SAURASHTRA UNIVERSITY

RAJKOT

Accredited Grade “A” by NAAC

(CGPA 3.05)

FACULTY OF SCIENCE

SYLLABUS FOR

B.Sc.

PHYSICS

(Semester- 5 & 6)

According to Choice Based Credit System

Effective from June – 2018
Syllabus of B.Sc. (Physics) Sem-5
According to Choice Based Credit System
Effective from June – 2018

Course Contents :

- Physics-501 –Theory: Mathematical Physics, Classical Mechanics & Quantum Mechanics
- Physics-502 -Theory: Electrodynamics and Relativity
- Physics-503-Theory: Solid State Electronics
- Practical- Group A
- Practical- Group B
- Practical- Group C
- Project

Total Credit of the Semester-5: 24

Educational Study Tour:
Physics Department of college should arrange at least one Educational Study tour during semester 5 or 6. In this tour, students may visit any state or national research institute, scientific organization, industry or any educational scientific institute in India. Students have to submit detailed report of this study tour. This report is to be considered as a project of 50 marks.
B. Sc. Physics Semester : 5
The Course Design of B. Sc. Sem.- 5 (Physics) according to choice based credit system (CBCS) as follows:

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Subject</th>
<th>No of theory Lecture per week</th>
<th>No of Practical Lecture per week</th>
<th>Total Marks</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PAPER Physics- 501 (Theory) Mathematical Physics Classical Mechanics &amp; Quantum Mechanics</td>
<td>6</td>
<td>-</td>
<td>70(External)+ 30(Internal) = 100 Marks</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>PAPER Physics-502 (Theory) Electrodynamics and Relativity</td>
<td>6</td>
<td>-</td>
<td>70(External)+ 30 (Internal) = 100 Marks</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>PAPER Physics-503 (Theory) Solid State Electronics</td>
<td>6</td>
<td>-</td>
<td>70(External)+ 30 (Internal) = 100 Marks</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Practical -1 (Group A) One practical from group A</td>
<td>-</td>
<td>6</td>
<td>35(External)+ 15(Internal) = 50 Marks</td>
<td>3</td>
</tr>
<tr>
<td>No.</td>
<td>Practical -2 (Group B)</td>
<td>-</td>
<td>6</td>
<td>35(External)+15(Internal) = 50 Marks</td>
<td>3</td>
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<td>----</td>
</tr>
<tr>
<td>5</td>
<td>One practical from group B</td>
<td></td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>No.</th>
<th>Practical -3 (Group C)</th>
<th>-</th>
<th>6</th>
<th>35(External)+15(Internal) = 50 Marks</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>One practical from group C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| No. | Project Work & Viva | • 1 Guidance Lecture. for a group in a week.  
• Evaluation of project will be in the SIXTH semester |     | 3 |
|-----|----------------------|---------------------------------|----|    |

|     | **Total credit of the semester 5** | 24 |
: Project Work :

Project work is divided in two parts :

(1) : Theoretical essay or educational tour report : 50 marks
(2) : Preparation of Working Model : 50 marks

Project (1): Theoretical essay or educational tour report:
Each student has to prepare one detailed essay based on any topic of Physics which includes the principle of physics or based on any theory of physics or application of physics.

OR

Student should submit detailed report of educational study tour.

Each student should submit this report at the end of the 6th Semester. The Project work would be evaluated by the examiner based on the presentation of the report by students and conducting viva-voce on the topic.

The distribution of marks is as follows:

- Essay/ Report writing : 35
- Viva voce : 15
- Total : 50

Project(2): Preparation of the Working Model:

The project work will be assigned in the team (group) of minimum one and maximum four students.

Students has to prepare one model (preferably working model) based on the principle of Physics. The model, along with a detailed write up (dissertation), explaining the principle, working and applications, should be submitted to the Practical-in-charge at the end of 6th semester.
Each group of the students has to submit a working model in common but each student of the group has to separately submit write up for their common group working model.

Project-in-charge should extend the guidance regarding the selection, preparation and troubleshooting of working model, and there would be one lecture per week per batch of students.

The Project work would be evaluated by the examiner based on the presentation of the report by students and conducting viva-voce and demonstration of the working model.

The distribution of marks is as follows:

- Model making : 20
- Model presentation : 15
- Viva voce : 15
- Total : 50

**Total Marks of Project: 50 + 50 = 100.**

The Evaluation of the project work will be done at the end of the sixth semester. For the Evaluation of the both types of project works one session of three hours should be allocated during the practical examination.

There would be three sessions of 3 hours each for three experimental practical examination. Fourth session of 3 hours would be for the project work evaluation. (in total a student has to undergo four sessions (3 hours each) of practical +project evaluation examination)

**There shall be batch of 15 students for project and viva.**
B.Sc. (Physics)
Semester -5
Paper: Physics-501
( Mathematical Physics, Classical Mechanics & Quantum Mechanics)

Course duration:
Theory: 60 hours, 6 hours a week, Credit: 4
External Marks: 70, Internal Marks: 30, Total: 100

PAPER STYLE For paper 501

1. Syllabus of Physics paper 501 consists of 5 units:
2. All units carry 14 marks each.
3. There would be total 5 questions. One question from each unit.
4. Each question of 14 mark
5. Student can use the scientific (Non programmable) calculator.
6. Time duration: 2.5 Hours
   Question:1 from Unit 1 : Mark 14
   Question:2 from Unit 2 : Mark 14
   Question:3 from Unit 3 : Mark 14
   Question:4 from Unit 4 : Mark 14
   Question:5 from Unit 5: Mark 14

Each Question is divided in sub questions a,b,c and d as shown below

(a) Short answer questions 4 [4 Marks] (All questions are compulsory )
   (A short answer question may comprise of answer of One word, one line, explanation, definition, true or false, fill up the blanks, etc.)

(b) Sums - Numerical problem solving questions: (1 out of 2) [ 2 Marks]

(c) Moderate length questions: (1 out of 2) [3Marks] (In this section atleast one sum / numerical problem solving question should be preferably asked)

(d) Long questions (1 out of 2) [5 Marks]
Paper: Physics-501
(Mathematical Physics, Classical Mechanics & Quantum Mechanics)

UNIT 1: (12 hour : 14 Mark)
**Fourier Series:** Definition, Evaluation of the Coefficients of Fourier Series, Cosine Series, Sine Series, Dirichlet’s Theorem (Statement only), Extension of Interval, Complex form of Fourier series, Advantages of Fourier series, Properties of Fourier series, Physical Applications of Fourier series analysis (square wave, full wave rectifier, half wave rectifier, triangle wave), Fourier integrals, Fourier Transforms, Fourier sine and cosine Transforms, Numerical Problems.

**Dirac-Delta Function:** Introduction, Representation of the Dirac delta Function, derivative at a discontinuity, properties of Dirac delta function, the three dimensional Dirac delta function, Numerical Problems.

Reference books:
1. Mathematical Physics By Rajput, Publisher: Pragati Prakashan, Meerut.
2. Quantum Mechanics theory and applications By Ajoy Ghatak & S Lokanathan Publisher: Macmillan India Limited.
3. Mathematical Physics By H K Dass & Dr. Rama Verma, publisher:S.Chand
4. Mathematical Physics By P.K.Chattopadhyay

UNIT 2: (12 hours: 14 Mark)
**Variational Principle and Lagrangian Formulation:** Constrained motion, Constraints, degree of freedom, Generalized co ordinates, Generalized notation for displacements & Velocity, Limitation of Newton’s laws, variation Technique for many independent variables, Euler-Lagrange differential equation, Hamilton’s Variational Principle, Deduction of Lagrange’s equations of motion from Hamilton’s principle (for Conservative System), D’Alembert’s principle, Lagrange’s equations from D’Alembert’s principle, Rayleigh’s dissipation function, Deduction

UNIT 3: (12 hour: 14 Mark)


Reference books for 2 & 3:
2. Introduction to Classical Mechanics By R G Takwale & P S Puranik Publisher: TMG
3. Classical Mechanics By Herbert Goldstein Publisher: Narosa Publishing House

UNIT 4: (12 hour: 14 Mark)

Wave particle duality and Schrödinger equation: Introduction, particle nature of radiation, Compton effect, Wave nature of matter, Uncertainty principle, Schrödinger equation, Commutator, Physical interpretation of $\psi$, Expectation values, Proof of the uncertainty principle, Eigenfunction of operator $p_x$, General solution of the one dimensional Schrödinger equation for a free particle, Time evolution of
a wave packet, Group velocity of wave packet, Stationary state, Boundary and Continuity conditions, Degeneracy, Orthogonality of eigenfunctions, Parity, Some exact solutions- particles in a one dimensional infinitely deep potential well; particles in a one dimensional potential well of finite depth, Three dimensional Schrödinger equation, Particle in a box- density of states, Numerical Problems.

UNIT 5: (12 hour: 14 Mark)

**Harmonic oscillator & Angular momentum:** Introduction, Solution of the time dependent Schrödinger equation, Eigenfunctions, Angular momentum operator, Eigen values and Eigenfunctions of $L^2$, Spherically symmetric potentials, Two body problem, Hydrogen-like atom, Bra and ket notation, Linear operator, Eigenvalue equation, Completeness condition, Examples from Matrix Algebra, Solution of the Eigen value problem, Harmonic oscillator wave functions, Coherent state, Time evolution of the coherent state, Number operator, Density operator, Numerical Problems.

**Reference books for 4 & 5:**

1. Quantum Mechanics theory and applications By Ajoy Ghatak & S Lokanathan Publisher: Macmillan India Limited.

2. A text book of quantum mechanics By P M Mathews & K Venkatesan Publisher: TMG.
B.Sc. (Physics)  
Semester -5  
**Paper: Physics-502**  
(Electrodynamics and Relativity)  

Course duration:  
Theory: 60 hours, 6 hours a week, Credit: 4  
External Marks: 70, Internal Marks: 30, Total: 100

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**PAPER STYLE For paper 502**

1. Syllabus of Physics paper 502 consists of 5 units:  
2. All units carry 14 marks each.  
3. There would be total 5 questions. One question from each unit.  
4. Each question of 14 mark  
5. Student can use the scientific (Non programmable) calculator.  
6. Time duration: 2.5 Hours  

**Question:**  
1. Question:1 from Unit 1 : Mark 14  
2. Question:2 from Unit 2 : Mark 14  
3. Question:3 from Unit 3 : Mark 14  
4. Question:4 from Unit 4 : Mark 14  
5. Question:5 from Unit 5: Mark 14  

Each Question is divided in sub questions a,b,c and d as shown below

(a) Short answer questions 4 [4 Marks] (All questions are compulsory)  
(A short answer question may comprise of answer of One word, one line, explanation, definition, true or false, fill up the blanks, etc.)

(b) Sums - Numerical problem solving questions: (1 out of 2) [2 Marks]

(c) Moderate length questions: (1 out of 2) [3Marks] (In this section atleast one sum / numerical problem solving question should be preferably asked)

(d) Long question: (1 out of 2) [5 Marks]
**Paper: Physics-502**  
*(Electrodynamics and Relativity)*

**UNIT 1: (12 hour : 14 Mark)**  
**Electrodynamics:** Ohm’s law, Electromotive force and motional emf, Faraday’s law, The induced Electric field, inductance, energy in magnetic fields, Electrodynamics before Maxwell, Maxwell’s modification of Ampere’s law, Maxwell’s equations, The continuity equation, Poynting’s theorem, Newton’s third law in Electrodynamics, Maxwell’s stress tensor, conservation of momentum, Angular momentum, Numerical Problems.

**UNIT 2: (12 hour : 14 Mark)**  
**Electromagnetic Waves:**  
Waves in one dimension: Wave equation, sinusoidal waves, Boundary conditions: Reflection and Transmission, Polarization, Electromagnetic waves in vacuum: The wave equations for $\mathbf{E}$ and $\mathbf{B}$, Monochromatic plane waves, Energy and Momentum in Electromagnetic waves, Numerical Problems.

**UNIT 3: (12 hour : 14 Mark)**  
**Potentials and Fields:**  

**UNIT 4: (12 hour : 14 Mark)**  
**Radiation:**  
UNIT 5: (12 hour : 14 Mark)

Electrodynamics and relativity:
The special theory of relativity and Einstein postulates of it, The geometry of relativity, Lorentz transformations, structure of space-time, Proper time and Proper velocity, Relativistic momentum and relativistic energy, Relativistic Kinematics, Relativistic Dynamics, Numerical Problems.

**Basic Reference book:** Introduction to electrodynamics By David J Griffiths, Publisher: PHI.

**Other Reference Books:**

1. Electricity and Magnetism - Mahajan and Rangwala
2. Classical Electrodynamics - J.D.Jackson
3. Electricity and Magnetism - R. Murugesan
4. Electromagnetics - B.B.Laud
5. Electricity and Magnetism - K.K.Tiwari
7. Electricity and Magnetisam By D.C. Tayal, Publisher: Himaliya publishing House.
8. Refresher Course in Physics Volume 1,2 & 3 By C.L.Arora
B.Sc. (Physics)
Semester -5
Paper: Physics-503
(Solid State Electronics)

Course duration:
Theory: 60 hours, 6 hours a week, Credit: 4
External Marks: 70, Internal Marks: 30, Total: 100

PAPER STYLE For paper 503

1. Syllabus of Physics paper 503 consists of 5 units:
2. All units carry 14 marks each.
3. There would be total 5 questions. One question from each unit.
4. Each question of 14 mark
5. Student can use the scientific (Non programmable) calculator.
6. Time duration: 2.5 Hours

Question: 1 from Unit 1: Mark 14
Question: 2 from Unit 2: Mark 14
Question: 3 from Unit 3: Mark 14
Question: 4 from Unit 4: Mark 14
Question: 5 from Unit 5: Mark 14

Each Question is divided in sub questions a,b,c and d as shown below

(a) Short answer questions 4 [4 Marks] (All questions are compulsory)
   (A short answer question may comprise of answer of One word, one line, explanation, definition, true or false, fill up the blanks, etc.)

(b) Sums - Numerical problem solving questions: (1 out of 2) [2 Marks]

(c) Moderate length questions: (1 out of 2) [3Marks] (In this section atleast one sum / numerical problem solving question should be preferably asked)

(d) Long question: (1 out of 2) [5 Marks]
UNIT 1: (12 hour : 14 Mark)

**Multi-stage Transistor Amplifiers:** Multistage Transistor Amplifier, Role of Capacitors in Transistor Amplifiers, RC coupled Transistor Amplifier, Transformer Coupled Amplifier, Direct coupled Amplifier, Comparison of Different types of coupling, Numerical Problems.


UNIT 2: (12 hour : 14 Mark)

**Solid State Switching Circuits:** Switch, Mechanical switch, Electronic Switches, Advantages of electronic switches, switching transistors, switching action of Transistor, Multivibrators, Types of Multivibrators, Transistor Astable Multivibrators, Transistor Monostable Multivibrators, Transistor Bistable Multivibrators, Differentiating circuit, Integrating circuit, Clipping circuits, Application of Clippers, Basic idea of a clamper, clamping circuits, Numerical Problems.

UNIT 3: (12 hour : 14 Mark)

**Regulated D.C. Power Supply:** Ordinary D.C. power supply, Important terms, Regulated Power supply, Types of voltage regulators, Zener diode as a voltage regulator, Transistor series
voltage regulator, Series feedback voltage regulator, Short-circuit protection, Transistor shunt voltage Regulator, Numerical Problems.


**UNIT 4: (12 hour : 14 Mark)**


**UNIT 5: (12 hour : 14 Mark)**

**Electronic Instruments:** Analog and Digital Instruments, Functions of Instruments, Electronic versus Electrical Instruments, Essentials of an Electronic Instrument, The Multimeter, Rectifier type AC meter, Electronic Voltmeter, Electronic voltmeter for Alternating currents, Digital voltmeter,
Cathode Ray Oscilloscope, Frequency Determination, Application of CRO.

**Basic Reference Books for above units:**
1. Principles of Electronics By V.K.Mehta & Rohit Mehta. Publisher:S. Chand & Company Ltd.
2. Basic Electronics By B.L.Theraja, Publisher:S. Chand & Company Ltd

**Digital circuits & Applications:**
Combinational logic circuits: Introduction, Half adder; Full adder; Multiplexer: 16 to 1 Multiplexer; The 74150; Multiplexer Logic; Bubbles on Signal Lines; Nibble Multiplexers, Demultiplexer: 1 to 16 Demultiplexer; The 74154, 1 of 16 Decoder, BCD To Decimal Decoders; The 7445, Encoder, The 74147.
IC 555 timer and its application as astable and monostable Multivibrator. Numerical Problems.

**Basic Reference Book:**

**Other Reference Books:**
1. Electronic Devices & Circuits By Allen Mottershad, Publisher: Prentice-Hall of India Pvt. Ltd., Delhi
2. Electronic Devices & Circuits Theory by Boylestead & Nashelsky
3. Handbook of Electronics By Kumar & Gupta, Publisher: Pragati Prakashan, Meerut, India
4. Principal of Electronics By Malvino, Publisher: TMG
5. Modern Digital Electronics By R.P.Jain
6. A Text book of Digital Electronics By R.S.Sedha, Publisher:S.Chand
B.Sc. Semester – 5 - Practical

Each student will have to perform **three (3) experiments** (**one from each group**) in the University Examination.

Each Practical would be of 35 Marks and should be performed in a session of 3 Hours in practical exam.

There would be three sessions of 3 hours each for three experimental practical examination.

There shall be **batch of 15 students** for practical exam in university examination.

**List of Experiments**

**Group A**

1. Determine the "g" using Kater's Pendulum
2. Study of Damped Simple Harmonic Motion
3. Study of Fabry-Perot Etalon
4. Study of Lloyd's Mirror.
5. Study of Double Refraction in Calcite Prism
6. Young Modulus of beam by elevation method
7. To determine the thermal conductivity of cardboard (bad conductor) by Lee's Method.
8. $\eta$ of metal rod using Barton’s Vertical apparatus
9. To determine radius of curvature of a given lens and refractive index of glass using optical lever method.
10. To study Diffraction at Straight edge.
11. To study the elliptical polarization of light using babinet compensator.
12. To determine viscosity of liquid by log decrement method.
Group B

1. Study of Absorption spectra of Iodine
2. Comparison of Capacities by Mixture Method
3. Determine the constant of Ballistic Galvanometer
4. Determine the Self Induction of coils using Owen's Bridge
5. Determine the Mutual Induction of coils using Ballistic Galvanometer
6. Study of Transformer's coils using Bridge rectifier
7. Determine e/m using Magnetron Method.
8. Determine e/m using Helical Method
9. Study of Hysterisis loop of Ferromagnetic Material
10. Study of Hall Effect.
11. To determine the self inductance/ Mutual Inductance of a given coil by Rayleigh’s method.
12. Absolute value of capacity of a capacitor by B.G.
13. To determine Permeability of Free space.

Group C

1. Study of h-Parameter of CE- Transistor.
2. Study of Single stage Transformer coupled Amplifier
3. Study of Complementary-Symmetry Power Amplifier
4. Study of Series Voltage Regulator using Transistor
5. Electronic voltmeter using FET
7. Study of RC phase shift Oscillator.
8. Study of Lissageous figure/Measurement of frequency and phase using CRO.
9. Study of X-OR Gate.
10. Study of X-NOR Gate.
11. Verification of De’Morgans Theorem.
12. To determine the capacitance or to compare capacitance by Wien Brideg.

Reference Books:
1. Practical Physics by C.L. Arora (S.Chand)
2. Advanced Practical Physics by Chauhan & Singh. (Pragati Prakashan)
3. B. Saraf et al-Physics through experiments Vol.I & II
4. Electronic Laboratory Primer by Poorna Chandra & Sasikala, (S.Chand)
5. Practical Physics by Chattopadhyay, Rakshit & Saha.
Syllabus of B.Sc. (Physics) Sem-6
According to Choice Based Credit System
Effective from June – 2018

Course Contents:

- Physics-601 - Theory: Nuclear & Particle Physics
- Physics-602 - Theory: Statistical Mechanics & Solid state physics
- Physics-603 - Theory: Spectroscopy and Applied Optics
- Practical - Group A
- Practical - Group B
- Practical - Group C
- Project

Total Credit of the Semester-6: 24

Educational Study Tour:
Physics Department of college should arrange at least one Educational Study tour during semester 5 or 6. In this tour, students may visit any state or national research institute, scientific organization, industry or any educational scientific institute in India. Students submit detailed report of this study tour. This report consider as a project of 50 marks.
### B. Sc. Physics Semester : 6

The Course Design of B. Sc. Sem. - 6 (Physics) according to choice based credit system (CBCS) as follows:

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Subject</th>
<th>No of theory Lecture per week</th>
<th>No of Practical Lecture per week</th>
<th>Total Marks</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PAPER Physics-601 (Theory) Nuclear &amp; Particle Physics</td>
<td>6</td>
<td>-</td>
<td>70(External)+30 (Internal) = 100 Marks</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>PAPER Physics-602 (Theory) Statistical Mechanics &amp; Solid state physics</td>
<td>6</td>
<td>-</td>
<td>70(External)+30 (Internal) = 100 Marks</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>PAPER Physics-603 (Theory) Spectroscopy and Applied Optics</td>
<td>6</td>
<td>-</td>
<td>70(External)+30 (Internal) = 100 Marks</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Practical -1 (Group A) One practical from group A</td>
<td>-</td>
<td>6</td>
<td>35(External)+15(Internal) = 50 Marks</td>
<td>3</td>
</tr>
<tr>
<td>No</td>
<td>Practical &amp; Details</td>
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<td>Marks</td>
<td>Credit</td>
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</tr>
<tr>
<td>5</td>
<td>Practical -2 (Group B)&lt;br&gt;One practical from group B</td>
<td>6</td>
<td>35(External)+15(Internal) = 50 Marks</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Practical -3 (Group C)&lt;br&gt;One practical from group C</td>
<td>6</td>
<td>35(External)+15(Internal) = 50 Marks</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Project Work &amp; Viva&lt;br&gt;1 Guidance Lecture for a group in a week.&lt;br&gt;Evaluation of project will be in SIXTH semester</td>
<td></td>
<td>50 + 50 = 100 Marks</td>
<td>3</td>
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</table>

**Total credit of the semester 6** 24
**B.Sc. (Physics)**

**Semester -6**

**Paper: Physics-601**

*(Nuclear & Particle Physics)*

Course duration:
Theory: 60 hours, 6 hours a week, Credit: 4
External Marks: 70, Internal Marks: 30, Total: 100

<table>
<thead>
<tr>
<th>PAPER STYLE For paper 601</th>
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<tbody>
<tr>
<td>1. Syllabus of Physics paper 601 consists of 5 units:</td>
</tr>
<tr>
<td>2. All units carry 14 marks each.</td>
</tr>
<tr>
<td>3. There would be total 5 questions. One question from each unit.</td>
</tr>
<tr>
<td>4. Each question of 14 mark</td>
</tr>
<tr>
<td>5. Student can use the scientific (Non programmable) calculator.</td>
</tr>
<tr>
<td>6. Time duration: 2.5 Hours</td>
</tr>
<tr>
<td><strong>Question:1 from Unit 1 : Mark 14</strong></td>
</tr>
<tr>
<td><strong>Question:2 from Unit 2 : Mark 14</strong></td>
</tr>
<tr>
<td><strong>Question:3 from Unit 3 : Mark 14</strong></td>
</tr>
<tr>
<td><strong>Question:4 from Unit 4 : Mark 14</strong></td>
</tr>
<tr>
<td><strong>Question:5 from Unit 5: Mark 14</strong></td>
</tr>
<tr>
<td>Each Question is divided in sub questions a,b,c and d as shown below</td>
</tr>
</tbody>
</table>

(a) Short answer questions 4 [4 Marks] (All questions are compulsory)
(A short answer question may comprise of answer of One word, one line, explanation, definition, true or false, fill up the blanks, etc.)

(b) Sums - Numerical problem solving questions: (1 out of 2) [2 Marks]

(c) Moderate length questions: (1 out of 2) [3 Marks] (In this section atleast one sum / numerical problem solving question should be preferably asked)

(d) Long question: (1 out of 2) [5 Marks]
B.Sc. (Physics)  
Semester -6  
Paper: Physics-601  
(Nuclear & Particle Physics)

UNIT -1: (12 hour: 14 Mark)

UNIT -2: (12 hour: 14 Mark)

UNIT -3: (12 hour: 14 Mark)
Interaction of Nuclear Radiation with matter And Detector: Interaction between Energetic Particle and matter, Principle construction and working of - Ionization Chamber; Solid state Detector; Scintillation Counters, GM Counter, Plateau Curve.
**Nuclear Reaction:** Rutherford experiment for artificial transmutation, Q-value of Nuclear reaction, Type of Nuclear reactions, Energy balance in Nuclear reaction, Threshold energy of Endoergic reaction, Nuclear Transmutation, Numerical Problems.

**UNIT -4: (12 hour: 14 Mark)**

**Particle Accelerator:** Construction and working of – Linear Accelerator; Cyclotron, Formula of Cyclotron Frequency, Limitation of Cyclotron, Principle of Phase Stability, Synchrocyclotron, Synchrotron - Proton Synchrotron; electron Synchrotron( Betatron).

**Nuclear Fission:** Discovery of Nuclear fission, Energy released in fission, Bohr & Wheeler's theory of fission, Chain reaction, Multiplication Factor, Critical Size, Atom bomb, Nuclear reactors, Use of Nuclear Reactor Power Reactor, Breeder Reactor, Numerical Problems.

**UNIT -5: (12 hour: 14 Mark)**

**Nuclear fusion:** Nuclear fusion, Source of stellar energy, Thermonuclear reactions, Hydrogen Bomb, Controlled Thermo Nuclear Reaction, Fusion Reactor, Plasma Confinement – Gravitation Confinement, Magnetic Bottle, Tokamak, Internal Confinement, Numerical Problems.

**Elementary Particles:** Introduction, Classification of Elementary Particles, Particles & Antiparticles, Antimatter, The fundamental Interactions, Elementary particle Quantum numbers, Conservation laws and symmetry, Quark model.

**Reference Books:**
1. Modern Physics By R.Murugeshan & Kiruthinga Sivaprasatha, Publication: S.Chand & Company Ltd.
4. Concept of Nuclear Physics By B.L.Cohen Publisher: TMG
6. Concept of Modern Physics By Arthur Beiser Publisher: TMG
7. Refresher Course in Physics Volume 1,2 & 3 By C.L.Arora
B.Sc. (Physics)
Semester -6
Paper: Physics-602
(Statistical Mechanics & Solid state physics)

Course duration:
Theory: 60 hours, 6 hours a week, Credit: 4
External Marks: 70, Internal Marks: 30, Total: 100

PAPER STYLE For paper 602

1. Syllabus of Physics paper 602 consists of 5 units:
2. All units carry 14 marks each.
3. There would be total 5 questions. One question from each unit.
4. Each question of 14 mark
5. Student can use the scientific (Non programmable) calculator.
6. Time duration:2.5 Hours

   Question:1 from Unit 1 : Mark 14
   Question:2 from Unit 2 : Mark 14
   Question:3 from Unit 3 : Mark 14
   Question:4 from Unit 4 : Mark 14
   Question:5 from Unit 5: Mark 14

Each Question is divided in sub questions a,b,c and d as shown below

(a) Short answer questions 4 [4 Marks] (All questions are compulsory )
   (A short answer question may comprise of answer of One word, one line,
   explanation, definition, true or false, fill up the blanks, etc.)

(b) Sums - Numerical problem solving questions: (1 out of 2) [ 2 Marks]

(c) Moderate length questions: (1 out of 2) [3Marks] (In this section atleast one sum
   / numerical problem solving question should be preferably asked)

(d) Long questions: (1 out of 2) [5 Marks]
Paper: Physics-602
(Statistical Mechanics & Solid state physics)

UNIT 1: (12 hour: 14 Mark)


Basic Reference Book:
Elementary Statistical Mechanics by Gupta and Kumar, Publisher: Pragati Prakashan.

UNIT 2: (12 hour : 14 Mark)

Crystal structure: The crystal lattice and lattice translation vector, Unit cell, Bravais lattice in three dimension, Crystal planes and mirror indices, Simple crystal Structure (hcp,fcc,bcc,sc,Dimond)

Crystal binding: Ionic crystals, Covalent crystals, Metallic crystals, Hydrogen bonded crystals.


UNIT 3: (12 hour : 14 Mark)

Free electron theory of metals: Free electron model, Free electron gas in one and three dimensions, Density of states, Effect of temperature, Thermal conductivity of free electron system, Sommerfield

UNIT 4: (12 hour : 14 Mark)

**Semiconductor physics:** Insulators, Semiconductors, Intrinsic semiconductors: Electron-Hole carrier concentrations, Fermi level, Electrical conductivity and bonding, effect of impurities

**Basic Reference Book for ( 2 to 4):**

UNIT 5: (12 hour : 14 Mark)

**Superconductivity:** Experimental Aspects, Influence of external agents on Superconductivity, Meissner effect, Critical field of Small Specimens, Thermodynamic of Superconducting transition, Alloys & Compounds, London's theory, Josephson effects, BCS theory, Applications of Superconductivity, Numerical Problems.

**Basic Reference books:**
1. Fundamental of Solid State Physics By Saxena, Gupta, Saxena, Publisher: Pragati Prakashan

**Other Reference Books:**
1. Statistical Mechanics by Mayor and Mayor
2. Statistical Mechanics by Agrawal and Eisner
7. Superconductivity & Superconducting Materials by Narlikar and Ekbote.
8. Refresher Course in Physics Volume 1,2 & 3 By C.L.Arora
B.Sc. (Physics)
Semester -6
Paper: Physics-603
(Spectroscopy and Applied Optics)

Course duration:
Theory: 60 hours, 6 hours a week, Credit: 4
External Marks: 70, Internal Marks: 30, Total: 100

PAPER STYLE For paper 603

1. Syllabus of Physics paper 603 consists of 5 units:
2. All units carry 14 marks each.
3. There would be total 5 questions. One question from each unit.
4. Each question of 14 mark
5. Student can use the scientific (Non programmable) calculator.
6. Time duration: 2.5 Hours

  Question:1 from Unit 1 : Mark 14
  Question:2 from Unit 2 : Mark 14
  Question:3 from Unit 3 : Mark 14
  Question:4 from Unit 4 : Mark 14
  Question:5 from Unit 5: Mark 14

Each Question is divided in sub questions a,b,c and d as shown below

(a) Short answer questions 4 [4 Marks] (All questions are compulsory )
    (A short answer question may comprise of answer of One word, one line, explanation, definition, true or false, fill up the blanks, etc.)

(b) Small Length Questions: (1 out of 2) [ 2 Marks] (In this section sums / numerical problem solving questions should be preferably asked)

(c) Moderate length questions: (1 out of 2) [3Marks] (In this section atleast one sum / numerical problem solving question should be preferably asked)

(d) Long questions: (1 out of 2) [5 Marks]
Paper: Physics-603  
(Spectroscopy and Applied Optics)

UNIT -1: (12 hour: 14 Mark)
Atomic Spectroscopy:
Production of Spectra, Type of Spectra- Emission Spectra, Absorption Spectra. Bohr's Theory of atom, Franck-Hertz Experiment, Shortcoming of Bohr Theory, Sommerfield Elliptical orbits (theoretical part only), The spinning electron, Space quantization, Quantum numbers and their physical interpretations, Magnetic moments of an Atom and Lande’s g Factor.


UNIT -2: (12 hour: 14 Mark)

Basic Reference Book: Atomic Physics By J.B.Rajam. Publisher: S.Chand &Company Ltd.

**Basic Reference Book:** Elements of Spectroscopy By Gupta, Kumar, Sharma Publisher: Pragati Prakashan Twenty-eight Edition 2016.

**UNIT -3: (12 hour: 14 Mark)**


**Basic Reference Book:** Elements of Spectroscopy By Gupta, Kumar, Sharma Publisher: Pragati Prakashan Twenty-eight Edition 2016.

**UNIT -4: (12 hour: 14 Mark)**


**Basic Reference Books:**

1. Elements of Spectroscopy By Gupta, Kumar, Sharma Publisher: Pragati Prakashan Twenty-eight Edition 2016.
UNIT -5: (12 hour: 14 Mark)


**Other Reference Books:**
1. Fundamentals of Solid state Physics by Saxena, Gupta and Saxena, Publisher: Pragati Prakashan
2. Introduction to LASER by Tyagrajan.
3. Optics and Spectroscopy - R. Murugeshan & Kiruthiga Sivaprasakasha. Publisher: S.Chand & Company Ltd.
5. A Text Book of Optics N.Subrahmanyan, Brij Lal & M.N.Avadhanulu, Publisher: S.Chand & Company Ltd.
6. Atomic Physics By J.B.Rajam. Publisher: S.Chand & Company Ltd.
7. Modern Physics By S.L.Kakani and Shubhra Kakani
8. Fundamental of Molecular Spectroscopy By Colin N Banwell & Elaine M McCash Publisher: TMG Latest Edition
9. Refresher Course in Physics Volume 1,2 & 3 By C.L.Arora
B.Sc. Semester – 6 - Practical

Each student will have to perform **three (3) experiments** (one from each group) in the University Examination.

Each Practical would be of 35 Marks and should be performed in a session of 3 Hours in practical exam.

There would be three sessions of 3 hours each for three experimental practical examination. Fourth session of 3 hours would be for the project work evaluation. (So, in total a student has to undergo four sessions (3 hours each) of practical + project evaluation examination)

There shall be **batch of 15 students** for practical exam in university examination.

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**List of Experiments**

**Group A**

1. To Study of Resonance Pendulum.
2. To Determine the Young's Modulus by Koeing Method.
3. Determine the Elastic constants using Flat Spiral Spring.
5. Study of Searle's Goniometer.
7. To Study of Edser-Butler Plate.
8. To determine Planck's constant using Photocell.
9. Study of Temperature ON-OFF Controller with Thermistor.
10. To determine Young’s modulus \(Y\), modulus of rigidity \(\nu\), Poission’s ratio \(\sigma\) and bulk modulus \(K\) for the material of wire by Searl’s arrangement.
11. To measure the divergence of a given LASER source.
12. To determine wavelength of LASER by Diffraction Gratting.
13. To determine refractive index of liquid by Bi prism.

**Group B**

1. Photo Conductivity of Selenium cell  
2. Characteristics of SCR.  
4. To determine e/m by Thomson's method.  
5. To verify the Thevenin’s theorem.  
6. To determine self inductance of a coil by Anderson’s Bridge.  
7. To study variation of thermo-electric emf with temperature for Thermo couple.  
8. ‘e’ By Milikan’s Method  
9. e/K By Power Transistor  
10. Convert a moving coil galvanometer into current meter & Voltmeter  
11. Study of the Output Wave form Clipping circuit  
12. Study of the Output Wave form Clamping circuit

**Group C**

2. To study the working of an OP-AMP as integrator and differentiator.  
3. Study of IC 555 Timer circuit.  
4. Study of Multiplexer(4-1 line) using (Discrete components or using IC.  
5. Study of Demultiplexer(1-4 line) using (Discrete components or using IC  
7. Study of 4-bit Ripple Counter.  
9. Study of UJT as Relaxation Oscillator.
11. Study of Modulation and Demodulation using IC 723.

**Reference Books:**
1. Practical Physics by C.L.Arora (S.Chand)
2. Advanced Practical Physics by Chauhan & Singh. (Pragati Prakashan)
3. B.Saraf et al-Physics through experiments Vol.I & II
4. Electronic Laboratory Primer by Poorna Chandra & Sasikala, (S.Chand)
5. Practical Physics by Chattopadhyay, Rakshit & Saha.