 1 mark.
Total marks: 50.

- 1. Amino acid(s) useful in the determination of macromolecular absorption using spectrophotometer is/are...**
 - a. Glycine
 - b. Phenylalanine
 - c. Tryptophan
 - d. Both (b) and (c)
- 2. Macromolecular absorption is measured based on ...**
 - a. Newton's laws of motion
 - b. Quantum mechanics
 - c. Beer-Lambert's law
 - d. Bernoulli's principle
- 3. Absorption of light by the nucleic acids occurs in the...**
 - a. Visible range
 - b. Infrared range
 - c. Ultraviolet range
 - d. None of the above
- 4. Protein structure can be studied using**
 - a. X-ray crystallography
 - b. Nuclear magnetic resonance spectroscopy
 - c. Circular dichroism
 - d. All of the above
- 5. Circular dichroism is based on**
 - a. Electron density maps
 - b. Absorption of light
 - c. Newton's laws of motion
 - d. Molecular dynamic simulations
- 6. Secondary structural elements of proteins are...**
 - a. Nanotubes
 - b. Alpha helices
 - c. Beta strands
 - d. Both (b) and (c)
- 7. Folded and unfolded states of proteins can be determined using...**
 - a. Circular dichroism (CD)
 - b. Differential scanning fluorimetry (DSF)
 - c. Both CD and DSF
 - d. A barometer
- 8. Dynamic light scattering is a method to determine the protein aggregation.**
 - a. True
 - b. False
- 9. In a FRET assay, the efficiency of energy transfer from the donor is inversely proportional to the...**

- a. Nuclear spin state of the donor
 - b. Sixth-power of the distance between donor and acceptor
 - c. Molar extinction coefficient of the donor
 - d. None of the above
- 10. NMR spectroscopy is based on the...**
- a. Electron density maps
 - b. Nuclear spin states
 - c. Pauli's exclusion principle
 - d. Hund's rule of maximum multiplicity
- 11. A high resolution NMR spectrum of proteins can obtained using a...**
- a. 400 MHz magnet
 - b. 800 MHz magnet
 - c. 16 inch bar magnet
 - d. 100 MHz magnet
- 12. What type of NMR spectrum is a ^1H - ^{15}N - ^{13}C -HSQC?**
- a. Homo-nuclear quantum coherence
 - b. Hetero-nuclear quantum coherence
 - c. 3-D HSQC
 - d. Both (b) and (c)
- 13. What are the commonly used heavy isotopes in protein NMR studies?**
- a. ^{15}N
 - b. ^{13}C
 - c. Both (a) and (b)
 - d. None of the above
- 14. D_2O is added to the protein NMR samples in order to...**
- a. Lock the frequency and avoid field drift
 - b. Reduce solvent absorption
 - c. Both (a) and (b)
 - d. None of the above
- 15. Shimming is done before NMR data acquisition to...**
- a. Decrease the heterogeneity of the magnetic field
 - b. Increase the homogeneity of the magnetic field
 - c. Both (a) and (b)
 - d. None of the above
- 16. Perturbations in the chemical shifts of HSQC spectra indicate...**
- a. Protein-protein interactions
 - b. Chemical changes in the local environment
 - c. Protein-drug interactions
 - d. All of the above
- 17. Among HIV-1 protease (Mol. Wt.: 11 kD), Ubiquitin (Mol. Wt.: 8.6 kD) and Rpn10 (Mol. Wt.: 30 kD), which one(s) are better suited for NMR studies?**
- a. All three proteins
 - b. HIV-1 protease and Rpn10
 - c. Ubiquitin and Rpn10
 - d. Ubiquitin and HIV-1 protease
- 18. Which of the following method(s) can be used to determine the binding interaction between a protein and a drug molecule?**
- a. ^1H - ^{15}N -NMR HSQC
 - b. ^1H - ^{13}C -NMR HSQC

- c. Both (a) and (b)
 - d. None of the above
- 19. The 3-dimensional structure of a protein whose molecular weight is 110 kD can be determined using conventional NMR spectroscopy.**
- a. True
 - b. False
- 20. Electron paramagnetic spectroscopy requires one or more unpaired electrons.**
- a. True
 - b. False
- 21. Which one of the following spin label molecules produces relatively less number of rotamers increasing the preciseness of DEER signals and why?**
- a. MTSL, because it has more rotatable bonds than IDSL
 - b. IDSL, because it has more rotatable bonds than MTSL
 - c. MTSL, because it has less rotatable bonds than IDSL
 - d. IDSL, because it has less rotatable bonds than MTSL
- 22. Sulfur based spin label molecules such as IDSL and MTSL can be attached to proteins at...**
- a. Tyrosine
 - b. Alanine
 - c. Cysteine
 - d. All of the above
- 23. Which one of the following stop codons are normally used for spin labeling proteins during protein production from bacteria?**
- a. Ochre (UAA)
 - b. Amber (UAG)
 - c. Opal (UGA)
 - d. Met (AUG)
- 24. Before collecting the EPR spectrum of a spin labeled protein sample, the sample must be filled into...**
- a. An NMR tube
 - b. An EPR tube
 - c. A capillary tube
 - d. A normal test tube
- 25. In the Rpn10-ubiquitin case study that was discussed in the class, which amino acids on ubiquitin were used for SDSL of IDSL?**
- a. Ser20 and Gly35
 - b. Leu8 and Ala46
 - c. Ser20 and Ala46
 - d. Leu8 and Gly35
- 26. What are the minimum number of spin labels required to obtain EPR and DEER spectra of proteins?**
- a. One and two
 - b. Two and three
 - c. Four and two
 - d. Two and two
- 27. Which one of the following is used to measure distance between protein atoms?**
- a. EPR- C_w spectrum
 - b. EPR-DEER spectrum
 - c. Both (a) and (b)

- d. None of the above
- 28. DEER distances based on the spin label rotamers can be predicted using molecular dynamics simulations.**
- True
 - False
- 29. What kind of spin label molecule was used in the lysozyme DEER analysis case study discussed in the class?**
- SDSL
 - IDSL
 - MTSL
 - None of the above
- 30. Typically the liquid chromatography technique has how many phases and what are they?**
- One. Stationary phase only
 - Three. Stationary phase, mobile phase and plasma phase
 - Two. Stationary phase and mobile phase
 - Two mobile phases only
- 31. Ion exchange chromatography is used to purify proteins based on their...**
- Molecular weight only
 - Charge groups
 - Affinity to the resin
 - All of the above
- 32. Which one of the following needs an affinity tag in order to purify using Ni-NTA column chromatography? What is the name of the tag?**
- Small molecule drug. HIS-tag
 - Protein molecule. HIS-tag
 - DNA molecule. HIS-tag
 - All of the above
- 33. DNA chromatograms contain...unique peaks calling for...bases**
- Two, four
 - Two, eight
 - Four, two
 - Four, four
- 34. Mass spectrum shows the relative abundance of ions on y-axis based on their...on x-axis.**
- Mass (m)
 - Charge (z)
 - m/z ratio
 - None of the above
- 35. Mass spectrometry can be used...**
- For peptide sequencing
 - To determine the quantity of a protein in a mixture
 - Both (a) and (b)
 - None of the above
- 36. What is the difference between analytical and preparatory chromatography columns?**
- Amount of sample injected onto the columns is different
 - Size of the column is different
 - Both (a) and (b)

- d. None of the above
- 37. Mass spectrometry is used in metabolomics to...**
- Analyze the bone density
 - Detect the intermediate metabolites
 - Characterize the intermediate metabolites
 - Both (b) and (c)
- 38. What is ESI-MS?**
- Electron spin interaction-mass spectrum
 - Electrospray ionization-mass spectrometry
 - Electronic spontaneous integration-mass spectrum
 - None of the above
- 39. The enantiomers of small molecule drugs are separated using...**
- HPLC (high performance liquid chromatography)
 - Silica columns
 - Both (a) and (b)
 - None of the above
- 40. X-ray crystallography is based on...**
- Beer Lambert's law
 - Bragg's law
 - Both (a) and (b)
 - None of the above
- 41. Which of the following factor(s) effect crystallization of proteins?**
- Protein concentration
 - Salt concentration
 - pH of the buffer used
 - All of the above
- 42. X-ray diffraction of crystals can be obtained using...**
- X-ray diffractometer
 - Synchrotron
 - Rotating anode
 - All of the above
- 43. Structure factors and ... are needed in order to solve the X-ray crystal structure of a protein after processing the X-ray diffraction data.**
- Crystals
 - Phases
 - Proteins
 - None of the above
- 44. Which software program is commonly used to refine the X-ray crystal structures?**
- CCPNMR
 - DESMOND
 - PHENIX
 - HKL2000
- 45. What type of electron density map is used to fit the ligands in drug discovery?**
- Solvent mapping
 - Difference density
 - Ramachandran plot
 - None of the above

- 46. With an occupancy of 0.5 and B-factor of 200 \AA^2 , using a poor electron density map, if you were to solve the position of an atom, what is your judgement about this atom?**
- This atom is highly mobile, so treat it as a special case
 - Probably reducing the occupancy may improve B-factor
 - This atom is impossible to fit
 - Both (a) and (b)
- 47. In protein X-ray crystallography, what are symmetry mates?**
- Different protein molecules from other crystals.
 - Same protein molecules from other asymmetric units
 - Both (a) and (b)
 - None of the above
- 48. Solvent content of asymmetric unit is determined using...**
- Archimedes principle
 - Maximum likelihood function
 - Matthew's coefficient
 - Bragg's law
- 49. MD simulations can be used to understand...**
- Protein dynamics of an X-ray crystal structure
 - Protein dynamics of an NMR structure
 - Both (a) and (b)
 - None of the above
- 50. What information can you obtain from the header of a protein databank file?**
- Space group
 - Refinement R-factors
 - Details of Ramachandran plot
 - All of the above
- 51. In a Surface plasmon resonance spectroscopic experiment, the binding constant of a ligand (K_D) can be obtained by the formula...using the k_a (association constant) and k_d (dissociation constant)**
- $K_D = k_d / k_a$
 - $K_D = k_a / k_d$
 - $K_D = k_d - k_a$
 - $K_D = k_a + k_d$
- 52. What are the common types of SPR chip chemistries used?**
- Amine coupling
 - Carboxylic acid coupling
 - Ni-NTA to trap HIS-tag
 - All of the above
- 53. What is the importance of reference in SPR spectroscopy?**
- To remove background noise
 - Serves as a control
 - Improves the contrast of the data
 - All of the above
- 54. In pharmaceutical industry, what factor for the compounds do they assess using SPR spectroscopy?**
- Molecular weight
 - Number of hydrogen bonds
 - Binding affinity

- d. None of the above
- 55. In the case study discussed in the class about DMP450 using SPR, what was the end result?**
- DMP450 binds tightly to the mutant
 - DMP450 binds tightly to the wild type
 - DMP450 can bind both wild type and mutant equally
 - None of the above
- 56. Isothermal titration calorimetry is based on...**
- Molecular dynamics simulations
 - Thermodynamics
 - Newton's laws of motion
 - None of the above
- 57. Gibb's free energy depends on**
- Enthalpy
 - Entropy
 - Temperature
 - All of the above
- 58. A student performed an ITC experiment where he used different buffers for the preparation of protein and drug. His results were confusing compared to his classmate's results. Why?**
- Difference in buffers contributes to the Gibb's free energy
 - Because it was Monday
 - The student should have used same buffers for both protein and drug
 - Both (a) and (c)
- 59. In drug discovery, which one of the following factors about the drug can be evaluated using an ITC-isotherm?**
- 3-dimensional structure of the drug
 - Entropy
 - Stoichiometry
 - All of the above
- 60. If the Gibb's free energy values of two inhibitors of HIV-1 protease, darunavir and lopinavir are: -15 kcal/mol. and -10 kcal/mol., respectively, then which inhibitor has higher binding affinity?**
- Darunavir
 - Lopinavir
 - Both have low affinities because of negative values
 - None of the above

MODEL QUESTION PAPER (PRACTICAL)**BIO PHYSICS****(TYIDE - TORONTO)**

=====

Solve any 5 problems out of 6 problems given below. Each problem is worth 5 marks. Total marks: 50.

1. Estimate the concentration of DNA in the given sample. What instrument did you use to solve this problem? What Physics law is this problem based on?
2. Identify the type of NMR spectrum given to you. What type of isotopes were used to obtain this spectrum? Based on the spectral overlay given to you, is the ligand binding to the protein? How did you conclude? List the observations in detail.
3. Based on the protein EPR spectra (C_w and DEER) given to you answer the following:
 - a. Is this protein labeled with spin label (such as IDSL or MTSL)? How did you conclude? Does this protein bind to the ligand? How did you conclude?
 - b. What is the DEER distance between spin labels in the absence and presence of ligand? If there is a change in these distances, what did you conclude about the protein conformation?
4. Based on the chromatograms given to you answer the following:
 - a. Write the DNA sequence using the chromatogram. Were there any ambiguities? How did you solve the ambiguity in the DNA sequence?
 - b. Which peak in the HPLC chromatogram contains the protein of interest? Were there more than one HPLC peaks in which the protein of interest was found? If so what is the most likely explanation? Justify your answer.
 - c. Is there a difference between the two given HPLC chromatograms? What is the most likely reason for the compound 1 being inactive while compound 2 is active?
5. Using the protein databank file given to you answer the following:
 - a. What are the values (along with units if any) of: resolution, R_{work}, R_{free}, space group, unit cell (a, b, c, alpha, beta and gamma).
 - b. Identify the amino acids with alternate conformations and write the occupancies along with B factors for all atoms of those amino acids.
 - c. What is the total number of atoms in the file and how many of them belong to solvent?
6. Answer the following based on the data given to you:
 - a. Calculate the binding constants (K_D) using the SPR curves of drug evaluated against protein1 and protein2. What is your conclusion about the binding of drug to protein1 vs. protein2? Justify your conclusion.
 - b. Calculate the stoichiometry of drug binding to the protein using the ITC-isotherm given to you. Calculate the Gibbs free energy difference of the drug binding using the given values and mention the units for your final answer.

LIST OF EXAMINER

S.NO	CODE	EXAMINER NAME	PAPERS	SERVICE	COLLEGE	CITY
1	202081	DR.K.BALARAJU Board of Studies	3,4	27 Dept.of Physics	GOVT.CITY COLLEGE Government College [A], Rajamahendravaram	HYDERABAD
2	202084	P.VENKATESWARAREDDY	2	21	COLLEGE	HYDERABAD
3	202041	N.RANGAJI	2	20	AMAL COLLEGE	ANAKAPALLI
4	202069	U.DHANAPATHI VARMA	1,3	20	D.N.R.COLLEGE	BHIMAVARAM
5	202040	M.R.L.GOPAL	1,2	19	AMAL COLLEGE	ANAKAPALLI
6	202013	A.S.N.MURTHY	2,4	19	GBR COLLEGE	ANAPARTHI
7	202073	K.S.R.P.KUMAR JOHN	3,2	16	SVKP COLLEGE	PENUGONDA
8	202091	S.VENKATARAJU	1,3	15	D.N.R.COLLEGE	BHIMAVARAM
9	202111	P.V.SRINIVASARAO	1,2,3	14	S.S.N.COLLEGE	NARSARAOPETA
10	202112	B.VENKATESWARARAO	ALL	14	S.S.N.COLLEGE	NARSARAOPETA
11	202074	S.SRINIVASARAO	2,4	13	SVKP COLLEGE	PENUGONDA
12	202087	DR.A.NIRMALA JYOSTHANA	1	13	ST.THERESSA'S	ELURU
13	302056	G.VENU GOPAL	ALL	13	MRS.A.V.N.COLLEGE	VISAKHAPATNAM
14	302055	DR.S.SRINIVASARAO	ALL	11	MRS.A.V.N.COLLEGE	VISAKHAPATNAM
15	202096	C.J.SOMARAJU	2	10	D.N.R.COLLEGE	BHIMAVARAM
16	202022	N.VEERA KUMAR	2	9	SRVBSJV MAHARANI	PEDDAPURAM
17	202107	P.SUBRAHMANYAM NAIDU	ALL	8	JBD COLLEGE	KAVALI
18	202047	DR.SANTHA DEVI	ALL	8	GOVT.DEGREE COLLEGE	ANANTHAPUR
19	202057	DR.B.V.H.N.SAINATH	1,2,3	8	MRS.A.V.N.COLLEGE	VISAKHAPATNAM
20	202108	D.RAMAKRISHNA REDDY	3	7	GOVT DEGREE COLLEGE	KARNOOL
21	202023	S.RAMARAO	4	7	SRVBSJV MAHARANI	PEDDAPURAM
22	202097	K.RAMAKRISHNA	ALL	6	M.G.COLLEGE	ATREYAPURAM
23	202105	P.S.S.SRINIVAS	ALL	6	GBR COLLEGE	ANAPARTHI
24	302046	M.RAVIKUMAR	ALL	6	GOVT DEGREE COLLEGE	ANANTHAPUR
25	202092	M.SATYAVANI	1,2	6	D.N.R.COLLEGE	BHIMAVARAM
26	302058	P.PRAMEELA	ALL	5	MRS.A.V.N.COLLEGE	VISAKHAPATNAM
27	202101	B.V.R.K.MURTHY	ALL	5	MAHARAJA'S	VIZIANAGARAM
28	202082	DR.I.H.PRASAD	3	4	GOVT.CITY COLLEGE	HYDERABAD
29	202083	DR.B.KRISHNA SENKAR	1,2	4	GOVT.CITY COLLEGE	HYDERABAD
30	302041	R.CHANDRA SEKHAR	ALL	4	SRVBSJV MAHARANI	PEDDAPURAM
31	202080	P.B.V.A.G.RAVI KIRAN		3	SKSD MAHILA COLLEGE	TANUKU
32	202109	M.VENKATESWARARAO	4	3	GOVT DEGREE COLLEGE	KARNOOL
33	202113	CH.VIJAYA KUMARI	1,2,4	3	SSN COLLEGE	NARSARAOPETA
34	202106	SURIBABU	ALL	3	GBR COLLEGE	ANAPARTHI
35	202114	A.SUBBARAO	1,2,3	3	SSN COLLEGE	NARSARAOPETA
36	202093	M.V.S.PRASAD	1,2	2	D.N.R.COLLEGE	BHIMAVARAM
37	202094	N.UDAYASRI	1,2	2	D.N.R.COLLEGE	BHIMAVARAM
38	202102	G.V.S.JAYAPALRAO	ALL	2	MAHARAJA'S	VIZIANAGARAM
39	202095	A.VEERAYYA	3	2	D.N.R.COLLEGE	BHIMAVARAM
40	202003	P.SREEDEVI	ELE	2	ST.THERESSA'S	ELURU
41	202004	K.SUNICYROSE	1,2,ELE	1	ST.THERESSA'S	ELURU
42	202005	K.LALITHADEVI	1,2	1	ST.THERESSA'S	ELURU

43	202006	K.SREELATHA	1,2	1	ST.THERESSA'S	ELURU
44		G.NARAYANARAO	ALL		ASDW COLLEGE	KAKINADA
45		N.R.LEELAKRISHNA PRASAD	ALL		P.R.G.COLLEGE	KAKINADA
46		K.SREENIVASARAO	ALL		V.S.M.COLLEGE	RAMACHANDRAPURAM
47		KRISHNA	ALL		SCIMGVOT COLLEGE	TANUKU
48		P.S.N.RAJU	ALL		P.R.G.COLLEGE	KAKINADA
49		P.S.BRAHMACHARI	ALL		P.R.G.COLLEGE	KAKINADA
50		D.VIJAYASREE	ALL		GOVT.DEGREE COLLEGE	MACHERLA
51		SYAMALA	ALL		ASDW COLLEGE	KAKINADA
52		P.V.RAMANA	ALL		P.R.G.COLLEGE	KAKINADA
53		MEHAR	ALL		P.R.G.COLLEGE	KAKINADA
54		D.GANGADHARUDU	ALL		SRVBSJV MAHARANI	PEDDAPURAM
55		DR.GS.NARAYANARAO	ALL		VS KRISHNA COLLEGE	VISAKHAPATNAM
56		BHASKARAPRASAD	ALL		SRR COLLEGE	VIJAYAWADA
57		A.V.RAMANAMURTHY	ALL		GOVT DEGREE COLLEGE	TANUKU
58		A.K.SURYANARAYANA	ALL		IDEAL COLLEGE	KAKINADA
59		SUBBARAJU	ALL		KGRL COLLEGE	BHIMAVARAM
60		SATYANARAYANA RAJU	ALL		KGRL COLLEGE	BHIMAVARAM
61		VENKATESWARA RAO	ALL		CRR COLLEGE	ELURU
62		DR A.R.S.KUMAR	ALL		Y.N.COLLEGE	NARASAPUR
63		K.LAKSHMINARAYANA	ALL		Y.N.COLLEGE	NARASAPUR

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