Board of Studies in Physics
FACULTY OF SCIENCE
GONDWANA UNIVERSITY, GADCHIROLI

Syllabus of

B.Sc. Third Year (Semester Pattern)

SUBJECT - PHYSICS

Semester VI
# GONDWANA UNIVERSITY, GADCHIROLI
## SUBJECT - PHYSICS

### (A) Teaching workload and Semester Examination Scheme for B.Sc.

<table>
<thead>
<tr>
<th>Class</th>
<th>Semester</th>
<th>Teaching workload per week</th>
<th>Examination Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>Theory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>marks</td>
<td></td>
</tr>
<tr>
<td>B.Sc.I</td>
<td>I</td>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td>B.Sc.II</td>
<td>III</td>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td>B.Sc.III</td>
<td>V</td>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>VI</td>
<td>6</td>
<td>50</td>
</tr>
</tbody>
</table>

B.Sc.          | Total marks : 900 | Total Credits : 120

T* Periods for Tutorials per batch.

### (B) B.Sc. Semester Pattern Examination Scheme

1. There shall be total six semesters.
2. Each semester shall comprise of 90 (Ninety) actual teaching days.
3. Each Semester I to VI shall be of 150 marks.
4. Every subject in each semester will comprise of two theory papers of 50 marks each. Practical/ laboratory work will be of 30 marks and Internal assessment of 10 marks for each theory paper.

i. Paper I  Theory  ----  50 marks
   Internal Assessment  ----  10 marks

ii. Paper II  Theory  ----  50 marks
    Internal Assessment  ----  10 marks

iii. Practical  ----  30 marks

Total marks  ----  150 marks

5. All theory papers shall be divided into four units. Each unit shall be cover in 15 periods of 45 minutes.

6. The scope and limitations of the subject of all semester opted by the students shall be indicated in the syllabi from time to time. The medium of instruction and examination shall be English.

7. The theory question paper will be intraunit choice and equal weightage to all questions. Duration of each theory paper shall be three hours. There will be five questions each of 10 marks. All questions are compulsory. Fifth question will be on all four units with three sub-questions from each unit.

8. Pattern of question paper:  Subject - Physics

<table>
<thead>
<tr>
<th>Question No.</th>
<th>Marks Allotted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qu. 1 Either</td>
<td></td>
</tr>
<tr>
<td>(A) From Unit - I</td>
<td>10</td>
</tr>
<tr>
<td>Or</td>
<td></td>
</tr>
<tr>
<td>(B) From Unit – II / III / IV</td>
<td>10</td>
</tr>
<tr>
<td>Qu. 2</td>
<td></td>
</tr>
<tr>
<td>If Qu. 1 (B) From Unit – II Then</td>
<td></td>
</tr>
<tr>
<td>Either (A) From Unit – II Or (B) From Unit - IV</td>
<td>10</td>
</tr>
<tr>
<td>If Qu. 1 (B) From Unit – III Then</td>
<td></td>
</tr>
<tr>
<td>Either (A) From Unit – II Or (B) From Unit - IV</td>
<td>10</td>
</tr>
<tr>
<td>If Qu. 1 (B) From Unit – IV Then</td>
<td></td>
</tr>
<tr>
<td>Either (A) From Unit – II Or (B) From Unit - III</td>
<td>10</td>
</tr>
<tr>
<td>Qu. 3 Either</td>
<td></td>
</tr>
<tr>
<td>a) From Unit - I</td>
<td>2.5</td>
</tr>
<tr>
<td>b) From Unit - II</td>
<td>2.5</td>
</tr>
<tr>
<td>c) From Unit - III</td>
<td>2.5</td>
</tr>
<tr>
<td>d) From Unit - IV</td>
<td>2.5</td>
</tr>
<tr>
<td>Or</td>
<td></td>
</tr>
<tr>
<td>e) From Unit - I</td>
<td>2.5</td>
</tr>
<tr>
<td>f) From Unit - II</td>
<td>2.5</td>
</tr>
<tr>
<td>g) From Unit - III</td>
<td>2.5</td>
</tr>
<tr>
<td>h) From Unit - IV</td>
<td>2.5</td>
</tr>
</tbody>
</table>
Qu. 4 Either
   a) From Unit - I       2.5
   b) From Unit - II      2.5
   c) From Unit - III     2.5
   d) From Unit - IV      2.5
Or
   e) From Unit - I       2.5
   f) From Unit - II      2.5
   g) From Unit - III     2.5
   h) From Unit - IV      2.5

Qu. 5 Attempt any 10 questions from the following.
   (a) Unit - I            1
   (b) Unit - I            1
   (c) Unit - I            1
   (d) Unit - II           1
   (e) Unit - II           1
   (f) Unit – II           1
   (g) Unit – III          1
   (h) Unit – III          1
   (i) Unit – III          1
   (j) Unit – IV           1
   (k) Unit – IV           1
   (l) Unit – IV           1

8. A student will have to perform at least five (05) experiments from each group.

9. Practical examination for all semesters shall be conducted twice in a year, at the end of each semester. Practical examination in odd semesters shall be conducted by Internal examiner, whereas practical examination in even semester shall be conducted by Internal as well as external examiner. Duration of practical examinations shall be of 6 hours. At the time of Practical examination every student has to perform two experiments one experiment from each group.

10. The distribution of marks for practical examination is as follows.
    Record Book ----  6 marks
    Viva-voce      ----  6 marks
    Each Experiment (9 marks) ----  18 marks
    TOTAL          ----  30 MARKS

11. Evaluation of the student during the semester for internal assessment:

    The University approved teacher will have to conduct a test on each unit. The test is to be carried out with the interest to make the student aware of the basics of the theory and the experiments as well. This will enhance the viva-voce competence and subject interest of the student. The record of these tests is to be maintained in the department duly signed by the teacher in-charge and head of the department. The record is to be maintained in the following format. Each unit test should be of 10 marks. Find the average and assign it to the student.
Record of marks scored in the unit tests during the semester.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of the Student</th>
<th>Paper I</th>
<th>Paper II</th>
<th>Average marks obtained</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Test 1</td>
<td>Test 2</td>
<td>Test 3</td>
</tr>
<tr>
<td>1</td>
<td>ABC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>DEF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>GHI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>JKL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>MNO</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>PQR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>STU</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>VWX</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>YZ</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Signature of teacher in-charge

Head of Department

12. The internal assessment shall be done by respective college and the marks shall be sent to the university one month prior to the final examination of each semester.

13. Minimum marks for passing will be **35%** of the total marks. A candidate has to pass individuality in theory / internal assessment / practical separately. The minimum passing marks for theory **35** marks, for internal assessment **7** marks and that for practical **11** marks.

C) Grade Point Average (GPA) and Course Grade Point Average (CGPA)

In the Credit and Grade Point System, the assessment of individual Courses in the concerned examinations will be on the basis of marks only, but the marks shall later be converted into Grades wherein the overall performance of the Learners can be reflected after considering the Credit Point. The overall evaluation shall be designated in terms of Grade.

(Table No.1): Performance Grading Scale

<table>
<thead>
<tr>
<th>Marks Obtained %</th>
<th>Grade</th>
<th>Grade Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>75 &amp; above</td>
<td>O</td>
<td>6</td>
</tr>
<tr>
<td>65 to 74.99</td>
<td>A</td>
<td>5</td>
</tr>
<tr>
<td>55 to 64.99</td>
<td>B</td>
<td>4</td>
</tr>
<tr>
<td>50 to 54.99</td>
<td>C</td>
<td>3</td>
</tr>
<tr>
<td>45 to 49.99</td>
<td>D</td>
<td>2</td>
</tr>
<tr>
<td>40 to 44.99</td>
<td>E</td>
<td>1</td>
</tr>
<tr>
<td>00 to 39.99</td>
<td>F</td>
<td>0</td>
</tr>
</tbody>
</table>

(Table No. 2): Final Grade Points

<table>
<thead>
<tr>
<th>Final Grade Points</th>
<th>Final grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0 to 6.0</td>
<td>O</td>
</tr>
<tr>
<td>4.50 to 4.99</td>
<td>A</td>
</tr>
<tr>
<td>3.50 to 4.49</td>
<td>B</td>
</tr>
<tr>
<td>2.50 to 3.49</td>
<td>C</td>
</tr>
<tr>
<td>1.50 to 2.49</td>
<td>D</td>
</tr>
<tr>
<td>0.50 to 1.49</td>
<td>E</td>
</tr>
<tr>
<td>0.00 to 0.49</td>
<td>F</td>
</tr>
</tbody>
</table>
O: Outstanding, A: Very Good, B: Good, C: Average, D: Satisfactory, E: Pass, F: Fail

**Semester Grade point average (SGPA)**

SGPA: Semester Grade Point Average shall be calculated for individual semesters. It is also designated as GPA.

\[
SGPA = \frac{\sum CG}{\sum C}
\]

Where, \( \sum CG \): Sum of Product of Credits & Grade points and \( \sum C \): Sum of Credit points.

**Cumulative Grade Point Average (CGPA)**

CGPA: Cumulative Grade Point Average shall be calculated for the entire Program by considering all the semesters taken together. The CGPA of a student will be Average of the SGPA’s of that student. A student will be allotted a cumulative Grade Point Average (CGPA) after clearing all the four semesters. The CGPA of a student will be Average of the four SGPA’s of that student.

After calculating the SGPA for an individual semester and the CGPA for entire program, the value can be matched with the grade in the Final Grade Point table No. 2 as per the Seven (07) Points Grading System and expressed as a single designated GRADE such as O, A, B, C, D,

**Syllabus for B.Sc. III  Subject – Physics**

The syllabus of Physics as per semester system for the B.Sc. III will be implemented from the Academic year **2014-2015**.

**Name of Programme : B.Sc. III**

**Duration: Two semesters**

**Semester V:**  Paper I (5S-PHY 501): Statistical Physics and Relativity  
Paper II (5S-PHY 502): X-rays and Solid State Physics,  
Practical (5S- PHY 503)

**Semester VI:** Paper I (6S-PHY 601): Nuclear Physics, Nanotechnology and Biophysics  
Paper II (6S-PHY 602): Fibre Optics, Communication and Digital Electronics  
Practical (6S- PHY 603)
Unit I

**Nuclear physics**- Interaction of charged particles and neutrons with matter, G. M. counter, Proportional counter and scintillation counter. Nuclear reactions, Packing fraction, Mass defect and binding energy, Nuclear fission.

*Numericals.*

Unit II

**Structure of nuclei:** Liquid drop model, Chain reaction, Nuclear fusion, Cosmic ray, Elementary particles, Shell model of the nucleus. Alpha decay, Range of α particle, Geiger Nuttal law, Tunneling, Gamow's theory of α decay.

*Numericals.*

Unit III

**Nanomaterials**- Size and properties of nanomaterials, Difference between nanomaterials and bulk materials, Nano cluster, quantum dots.

**Nanotechnology**- Different methods of synthesis of nanomaterials (Wet chemical, Sol-gel and HCR Technique), Basic principle of characterization technique of SEM and TEM.

Unit IV

**Applications of Nanotechnology**: Applications in nano-medicine, nano-electronics, nano-sensing, nano-magnetics (only basic idea).


**References and Text books** –
1. Nuclear Physics, by- S. N. Ghoshal.
10. Medical Instrumentation, by Khandpur TMH.
11. Text Book of Bio Physics, by R. N. Roy
12. Laboratory manuals of Bio Physics Instruments, by P. B. Vidyasagar.

**Paper II: 6S-PHY 602: Fibre Optics, Communication and Digital Electronics**

**Unit I**
**Fiber optics**- Importance of optical fiber, Propagation of light waves in optical fiber, Basic structure, Stepped index monomode fiber, Graded index fiber, Acceptance angle and acceptance cone, Numerical aperture, Fiber losses and their units (basic concept), Electrical and optical band width, bandwidth length product.

*Numericals.*

**Unit II**
**Communication**- Introduction to A.M. F.M. and P.M.
**Amplitude modulation (A.M.):** Frequency spectrum, Modulation factor, Percentage modulation, Expression for Power dissipation in AM wave, disadvantages.
**Frequency modulation** - Frequency deviation, Carrier swing, Modulation index, Deviation ratio, Expression for FM wave, Frequency spectrum, significant side band terms, FM band width, Merits and demerits.

*Numericals.*

**Unit III**
**Number Systems**- Binary, decimal, hexadecimal and their inter-conversions, Binary coded decimal (BCD), Addition and subtraction of binary numbers, 1'S, 2'S and 9'S, 10'S compliment,

Numericals.

Unit IV

Astable, monostable and bistable multivibrators, RS flip-flop, clock RS FF, DFF, JKFF, and JKMSFF 4-bit serial binary counter shift register (SISO and SIPO), Ring counter,

References and Text books -

1. Optical Fibres and Fibre Optic communication System, by- Subir Kumar Sarkar, S. Chand & Company,
3. Optical fiber communication, by- John M. Senior.
4. Laser and Optical fiber communication, by- P. Sarah.
8. Communication Electronics, by- A. Kumar
10. Digital Principle and Application, by- Malvino and Leach
11. Digital Electronics and It's Application, by- R. P. Jain

6S-PHY 603 :( Practical)

1. Every student will have to perform at least Five (05) experiments from each group.
2. Every student will have to perform two experiments one from each group at the time of university practical examination in 6 hours.
3. The distribution of practical/laboratory work of 30 marks is-

<table>
<thead>
<tr>
<th>Component</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two experiments (9 Marks each)</td>
<td>18 Marks</td>
</tr>
<tr>
<td>Record book</td>
<td>06 Marks</td>
</tr>
<tr>
<td>Viva Voce</td>
<td>06 Marks</td>
</tr>
<tr>
<td></td>
<td>--------</td>
</tr>
<tr>
<td>Total</td>
<td>30 Marks</td>
</tr>
</tbody>
</table>

List of the experiments-

Group A
1. Study of random decay of nuclear disintegration and determination of decay constant using dices.
2. To study low-pass, high-pass and band-pass filters.
3. To determine the electric charge \((e)\) of an electron by Millikan’s oil drop method.
4. To determine the value of specific charge \((e/m)\) of an electron by Thomson method.
5. Study of RS flip-flop
6. Study of JK flip-Flop
7. Study of 4-bit binary counter.
8. To study the working of an Astable multivibrator.
9. To study the working of a Mono-stable multivibrator.
10. To study the working of a bi-stable multivibrator.

**Group B**

1. To determine modulation index and percentage modulation of AM modulator.
2. To study Master Oscillator Power Amplifier (MOPA)
3. To study transistor as a switch - calculation of ON and OFF state resistance.
4. Study of Characteristics of LED.
5. Study of basic gates: AND, OR and NOT gates.
7. Study of NOR gate and its use as a Universal gate.
8. Verification of De Morgan’s theorem.
9. Simplification of logic circuits using laws and theorems of Boolean algebra.
10. Study of half adder and full adder.

**References books** -

2. Practical Physics For B. Sc. II – Kale, Soman, Gawande & Gokhale Publisher: Kitab Mahal, Nagpur
3. Practical Physics For B. Sc. III – Kale, Bahekar & Gokhale Publisher: Kitab Mahal, Nagpur