# Hemchandracharya North Gujarat University

PATAN-384265

NAAC 'A' ( 3.02 C GPA) Accredited (State University)

# U.G. (B. Sc.) Programme

## CBCS :: Semester Grading Pattern

**With Effect From**
**June- 2022 (In Continuation)**

**Faculty**

**SCIENCE**

**Subject**

**PHYSICS**

# SYLLABUS

**PROGRAM CODE : HNGU1058**

## B.Sc. SEMESTER – V & VI

**For Theory and Practical**

**Date : 14 /03/2022**

**Place : PATAN**

**Pri Dr J H Prajapati**
**CHAIRMAN**
**Board of Studies, PHYSICS**
I/c. Registrar
Hemchandracharya
North Gujarat University
PATAN

**HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN**
**Choice Based Credit System-Semester-Grading System**
**Under Graduate B Sc Programme**
**With Effective from June - 2022**

The New course in B.Sc. PHYSICS (Sem-V & VI) UG syllabus (Programme) is based on Choice Based CreditSystem (CBCS) which is inforce from june-2022.

**Salient Features of CBCS in UG programme:**

1. Physics subject in the Universities/Affiliated Colleges shall offer undergraduate programme in Faculty of Science from the Academic year 2022-23.
2. A student will have to get enrolled a **Core course** depending upon his/her requirement of a degree in the said discipline of study. A student will have a choice of selecting an **Elective** as well as **Foundation** courses from a pool of courses.
3. Each course shall be assigned a specific number of **Credits**.
4. A Core course is the course which should compulsorily be studied by a candidate as a Core requirement so as to get degree in a said discipline of study.
5. There shall be four **Core Compulsory** courses (Theory) each with **3 credits** and their practical's each with **1.5 credits**. Thus, a credit weight-age in Sem-V & VI of **B. Sc.** programme for each core course shall be of **4.5 credits**. In short, 4.5 credits multiplied by 4 core compulsory courses equal to total of **18 credits**.
6. In addition to the Core courses, a student will have to choose Elective as well as Foundation courses from a pool of courses.
7. **Two** courses of **Elective**, one each from **Generic Elective** and Interdisciplinary / Multidisciplinary / **Subject centric electives** shall have to be offered. The credit weight-age for each Elective course shall be of **02 Credits**. Hence, a total credit weight-age for Elective courses shall be of **4 credits**.
8. One **Foundation** (English Language) course shall have to be offered. The credit weight-age for Foundation course shall be of **02 credits**.

Each course shall have a unique Course code. The Core courses, Elective courses and the Foundation courses shall be abbreviated respectively as **CC, PC, EG, ES and FC.**

1. Core Compulsory-**CC** Practical Core -**PC**
2. Elective Generic **-EG**
3. Elective Subject- **ES**
4. Foundation Compulsory- **FC**

Each Academic year shall consist of **two** semesters, each of **15 weeks** of teaching equivalent to 90 working days. The Odd semester period shall be from **July to November** and the Even semester period shall be from **December to April**.

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The course with **4 credits** shall be of **60 hrs**(15 weeks x 4 credits) duration. The course with **3 credits** shall be of **45 hrs**(15 weeks x 3 credits) duration. The course with **2 credits** shall be of **30 hrs**(15 weeks x 2 credits) duration.

**A general framework for Bachelor of Science (B Sc) programme shall be as follows:**

| Semester wise credits | | | | | | Toatal Creditsof the Programme |
|---|---|---|---|---|---|---|
| I | II | III | IV | V | VI | |
| 24 | 24 | 24 | 24 | 24 | 24 | 144 |

**The semester wise weightage of core, elective and foundation courses shall be as follows:**

| Academic Year | Core compulsory Courses | Elective courses | Foundation Courses |
|---|---|---|---|
| Semester I & II | 75% | 15-20% | 10-15% |
| Semester III & IV | 75% | 15-20% | 10-15% |
| Semester V & VI | 75% | 15-20% | 10-15% |

Total weight-age - 100%

**Attendance:**

The Attendance Rules as per the norms of Hemchandracharya North Gujarat University.

**Medium of Instruction:**

The Medium of Instruction shall be of **Gujarati medium**. Student is free to write answers either in **Gujarati** or **English** language.

**Language of Question paper:**

Question paper should be drawn in **Gujarati** language and its **English** version should be given.

**Evaluation Methods:**

1. A student shall be evaluated through Comprehensive Continuous Assessment (**CCA**)/ (**Internal Evaluation**) as well as the **End of Semester examination** (**External Evaluation**). The weight-age of CCA shall be 30%, where as the weight-age of the Semester end examination shall be 70%. There will be **no internal evaluation in practical courses**.
2. The Semester assessment (**CCA**)/ (**Internal Evaluation**) is spread through the duration of the course and is to be done by the Teacher teaching the course. The assessment is to be done by various meansincluding:

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**Internal Test-15 Marks Assignments –10 Marks Attendance -05 Marks**

The performance of student in each course is evaluated in terms of percentage of marks with a provision for conversion to grade points. Evaluation for each course shall be done by continuous internal assessment as well as semester end exam and will be consolidated at the end of the course.

3. The **End of Semester examination** (**Theory Examination,External Evaluation**) shall have an assessment based upon following perspective with respect to all thecourses:

   - ✓ Evaluation with respect to Knowledge
   - ✓ Evaluation with respect to Understanding
   - ✓ Evaluation with respect to Skill
   - ✓ Evaluation with respect to Application
   - ✓ Higher Order Thinking Skills

4. With respect to all the above components, there shall be following types of Questions from each unit of the course.
   - ✓ Long answer questions
   - ✓ Medium answer questions
   - ✓ Short answer questions
   - ✓ Examples/ Problems,etc
   - ✓ MCQs/Fill in the blanks/ Match the pairs,etc.

**Only Bord of Studies can change the Pattern of question paper of external examination.**

5. The End of Semester Examination (Practical) will be conducted by the University. **A Certified Journal of the respective core compulsory course shall be produced at the time of practical examination. If a Student does not produce certified journal in the practical examination then examiner will be able to exclude him/her from practical examination.**

   In Practical Exam there will be four practicals (each from PC-501 to PC-504 for Sem-V & PC-601 to PC-604 for Sem-VI) each of 50 marks (35 Marks for practical+15 Marks for VIVA) and duration of each practical will be 3 hours. Numbers of student in a practical exam will be 16 per batch and examiners will be 2.

**SCHEME OF ASSESMENT for Each Practical**

| No. | Name of the head | Marks |
|---|---|---|
| 1. | Understanding and approach to the experiment, circuit layout, use of apparatus | 10 |
| 2. | Tabulation with correct units and accuracy of reading, which is read and noted by the student and verified by examiner. | 08 |
| 3. | Oral questions Regarding the experiment (Viva) | 15 |
| 4. | Calculations by correct formula and graph with scale. | 10 |
| 5. | Accuracy of the result as judged by comparing the students results with those supplied by expert assistant who has set the experiment. | 02 |
| 6. | Marks for journal. | 05 |
| | Total | 50 |

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6. It will be compulsory for a candidate to obtain passing percentage in both Internal as well as External Evaluation. The passing marks shall be **40%**, or as decided by concern Board of Studies of the Subject.
7. Promotion, Re-Admission and Time for Completion of Course, Procedure for Awarding Grades, Provision for Appeal, etc. as decided by the Hemchandracharya North Gujarat University.

# HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

## CBCS-Semester Grading Pattern

## B.Sc. SEMESTER - V PHYSICS SYLLABUS

## For Theory and Practical

**From Academic year 2022-23**

| Unit | Physics Theory<br>CC-PHY– 501<br>3 Credit<br>Total 100 Marks<br>Internal 30 Marks<br>External 70 Marks<br>3 Hrs/Week | Physics Theory<br>CC-PHY – 502<br>3 Credit<br>Total 100 Marks<br>Internal 30 Marks<br>External 70 Marks<br>3 Hrs/Week | Physics Theory<br>CC-PHY – 503<br>3 Credit<br>Total 100 Marks<br>Internal 30 Marks<br>External 70 Marks<br>3 Hrs/Week | Physics Theory<br>CC-PHY – 504<br>3 Credit<br>Total 100 Marks<br>Internal 30 Marks<br>External 70 Marks<br>3Hrs/Week | Elective Subject<br>ES-PHY – 07<br>ES-PHY- 08<br>2Credit<br>Total 50 Marks<br>Internal 15 Marks<br>External 35 Marks<br>2 Hrs/Week | Physics Practical<br>PC:PHY-501<br>PC:PHY-502<br>PC:PHY-503<br>PC:PHY-504<br>6Credit<br>Total 200 Marks<br>(External)<br>12 Hrs/Week |
|---|---|---|---|---|---|---|
| I | Mathematical Physics | Statistical Mechanics | Nuclear Physics | Electronics | Student has to select one elective course from above two courses | There are Four Groups of Practicals. Each group Consists of 5 experiments. Total 20 experiments . |
| II | Classical Mechanics | Solid State Physics | Nuclear Physics | Electronics | | |
| III | Quantum Mechanics | Plasma Physics | Molecular Spectra | Computer | | |

In order to give exposure of industry, research institute and higher learning in the field of physics, industrial visit may be arranged.

**It is expected that students of B.Sc. (PHYSICS) Semester – V & VI must visit industry / research institute /institute of higher learning.**

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# B.Sc. SEMESTER - VI PHYSICS SYLLABUS
## For Theory and Practical
**From Academicyear2022-23**

| Unit | Physics Theory<br>CC-PHY– 601<br>3 Credit<br>Total 100 Marks<br>Internal 30 Marks<br>External 70 Marks<br>3 Hrs/Week | Physics Theory<br>CC-PHY– 602<br>3 Credit<br>Total 100 Marks<br>Internal 30 Marks<br>External 70 Marks<br>3 Hrs/Week | Physics Theory<br>CC-PHY– 603<br>3 Credit<br>Total 100 Marks<br>Internal 30 Marks<br>External 70 Marks<br>3 Hrs/Week | Physics Theory<br>CC-PHY– 604<br>3 Credit<br>Total 100 Marks<br>Internal 30 Marks<br>External 70 Marks<br>3 Hrs/Week | Elective Subject<br>ES-PHY – 09<br>ES-PHY- 10<br>2Credit<br>Total 50 Marks<br>Internal 15 Marks<br>External 35 Marks<br>2 Hrs/Week | Physics Practical<br>PC:PHY-601<br>PC:PHY-602<br>PC:PHY-603<br>PC:PHY-604<br>6Credit<br>Total 200 Marks<br>(External)<br>12 Hrs/Week |
|---|---|---|---|---|---|---|
| I | Mathematical Physics | Statistical Mechanics | Electrodynamics | Electronics | Student has to select one elective course from above two courses | There are Four Groups of Practicals. Each group Consists of 5 experiments. Total 20 experiments . |
| II | Classical Mechanics | Solid State Physics | Electrodynamics | Electronics | | |
| III | Quantum Mechanics | Optics | Molecular Spectra | Computer Programming | | |

In order to give exposure of industry, research institute and higher learning in the field of physics, industrial visit may be arranged.

**It is expected that students of B.Sc. (PHYSICS) Semester – V & VI must visit industry / research institute /institute of higher learning.**


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**B.Sc. Programme with 144 credits**
**CBCS-Semester-Grading Pattern w.e.f. June-2022**
General Pattern/Scheme of study components along with credits for Science faculty.

| SEMESTER | Course code | Study Components | Instruction Hrs/ Week | Examination | | | Credit |
|---|---|---|---|---|---|---|---|
| | | | | Internal | Uni. Exam | Total | |
| B. Sc. Sem –V | | **Semester-V** | | | | | |
| | CC:PHY-501 | **Core Compulsory (CC) Course** | | | | | |
| | CC:PHY-502 | Core Course-I (Paper-7) | 3 | 30 | 70 | 100 | 3 |
| | CC:PHY-503 | Core Course-I (Paper-8) | 3 | 30 | 70 | 100 | 3 |
| | CC:PHY-504 | Core Course-I(Paper-9) | 3 | 30 | 70 | 100 | 3 |
| | | Core Course-I(Paper-10) | 3 | 30 | 70 | 100 | 3 |
| | | **Practical Core (PC) Course** | | | | | |
| | PC:PHY-501 | Practical Core Course-I (Paper-7) | 3 | -- | 50 | 50 | 1.5 |
| | PC:PHY-502 | Practical Core Course-I (Paper-8) | 3 | -- | 50 | 50 | 1.5 |
| | PC:PHY-503 | Practical Core Course-I(Paper-9) | 3 | -- | 50 | 50 | 1.5 |
| | PC:PHY-504 | Practical Core Course-I(Paper-10) | 3 | -- | 50 | 50 | 1.5 |
| | | **Foundation Course (FC)** | | | | | |
| | FC-5 | Foundation (**Generic**) Course – V Compulsory English (L.L.) | 2 | 15 | 35 | 100 | 2 |
| | | **Elective Course (E)** | | | | | |
| | EG-5 | Elective (**Generic**) Course –V | 2 | 15 | 35 | 50 | 2 |
| | ES:PHY-07 | Elective (**Subject**) Course –V | 2 | 15 | 35 | 50 | 2 |
| | ES:PHY-08 | | **30** | **165** | **585** | **800** | **24** |
| B. Sc. Sem-VI | | **Semester-VI** | | | | | |
| | | **Core Compulsory (CC)Course** | | | | | |
| | CC:PHY-601 | Core Course-I (Paper-11) | 3 | 30 | 70 | 100 | 3 |
| | CC:PHY-602 | Core Course-I (Paper-12) | 3 | 30 | 70 | 100 | 3 |
| | CC:PHY-603 | Core Course-II (Paper-13) | 3 | 30 | 70 | 100 | 3 |
| | CC:PHY-604 | Core Course-II (Paper-14) | 3 | 30 | 70 | 100 | 3 |
| | | **Practical Core (PC) Course** | | | | | |
| | PC:PHY-601 | Practical Core Course-I (Paper-11) | 3 | -- | 50 | 50 | 1.5 |
| | PC:PHY-602 | Practical Core Course-I (Paper-12) | 3 | -- | 50 | 50 | 1.5 |
| | PC:PHY-603 | Practical Core Course-II (Paper-13) | 3 | -- | 50 | 50 | 1.5 |
| | PC:PHY-604 | Practical Core Course-II (Paper-14) | 3 | -- | 50 | 50 | 1.5 |
| | | **Foundation Course (FC)** | | | | | |
| | FC-6 | Foundation (**Generic**) Course – VI Compulsory English (L.L.) | 2 | 15 | 35 | 100 | 2 |
| | EG-6 | **Elective Course (E)** | | | | | |
| | ES-PHY-09 | Elective (**Generic**) Course –VI | 2 | 15 | 35 | 50 | 2 |
| | ES-PHY-10 | Elective (**Subject**) Course –VI | 2 | 15 | 35 | 50 | 2 |
| | | | **30** | **165** | **585** | **800** | **24** |

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# Hemchandracharya North Gujarat University, Patan

**B. Sc. Programme (CBCS-Semester-Grading pattern)**
**Semester end Examination (Sem-V & VI)**
**Format for Question paper for Elective Courses (Subject) in Physics**

There will be three questions. First question will be from Unit - I, Second question from Unit-II, and Third question will be from both the Units. All the questions are detailed as under.

**Time: 1.5 Hrs** **Total Marks: 50**

1 (a) Answer the following (Any two out of three) 08 Marks
(Theory questions)
(b) Attempt any two of following (Out of three) 06 Marks
(Theory type **or** Application/Example/Problem)
(c ) Attempt any three (Out of five) 06 Marks
(Short answer or objective type questions)

2 (a) Answer the following (Any two out of three) 08 Marks
(Theory questions)
(b) Attempt any two of following (Out of three) 06 Marks
(Theory type **or** Application/Example/Problem)
(c ) Attempt any three (Out of five) 06 Marks
(Short answer or objective type questions)

3. Answer the following (Any ten out of twelve) 10 Marks
(M.C.Q. Type **or** objective type)

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# Hemchandracharya North Gujarat University, Patan

**B.Sc. Programme (CBCS-Semester Grading pattern) Semester end Examination (Sem-V & VI)**

**Format (Pattern) for Question paper of Core Compulsory Courses in Physics**

There will be four questions. All questions are of 18,17,18& 17 marks each. First question will be from Unit - I, Second question from Unit-II, Third question from Unit-III, Forth question will be from all Three Units. Detailed about all the questions is as under.

**Time: 2.5 Hrs** **Total Marks: 70**

| | | |
|---|---|---|
| 1 | (a) Answer any one out of Two (Long Theory type questions) | 08 Marks |
| | (b) Answer any Two Out of Three (Short Note/ Application/Example/Problem) | 10 Marks |
| 2 | (a) Answer any one out of Two (Long Theory type questions) | 07 Marks |
| | (b) Answer any Two (Out of Three) (Short Note/ Application/Example/Problem) | 10 Marks |
| 3 | (a) Answer any one out of Two (Long Theory type questions) | 08 Marks |
| | (b) Answer any Two (Out of Three) (Short Note/ Application/Example/Problem) | 10 Marks |
| 4 | (a) Answer the following (Any Six out of Eight) (Short answer or objective type questions) | 12 Marks |
| | (b) Answer the following (Any Five out of Seven) (Very Short answer or MCQ type questions) | 05 Marks |

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# HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

**CBCS - Semester - Grading Pattern**

## B. Sc. Semester - VI

**PHYSICS SYLLABUS (Effective from June-2022)**

## CC: PHY-601

**MATHEMATICAL PHYSICS, CLASSICAL MECHANICS & QUANTUM MECHANICS**

**Course Objectives:**

- To provide various numerical techniques for Legendre differential equation, Bessel differential equation, Hermite differential equation and can solve Leguerre, Legendre, Rodriguez's polynomials equations.
- To create awareness about motion of rigid body and get sufficient deep knowledge of Lagrange's and Hemilton's Equations and applications of them.
- To train the students in physical interpretations of the energy eigen functions, Properties of Stationary States, Coherent States.
- To give sufficient knowledge about the Angular momentum operators.

## UNIT – I MATHEMATICAL PHYSICS

**(a) Some Special Functions in Physics :**

Legendre Differential Equation (6.1), Generating Function of Legendre Polynomial (6.2), Rodriguez's formula for Legendre Polynomial (6.3), Orthogonal Properties of Legendre Polynomial (6.4), Recurrence of relation for Legendre Polynomials (6.5), Bessel differential equation (6.6), Recurrence formulae Bessel's functions (6.7), Generating Function for $J_n(x)$ (6.8), Orthogonality of Bessel's Functions (6.9), Hermite differential equation and Hermite Polynomial (6.11), Generating function of Hermite Polynomial (6.12), Recurrence formula for Hermite Polynomial (6.13), Rodriguez's formula for Hermite Polynomial (6.14), Orhogonality of the Hermite polynomials(6.15) ***Related Examples, Problems & Short Questions***

**Basic Reference:** *Quantum Mechanics by Satya Prakash, Pragati Prakashan (Reprint-2008)*

**Other References:**

1. Mathematical Physics by B. D.Gupta.
2. Mathematical Physics by H.K.Dass.
3. Mathematical Physics by P K Chattopadhyay (Second Edition), New age Int. publishers

## UNIT- II CLASSICAL MECHANICS

**(a) Motion of Rigid Body :**

Euler's theorem (10.1), angular momentum and kinetic energy (10.2), The inertia tensor (10.3), Euler's equations of motion (10.4) ***Related Examples, Problems & Short Questions***

**(b) Variational Principle: Lagrange's and Hemilton's Equations :**

Configuration Space (11.1), Some Techniques of Caclulus of Variation (11.2), Applications of The

Variational Principle (11.3), Hemilton's Principle (11.4). Equivalence of Lagrange's and Newton's Equations (11.5), Advantages of The Lagrangion Formulation-Electromechanical Analogies (11.6), Lagrange's undertermined Multipliers (11.7), Lagrange's Equation For Non- Holonomic System (11.8), Application of The Lagrangian Method of undetermined Multipliers (11.9), Hemilton's Equations of Motion (11.10), Some Applications of the Hamiltonian Formulation (11.11) ***Related Examples, Problems & Short Questions***

**Basic Reference:**

*Introduction to Classical Mechanics by Takawale and Puranik. McHill Edu. Private Ltd. (Chennai)*

**Other References:**

1. Classical Mechanics, by Goldstein. Narosa Publishing House, NewDelhi.
2. Classical Mechanics by Yasvant Waghmare.
3. Classical Mechanics by N.C.Rana and P. S. Joag, THM
4. Classical Mechanics by Gupta, Kumar and Sharma

## UNIT -III QUANTUM MECHANICS

**(a) Exactly Soluble Eigen Value Problems : The Simple Harmonic Oscillator**

The Echrodinger Equation and Energy Eigenvalues (4.1), The Energy Eigen Functions (4.2), Properties of Stationary States (4.3), The Abstract Operator Method (4.4), Coherent States (4.5).

**(a) Angular Momentum and Parity**

The Angular momentum Operators (4.6),The Eigenvalue Equation for $L^2$ ; Separation of Variables (4.7), Admissibility Conditions on Solutions ; Eigenvalues (4.8), The Eigen Functions:Spherical Harmonics (4.9), Physical Interpretation (4.10), Parity (4.11), Angular Momentum in Stationary States of Systems with Spherical Symmetry (4.12), Solution of the Interior region (4.13)

***Related Examples, Problems & Short Questions***

**Basic Reference:** *A Textbook of Quantum Mechanics by P.M. Methews and K. Venkateshan, McGraw Hill. Education 2nd Edition*

**Other References:**

1. Quantum Mechanics by Ghatak and Loknathan, The Macmillan Company of India Limited.
2. Quantum Mechanics by Fschwabi, Narosa Publishing House, NewDelhi.
3. Quantum Mechanics by John, L. Powell and B.Crasemann.
4. Quantum Mechanics by Schiff

**Learning Outcome:**

After the successful completion of the course students will be able to understands,

- The numerical techniques for Legendre, Bessel, Hermite differential equation and can able to solve Leguerre, Legendre, Rodriguez's polynomials equations.
- The motion of rigid body and get knowledge of Lagrange's and Hemilton's Equations and applications of them.
- The physical interpretations of the energy-eigen functions, Properties of Stationary States and Coherent States and the Angular momentum operators.

# HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

**CBCS - Semester - Grading Pattern**

## B. Sc. Semester - VI

## PHYSICS SYLLABUS (Effective from June-2022)

## CC: PHY-602

### STATISTICAL MECHANICS, SOLID STATE PHYSICS & OPTICS

**Course Objectives:**

- To give deep knowledge of Bose Einstein and Fermi Dirac Distribution.
- To provide deep knowledge of different partition function.
- To create awareness about Ideal gas system and Debye's Model of Solids: Phonon Gas.
- To provide knowledge of Superconductivity, Thermodynamic properties and BCS theory.
- To create knowledge in students about principle of Holography and its applications.
- To provide deep awareness about Fibre optics and Characteristics of the Fibres.

## UNIT- I STATISTICAL MECHANICS

**(a) B.E. and F.D. Distribution**

Symmetry of Wave Function(8.1), The Quantum Distribution Functions(8.2), The Boltzman Limit of Boson And Fermion Gases(8.3), Evaluation of Partition Function(8.4), Partition Function For Diatomic Molecules(8.5), [(a)Translational-(b)Rotational-(c)Vibrational-(d) Electronic Partition Function (8.5-a,b,c,d)], Equation of State for an Ideal Gas(8.6), The Quantum Mechanical Paramagnetic Susceptibility(8.7), ***Related Examples, Problems & Short Questions***

**(b) Ideal Bose System :**

Photon Gas (9.1), Einsteen's Derivation of Planck's Law (9.2), Bose-Einstein Condensation (9.3), Specific Heat From Lattice Vibration (9.4), Debye's Model of Solids: Phonon Gas (9.5)

**Basic Reference:***Fundamentals of Statistical Mechanics by B. B. Laud, NewAge Int.Publishers*

**Other Reference** :

1. Statistical Mechanics and Properties of Matter, by E.S.R.Gopal Pub. McMillan Co. of India Ltd.
2. Statistical Mechanics by B. K. Agarwal- Melvin Eisner. NewAge Int.Pub.

## UNIT-II SOLID STATE PHYSICS

**Superconductivity :**

Phenomena without observable Quantization(15.1), Zero resistance and persistent currents(15.1.1), Perfect Diamagnetisms : Meissner Effect(15.1.2), London Equation (15.1.3), Critical Field : Type I and Type II super conductors (15.1.4), Thermodynamic properties (15.1.5), Energy gap (15.2), Properties Dependent on Energy gap (15.3), Heat Capacity (15.3.1), Thermal Conductivity (15.3.2), Absorption of Electromagnetic Radiation (15.3.3), Normal Tunnelling (15.3.4), Isotope Effect (15.4), BCS Theory : A

qualitative approach (15.5), Cooper pair formation (15.5.1), BCS ground state (15.5.2), Important predictions of the BCS theory and comparison with experiments (15.6), Critical temperature (15.6.1), Ginzburg-Landau Theory (15.7), Magnetic flux Quantization (15.7.1), Coherence Length (15.7.2), Type-II superconductivity (15.7.3), Josephson tunneling (15.7.4), Applications(15.9).

***Related Examples, Problems & Short Questions***

**Basic Reference:** *Elements of Solid State Physics by J.P. Srivastava, PHI New Delhi 2006 (2nd Edition)*

**Other Reference :**

1. Solid State Physics by C. Kittel. John Willy and Sons.
2. Solid State Physics by Saxena. Pragati Prakashan.
3. Solid State Physics by C. M.Kachhawa.
4. Solid State Physics by S O Pillai

## UNIT-III Holography and Fiber Optics

### (a) Holography

Introduction (23.1), Principle of Holography (23.2), Recording of the hologram (23.2.1), Reconstruction of the image (23.1.2),coaxial holography (23.3), off-axis holography (23.4), Theory (23.5), Holograms (23.6), Orthoscopic and pseudoscopic images (23.6.1), Holography and Photography (23.6.2) Important properties of Hologram (23.7), Classification of holograms (23.8), Applications (23.9), Medical application (23.10)

### (b) Fiber Optics

Introduction (24.1), Optical Fibre (24.2), Necessity of cladding(24.2.1),Optical Fibre System (24.2.2), Optical fiber cable (24.2.3), Total Internal Reflection (24.3), Propagation of Light Through and Optical Fibre (24.4),Critical angle of Propagation (24.4.1), Acceptance angle (24.4.2), Fraction of refractive index (24.5), Numerical aperture(24.6), Skip distance and number of total internal reflections (24.7), Classification of optical fibres (24.10), Types of Optical Fibre (24.11), (24.11.1, 24.11.2, 24.11.3), V-Number (Normalize frequency)(24.13), Losses in Optical Fibre (24.15), Attenuation (24.15.1), Bandwidth (24.17), Characteristics of the Fibres (24.18), Fibre Optic Communication System (24.21), Merits of Optical Fibres (24.22), Disadvantages (24.22.1).

***Related Examples, Problems & Short Questions***

**Basic Reference:** A Textbook of Optics by Dr.N.Subrahmanyam, Brijlal and Dr. M. N. Avadhanulu (as per UGC Model syllabus,25th revise addition 2012, reprint 2018) (S. Chand Co.)

**Learning Outcome:**

After the successful completion of the course students will be able to understands,

- Bose Einstein, Fermi Dirac Distribution and get knowledge of different partition function.
- The ideal gas system and Debye's model of solids. Also knows Type I and Type II super conductors as well as Meisner effect.
- About Superconductivity, Thermodynamic properties and BCS theory. Also aware about Josephson tunneling and its Applications.
- The principle of Holography and its applications. Also get awareness about Fibre optics and Characteristics of the Fibres.

# HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

**CBCS - Semester - Grading Pattern**

## B.Sc. Semester-VI

**PHYSICS SYLLABUS (Effective from June 2022)**

## CC: PHY-603

**ELECTRODYNAMICS & MOLECULAR SPECTRA**

**Course Objectives :**

- To learn Laplace's equation in one, two and three dimensions for potentials.
- To learn Boundary conditions and uniqueness theorems and Also to aware about Cartesian and spherical co-ordinates.
- To Provide knowledge of electromagnetic induction and electromagnetic waves.
- To Provide a Raman effect understanding of Raman spectra and molecular spectra.
- To enable the students to study electronic spectra and deep knowledge of it.

## UNIT- I ELECTROMAGNETICS

### (a) Potentials :

Laplace's Equation (3.1), Introduction (3.1.1), Laplace's Equation in one dimensions (3.1.2), Laplace's Equation in two dimensions(3.1.3), Laplace's Equation in three dimensions (3.1.4), Boundary conditions and Uniqueness theorems (3.1.5),Conductors and the second Uniqueness theorem (3.1.6), The method of images (3.2), The classic image problem (3.2.1), Induced surface charge (3.2.2), Force and energy (3.2.3), other image problems (3.2.4) Separation of variables (3.3), Cartesian Coordinates (3.3.1), Spherical coordinates (3.3.2), Multipole Expansion (3.4), Approximate Potential at large distances (3.4.1), The monopole and dipole terms (3.4.2), Origin of Coordinates in multipole Expansions (3.4.3).

***Related Examples, Problems & Short Questions***

## UNIT - II ELECTROMAGNETICS

### (a) Electrodynamics : Electromagnetic Induction:

Electromagnetic induction(7.2), Faraday's law(7.2.1), The Induced Electric Field(7.2.2), Inductance(7.2.3), Energy in Magnetic field(7.2.4), Maxwell's Equation(7.3), Electrodynamics before Maxwell(7.3.1), How Maxwell fixed Ampere's Law(7.3.2), Maxwell's Equations(7.3.3), Magnetic charge(7.3.4), Maxwells equations in matter(7.3.5),

### (b) Electromagnetic Waves :

Electromagnetic Waves in Vacuum (9.2), The Wave equation for E and B (9.2.1),Monochromatic plane waves (9.2.2), Energy and Momentum in Electromagnetic Waves (9.2.3), Electromagnetic Waves in Matter (9.3), Propagation in Linear Media (9.3.1), Reflection and transmission at normal

incidence (9.3.2), Reflection and transmission at oblique incidence (9.3.3), Absorption and Dispersion: Electromagnetic Waves in conductors (9.4.1) **Potentials and fields:** The Potential Formulation : Scalar and Vector Potentials (10.1.1), Gauge Transformations (10.1.2), Coulomb Gauge and Lorentz Gauge(10.1.3)

***Related Examples, Problems & Short Questions***

**Basic Reference:** *Introduction to Electrodynamics by David J. Griffiths. 4th Edition Cambridge University press.*

**Other Reference:** Electromagnetics by B. B. Laud. Willley Eastern Ltd**.**

## UNIT – III MOLECULAR SPECTRA

### (a) Raman Spectra

Nature of the Raman Effect (20.1), Experimental Arrangement for Raman Spectra (20.2), Classical Theory of Raman Effect (20.3), Quantum theory of Raman Effect (20.4), Raman Spectra and Molecular Structure (20.5), Infra-red Spectra Versus Raman Spectra (20.6),

### (b) Electronic Spectra

Salient Features of Molecular Electronic Spectra (21.1), Formation of Electronic Spectra (21.2), Vibrational (Gross) Structure of Electronic Band- System in Emission (21.3), Electronic Band Spectra in Absorption (21.4), Rotational Structure of Electronic Bands (21.5), Observed Intensity Distribution (Vibrational) in Band-Systems:Franck-Condon Principle(21.7), Quantum- Mechanical Formulations of Franck-Condon Principle (2.8), Explantation of Intensity Distribution in Absorption Bands from Franck-Condon Principle.

**Basic Reference**:
Atomic & Molecular-Spectra by RajKumar, KedarNath RamNath, Delhi. (2005)

**OtherReferences**:
1. Molecular spectroscopy by Herz-Berg.
2. Molecular spectroscopy by Banewell

**Learning outcomes :**

At the end of the course the students will be able to,

- Understand the Laplaces' equations.
- Understand the boundary conditions & Process of different co-ordinates.
- Learn electromagnetic induction as well as electromagnetic waves and potential formulation.
- Understand Raman effect with experimental arrangement for Raman spectra and molecular structure. Also understand electronic spectra.

# HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

**CBCS - Semester - Grading Pattern**

## B.Sc. Semester-VI

**PHYSICS SYLLABUS**

## CC: PHY-604
## ELCTRONICS AND COMPUTER PROGRAMMING

**Course objective :**

- To Provide the basic knowledge of feedback, its principle and negative feedback
- To Learn deep knowledge of various transistor like tuned, Hartly - Colpiltt's oscillators Phase shift oscillator etc.
- To Provide Sufficient awareness of modulation and different concept, techniques of it.
- To give basic knowledge of digital electronics and process of Decoder, multiplexer and De multiplexer.
- To Provide basic knowledge of operators, expressions, Decision making and branching in Programming C.

## UNIT – I

**(a) Feedback Amplifier :**

Feedback (8.1), Principle of Feedback Amplifiers (8.2), Advantages of Negative Feedback (8.3), Reasons for Negative Feedback (8.4 a,b,c,d), Negative feedback circuits (8.5).

***Related Examples, Problems & Short Questions***

**(b) Transistor Oscillators (Sinusoidal):**

Introduction to oscillators : Types, components and Barkhausen criterion,
Tuned Collector Oscillators(11.1), Tuned Emitter Oscillator(11.3), Tuned Base Oscillator(11.3), Hartley Oscillator (11.4), Colpitt's Oscillators (Circuit operation and alternative treatment only) (11.5), CLAPP Oscillator(11.6), Phase Shift oscillators (11.7), R-C- Oscillator (11.7.1), Wien Bridge Oscillator (11.7.2), Crystal Oscillator (11.8).

***Related Examples, Problems & Short Questions***

**Basic Reference:**

*Hand Book of Electronics by Gupta and Kumar.* ***(46th revised Edition 2019)***

## UNIT – II

**(a) Modulation :**

Definition(20.1), Amplitude Modulation (20.2 A,B,C,D), Method of amplitude Modulation(20.3), Transistor Modulators(20.3.1-A,B,C,D,E), Square law Modulation(20.3.2-A,B), Double Sideband



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Suppressed Carrier Modulation [DSBSC Modulation](20.4.1 A,B), Single Sideband Generation(20.4.2 A,B,C), Advantages and Disadvantages of the Single Sideband (SSB) Transmission(20.4.3), Vestigial Sideband Modulation(24.4.4), Independent Sideband System (ISB)(20.4.5), Frequency Modulation {characteristic and analysis of FM Wave- Frequency deviation, Power relation in FM Wave, Frequency Spectrum and Bandwidth of FM wave}(20.5), Reactance Method for Producing F.M. Wave(20.6), Comparison of Frequency and Amplitude Modulation(20.7), Phase modulation (20.8)

***Related Examples, Problems & Short Questions***

**Basic Reference:**

*Hand Book of Electronics by Gupta and Kumar.* ***(46th revised Edition 2019)***

**(b) Digital Electronics:**

Simplification using KARNAUGH Maps (18.10-Complete- 18.10.1,18.10.2,18.10.3), Simplification using QUINE-Mc CLUSKEY method(18.11 Complete-A,B), DON'T- CARE Conditions-Decoder /Encoder (18.12), BCD-to- 7 Segment Decoder (18.13), Digital Comparator (18.14), Multiplexer – Data Selector(18.15), Demultiplexer(18.16).

***Related Examples, Problems & Short Questions***

**Basic Reference:** *Hand Book of Electronics by Gupta and Kumar.* ***(46th revised Edition 2019)***

**Other Reference:**

1. Electronics and Radio Engineering by M. L. Gupta. 9th Enlarged Edition reprint 2002. Dhanpat Rai Publication Co.
2. Fundamental of Digital Circuits,by AnandKumar (Fourth Edition, PHI)
3. Electronic Devices and Circuits An Introduction by Allen Mottershead, PHI
4. Digital Principles and applications, D P Leach, A p Malvino, G Saha, Tata McGrawHill

## UNIT - III Programming in C

**(a) Operators and Expressions**

Introduction (4.1), Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Bitwise Operators, Special Operators (4.2 to 4.9), Arithmetic Expressions (4.10), Evolution of Expressions (4.11), Precedence of Arithmetic Operators (4.12), Some Computational Problems (4.13), Type Conversion in Expressions (4.14), Operator Precedence and Associatively (4.15), Mathematical Functions (4.16).

***Related Examples, Problems & Short Questions***

**(b) Managing Input and Output Operations**

Introduction (5.1), Reading a Character (5.2), Writing a Character(5.3), Formatted Input (5.4), Formatted Output (5.5)

***Related Examples, Problems & Short Questions***

**(c) Decision making and branching**

Introduction (61), Decision making with if statement (6.2), simple if statement (6.3), The if **. . . . .** else statement (6.4), Nesting of if**….**else statement (6.5), The else if ladder (6.6), The switch statement (6.7), The ? **:** Operator (6.8), The GOTO statement (6.9).

***Related Examples, Problems & Short Questions***

**Basic Reference** :

Programming in ANSI C **(Eighth Edition)** Mc Graw Hill Pub. E Balagurusamy.( Ch:4,5,6)

**Learning Outcomes:**

At the end of the Course students will be able to,

- Understand the basic concept of feedback & negative feedback
- Understand the operation of different oscillators and awareness of modulation within concept of techniques.
- Know digital electronic techniques and operation within it,
- Understand the programming in C with various aspect.



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**HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN**

**CBCS - Semester - Grading Pattern**

# B.Sc. Semester-VI

**PHYSICS SYLLABUS**

# LABORATORY EXPERIMENTS

**Course Objectives :**

- To learn by performing the experiments based (i) based on principles and (ii) application of the theoritical course.
- To get knowledge of working of equipments like optical level, ketter's pendulum, G.M. Counter, Michelson interferometer and Lioyd's minor.
- To have sufficient knowledge of experiments related optics, electronics, electricity and also known electronic circuits.
- To learn the usage of electrical and optical system of different measurements.
- To have ability to solve problems using programming in 'C' language.

## PC: PHY-601

1. Young Modulus 'y' by Koening method.
2. Optical Lever
3. Viscosity by Log decrement
4. Acceleration due to gravity (g) using Kater's pendulum(with **FIXED** knife edges)
5. G.M. Counter (Comparison of Intensities)

## PC: PHY-602

1. To determine air gape '**t**' between two plates of F.P. Etalon and determination of wavelength' **λ** ' of monochromatic light
2. Temperature of Flame
3. Find the Flatness of glass Plate using Newton's Ring
4. To determine λ and dλ of sodium light using Michelson interferometer
5. Determination of wavelength of light by Lioyd's mirror.

## PC: PHY-603

1. Mutual induction 'M' of two coil using B.G.
2. High resistance 'R' using leakage method
3. Maxwell's Bridge
4. Solenoid Inductor
5. Susceptibility of $FeCl_3$ using Quienk's method



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# PC: PHY-604

1. A study of transistorized Collpit's oscillator using CRO / Wavemeter
2. Negative Feedback Amplifier
3. A study of Half subtractor and Full subtractor
4. To determine frequency of AFO using Wein bridge
5. Use of Computer- Programming in 'C' language.

***(Only One experiment of C-language should be in Uni. Exam.)***

**Learning Outcomes :**

At the end of the course the students will be able to understand,

- The basic principles of physics related to their courses in the practical way.
- The experiment and operational details of CRO, Optical level, MI, GM Counter etc.
- The various properties of young modulus, viscosity, wavelength, mutual induction, etc.
- How to analyze the experimental data and graphical analysis. And programming in 'C'.

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**CBCS - Semester - Grading Pattern**

**Elective (Subject) Courses for** SEM **VI [Credits-2]**

**(In force from June 2022)**

# ES : PHY-09 OPTOELECTRONIC INSTRUMENTS

**Course Objectives:**

- To aware Population inversion and metastable state in Laser, type of Laser and applications
- To gain knowledge of principle, construction, working process of FP Interferometer and Italon.
- To provide hands on experimental aspect to measurement of wavelength.
- To develop knowledge of Electron microscope and Fabry Parot Interferometer and usage of it.
- To learn the working function of EM and different focusing.

**UNIT I**

Introduction (22.1), Attenuation of light in optical medium (22.2), Thermal Equilibrium (22.3), Interaction of light with matter (22.4 -22.4.1 to 22.4.4), Einstein coefficients and their relations (22.5-22.5.1, 22.5.2), Light Amplification (22.6-22.6.1 to 22.6.2), Meeting the three requirements: Population inversion, Metastable states, Confining radiation within the medium (22.7 - 22.7.1 to 22.7.3 ), Components of LASER (22.8), Active medium (22.8.1), Pumping (22.8.2), Optical Resonant Cavity (22.8.3), Lasing Action(22.9), Thresold for Oscillation(22.9.1), Principal pumping schemes (22.10), (22.10.1 to 22.10.4), Role of resonant cavity(22.11), MODES of the LASER Beam: Longitudinal modes (22.12.1), Gain curve and laser operating frequencies (22.12.2), Transverse modes (22.15), Types of Lasers, Rubby Lasers, ND : Yag Laser, Helium-Neon Laser (22.14), Laser beam Characteristics(22.16), Applications(22.19).

**Basic Reference:** ***A Textbook of Optics by Dr. N. Subrahmanyam, Brijlal and Dr. M. N. Avadhanulu, S. Chand & Co. (Reprint 2018)***

**UNIT-II Fabry - Parot Interferometer and Etalon** (15.12**),** Formation of fringes, Determination of wavelength, Measurement of difference in wavelength (15.12.1 to 15.12.3)

**Electron Microscope:** Principle, electrostatic focusing, magnetic focusing, description, use of electron microscope. (Page 204 to 213)

**Basic references:**

1. *A textbook of Optics by Dr. N.Subrahmanyam, Brijlal and Dr. M. N. Avadhanulu, S. Chand & Co. [For* **Fabry-Parot***]*
2. *Atomic Physics by J. B. Rajam, S. Chand & Co.(1960) [For Electron Microscope]*

**Learning Outcome:**

After the successful completion of the course students will be able to understands,

- The Population inversion and metastable state in Laser, type of Laser and applications.
- The principle, construction, working process of FP Interferometer and Italon.
- The experimental aspect to measurement of wavelength and have knowledge of Electron microscope and Fabry Parot Interferometer and usage of it.
- The working function of EM and different focusing.

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**CBCS - Semester - Grading Pattern**

**B. Sc. :: PHYSICS :: SEMESTER- VI [Credits-2]**

**(In force from June 2022)**

# ES : PHY-10: REMOTE SENSING AND TRANSDUCERS

**Course objective**

- To get deep knowledge of Remote sensing , its history, atmospheric effect and photo geometry.
- To aware about detector, types of optical sensor and applications of satellites.
- To learn about Transducer, classification of it and various types of transducer.

## UNIT-I

**Remote Sensing :**

Introduction, Beginning of Remote Sensing in India, History, Electromagnetic energy, Visible and non-visible radiation, Emission of EM radiation, Atmospheric effect, Solar constant Remote Sensing-a developing Science: Atmospheric Window, Human vision and Human Eye, Useful instruments, Micro-resolution, Photo-geometry.

New Technology: Detectors, Optical Sensors, Types of Optical Sensors, Optical mechanical sensor, Scanning radiometer, IR Scanner, Multi-spectra Scanner. TV, Radar and Solar systems, Applications of RS in different fields –Land set satellites, Earth resource satellites.

**Basic Reference:**

1. Remote Sensing by Suresh Shah (in Gujarati) Uni. Granth Nirman Board, Ahmedabad.
2. Introduction to Optical Remote Sensing by P. S. Phisaroty (ISRO-Banglore).

**UNIT-II**

**Transducers :**

What is Transducers? , Classification of Transducers, Classification based on electrical principle involved, Resistive Position Transducers, Resistive Pressure Transducer, Linear Variable Differential Transducer, Piezoelectric Transducer, Strain gauze Transducer, Temperature Transducers, Resistance temperature Detector, Thermistor, Thermocouple, Various types of Microphones, Carbon microphones, Ribbon microphones, Loudspeaker, Moving coil microphones.

**Basic Reference:** Basic Electronics (solide state) by B. L. Tharaja , Pub. S. Chand & Compny ($5^{th}$ Edition)

**Learning Outcome:**

After the successful completion of the course students will be able to understands,

- The Remote sensing, its history, atmospheric effect and photo geometry.
- The detector, types of optical sensor and applications of satellites.
- The Transducer, classification of it and various types of transducer.



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# હેમચંદ્રાચાર્ય ઉત્તર ગુજરાત યુનિવર્સિટી

NAAC A (3.02) State University

પો.બો.નં.–૨૧, યુનિવર્સિટી રોડ, પાટણ (ઉ.ગુ.) ૩૮૪૨૬૫

ફોનઃ(૦૨૭૬૬) ૨૩૭૦૦૦ ફેકસ : (૦૨૭૬૬) ૨૩૧૯૧૭

Email : regi@ngu.ac.in Website : www.ngu.ac.in


**પરિપત્ર ક્રમાંક – ૧૩૦ / ૨૦૨૨**

**વિષયઃ વિજ્ઞાન વિદ્યાશાખાના સ્નાતક કક્ષાના નવા અભ્યાસક્રમો અંગે...**

આ યુનિવર્સિટી સંલગ્ન સાયન્સ કોલેજોના આચાર્યશ્રીઓને જણાવવાનું કે, વિજ્ઞાન વિદ્યાશાખાએ કરેલ ભલામણ અનુસાર નીચેના વિષયોના સ્નાતક કક્ષાના સામેલ પરિશિષ્ટ પ્રમાણેના નવા અભ્યાસક્રમો **જૂન – ૨૦૨૨ થી ક્રમશઃ અમલ માં આવે તે રીતે** એકેડેમિક કાઉન્સિલએ તેની તા. ૧૨/૦૪/૨૦૨૨ ની સભા ના નિર્દિષ્ટ ઠરાવો થી મંજૂર કરેલ છે. જેનો અમલ કરવા સારૂ સંબંધિતોને આ સાથે મોકલવામાં આવે છે, જેનો ચુસ્ત અમલ થવા વિનંતી છે.

| ક્રમનં. | અભ્યાસક્રમ | એકેડેમિક સભાના ઠરાવક્રમાંક | સેમેસ્ટર |
|---|---|---|---|
| ૧ | વનસ્પતિશાસ્ત્ર | ૨૪ | સેમ.–૫ અને ૬ |
| ૨ | ગણિતશાસ્ત્ર | ૨૬ | સેમ.–૫ અને ૬ |
| ૩ | ભૌતિકશાસ્ત્ર | ૩૦ | સેમ.–૫ અને ૬ |
| ૪ | રસાયણશાસ્ત્ર | ૫૩ | સેમ.–૫ અને ૬ |

આ બાબતની સંબંધિત અધ્યાપકો તથા વિદ્યાર્થીઓને આપના સ્તરેથી જાણ કરવા વિનંતી છે.

નોંધઃ (૧) વિદ્યાર્થીઓની જરૂરીયાત માટે પરિપત્રની એક નકલ કોલેજ ના ગ્રંથાલયમાં મૂકવાની રહેશે.
(૨) આ અભ્યાસક્રમ યુનિવર્સિટીની વેબ સાઈટ www.ngu.ac.in પર પણ ઉપલબ્ધ કરાવવામાં આવનાર છે.

સહી/–
અધ્યક્ષ
કા.કુલસચિવ

બિડાણઃ ઉપર મુજબ

નં.–એ કે / અ× સ / ૧૧૭૫ / ૨૦૨૧
તારીખ : ૦૧ / ૦૬ / ૨૦૨૨

પ્રતિ,

૧. અધ્યક્ષશ્રી/ કો.ઓર્ડીનેટરશ્રી –વિજ્ઞાન વિદ્યાશાખા અંતર્ગત અનુસ્નાતક વિભાગો, હેમ. ઉ.ગુ. યુનિવર્સિટી, પાટણ.
૨. સંલગ્ન સાયન્સ કોલેજોના આચાર્યશ્રીઓ
૩. ડૉ. જગદીશ એચ. પ્રજાપતિ (ડીનશ્રી – વિજ્ઞાન વિદ્યાશાખા),સરકારી સાયન્સ કોલેજ, **થરાદ.** જિ. બનાસકાંઠા
૪. પરીક્ષા નિયામકશ્રી, હેમચંદ્રાચાર્ય ઉત્તર ગુજરાત યુનિવર્સિટી, પાટણ. (પાંચ નકલ)
૫. ગ્રંથપાલશ્રી, હેમ.ઉત્તર ગુજરાત યુનિવર્સિટી, પાટણ. ( વિદ્યાર્થીઓના ઉપયોગ સારૂ રેકર્ડ ફાઈલ માટે )
૬. સીસ્ટમ એનાલીસ્ટ, કોમ્પ્યુટર(રીઝલ્ટ) સેન્ટર, હેમ.ઉ.ગુ. યુનિવર્સિટી,પાટણ તરફ વેબસાઈટ પર મૂકવા સારૂ.
૭. પ્રવેશ પ્રશાખા(એકેડેમિક શાખા) હેમચંદ્રાચાર્ય ઉત્તર ગુજરાત યુનિવર્સિટી, પાટણ.
૮. મુખ્ય હિસાબી અધિકારીશ્રી (મહેકમ), હેમ. ઉત્તર ગુજરાત યુનિવર્સિટી, પાટણ તરફ–પરિપત્રની ફાઈલ અર્થે
૯. સિલેકટ ફાઈલે– (૨ નકલ)

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| | | | |
|---|---|---|---|
| Programme code : | | Programme Name : | B.Sc. |
| Faculty : | SCIENCE | Semester : | VI |
| Subject : | CHEMISTRY | | |
| Effective from : | June 2022 થી | | |

| Sr. | Paper Code | Name of Paper | Credit |
|---|---|---|---|
| 1 | CC CH-601 | INORGANIC CHEMISTRY-I | 3 |
| 2 | CC CH-602 | ORGANIC CHEMISTRY-II | 3 |
| 3 | CC CH-603 | PHYSICAL CHEMISTRY-III | 3 |
| 4 | CC CH-604 | STRUCTURAL -ANALYTICAL CHEMISTRY-IV | 3 |
| 5 | SE CH -605 A | POLYMER CHEMISTRY | 2 |
| | SE CH -605 B | ELECTRO ANALYTICAL TECHNIQUES | |
| 6 | GE CH 606 A | ELECTIVE (GENEIC) COURSE | 2 |
| 7 | LC CH-607 A | LABORATORY COURSE-I<br>INORGANIC CHEMISTRY PRACTICALS | 1.5 |
| | LC CH-607 B | LABORATORY COURSE-II<br>ORGANIC CHEMISTRY PRACTICALS | 1.5 |
| | LC CH-607 C | LABORATORY COURSE-III<br>PHYSICAL CHEMISTRY PRACTICALS | 1.5 |
| | LC CH-607 D | LABORATORY COURSE-IV VIVA -VOCE | 1.5 |

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**University Road, P.O.BOX NO: 21, PATAN-384265**

**N. Gujarat. INDIA.**

**NAAC Accreditation Grade – "B"**

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# FACULTY OF SCIENCE

# CHEMISTRY SYLLABUS

**(Effective from June-2022)**

## B.Sc. (semester V & VI Programme)

The proposed new courses in chemistry for under graduate classes are reassigned in accordance to semester/CBCS/Grading system with new education policy. The new course is based on model curriculum of the university grants commission.

The medium of instruction should be Gujarati and the question paper should be drawn in Gujarati with the English version. Students are permitted to write answer in English or Gujarati language.

## Its objective are as under:

1. To meet the growing demand of Specialization and Advanced Courses in applied science.
2. To help the colleges to update and modernize their laboratories.
3. To redesign the courses the special emphasis on local requirements, environment, to link the courses with requirements of the industries and research
4. To prepare for National level entrance test like NET/SLET/JRF and other competitive exams.

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# FACULTY OF SCIENCE

# CHEMISTRY SYLLABUS

**(Effective from June-2022)**

## Common Formula For Question Paper (Core course)

**Time: 3 Hours** **Total Marks:70**

**Theory Examination Pattern( Core Course):**

| | | |
|---|---|---|
| Que.No:1 | A: Write any Two out of Three Questions | 12 Marks |
| | B: Write any One out of Two Questions | 05 Marks |
| Que.No:2 | A: Write any Two out of Three Questions | 12 Marks |
| | B: Write any One out of Two Questions | 06 Marks |
| Que.No:3 | A: Write any Two out of Three Questions | 12 Marks |
| | B: Write any One out of Two Questions | 05 Marks |
| Que.No:4 | Write any Three Questions out of Five Questions.<br>(Ask Questions from Unit-1,2 and 3 With Equal Sharing.) | 18 Marks |

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**B. Sc. Chemistry**

**Semester : VI**

**Inorganic Chemistry**

**Paper : CC CH-601**

## UNIT :-1: Valency

- Variation method, Secular Equation, Stability of $H2^{+}$ ion; M.O. approach,Stability of $H_2$ molecule; V. B. approach, Classical interaction energy
- Representation of wave function for SP, $SP^2$ and $SP^3$ hybride orbitals, bond angle and bond strength
- M.O. treatment of Oh molecules
- Quantum mechanical representation of Pauli's exclusion principle

## UNIT :- II : Metal Carbonyl

- Introduction
- Classification: Mononuclear and Polynuclear
- Physical and Chemical Properties
- Metal Carbonyl (M-CO) bonding (On the basis of V.B.T. and M.O.T.)
- Use of IR Spectra to determination of structure of metal carbonyl
- Structure of Metal Carbonyl
  $Ni(CO)_4$, $Fe(CO)_5$, $Cr(CO)_6$, $Fe_2(CO)_9$, $Co_2(CO)_8$ , $Mn_2(CO)_{10}$ , $Fe_3(CO)_{12}$
- Calculation of EAN of metal atom in metal carbonyl
- Metal Nitrosyl complexes: - Bonding in metal nitrosyl
- Classification of metal Nitrosyl

## UNIT :- III : Bio-Inorganic Chemistry

- Introduction,
- Essential elements,
- Trace elements
- Metal porphyrine,
- Study of hemoglobin and myoglobin
- Nitrogen fixation: In Vivo and In Vitro

## Books Suggested (Inorganic Chemistry)

1. Valance and molecular structure by Cartmell and Flower.
2. Text book of Inorganic Chemistry by Durent and Durent.
3. Inorganic Chemistry by S. Chand.
4. Advance Inorganic Chemistry Vol-Il Satya Prakash (S.Chand)
5. Concise Inorganic chemistry by J.D.Lee.
6. Metalic Corrosion By M.N. Desai
7. Advance Inorganic Chemistry J.E. Huhee

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**B. Sc. Chemistry**

**Semester : VI**

**Organic Chemistry**

**Paper : CC CH-602**

## UNIT :-1: Electrophillic and Free radical addition reactions

- Addition to carbon carbon double bond
- Mechanism for addition of halogens
- Reactivity order of Alkene on electrophilic addition reactions
- Stereo selective and stereo specific reaction of alkene
- Markovnikov's rule
- Addition reaction of $H_2O$ and $H_2SO_4$ in alkene
- Rearrangement, Dimerization and Alkylation in electrophilic addition reactions
- Peroxide effect ( Anti markovnikov's rule)
- Free radical addition, mechanism of peroxide initiated addition of HBr
- Syn and Anti addition reactions
- Electrophillic addition to conjugated dienes ( 1:2 v/s 1: 4 addition)
- Free radical addition to conjugated dienes

## UNIT :-II : Active Methylene Group Compounds

- Introduction of Tautomerism
- Determination of keto-enol tautomerism
- Differences between Tautomerism and resonance
- Synthesis and application of Ethyl aceto acetate and malonic ester

## UNIT :- III : Nucleophillic Aromatic Substitutions

- Nucleophilic aromatic substitution [ Bimolecular displacement ($SN^2$) mechanism]
- Elimination - Addition mechanism via benzyne
- Stability and properties of benzyne
- Evidences of Benzyne intermediate

## Books Suggested (Organic Chemistry):


1. Organic chemistry by Morrison & Boyd $V^{th}$ Edition
2. Advance organic chemistry by R.K.Bansal.
3. Organic chemistry by I.L.Finar Voll &. Il $V^{th}$ Edition.
4. Organic chemistry by pine, Hendrikson, Cram and Hammond $IV^{th}$ edition...
5. Outline of chemical technology by Dryden $II^{nd}$ Edition
6. Synthetic organic chemistry by Gurdeep R Chatwal.




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7. Advanced organic chemistry by Jerry March.
8. Organic reactions and their mechanisms II$^{nd}$ edition by P.S. Kalsi.
9. Organic chemistry of natural product Vol: I & II by Gurdeep R. Chatwal.
10. Advanced organic chemistry by Arun Bahal and B.S. Bahal.
11. Organic chemistry Vol, I, II, III by S.M.Mukherjee , S.P.Singh , R.P.Kapoor.
12. Advanced Organic Chemistry by L.D.S. Yadav & Jagdambasingh, Pragati prakashan



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**Hemchandracharya North Gujarat University, Patan**

**B. Sc. Chemistry**

**Semester : VI**

**Physical Chemistry**

**Paper : CC CH-603**

## UNIT- I : Statistical Thermodynamics

- Introduction
- Combination and permutation
- Probability
- Sterling approximate formula (No Derivation)
- Langrage's undeterminated Constant
- Type of Statistics
  - Maxwell-Boltzmann
  - Bose-Einstine Statistics
  - Fermi-Dirac Statistics
- Partition Function
  - Transnational Partition function
  - Rotational Partition function
  - Vibrantional Partition function
- Numericals

## UNIT :- II : Photochemistry

- Introduction
- Difference between Thermal and Photochemical reaction
- The Law of Absorption, Lambert-Beer law
- Laws of Photochemistry,
  (1) Grotthuss-Draper law (2) Stark- Einstein law and it's devation
- Quantum Efficiency or Quantum Yield
- Experimental determination of Quantum yield
- Reason of high and low Quantum yield
- The Jablonski diagram
- Types of Photochemical reaction
  (1) Photosensitized reaction (2) Photochemical equilibrium
- Qualitative description of fluorescence, phosphorescence and chemiluminescence.
- Flash Photolysis
- Numerical

## UNIT :- III : Chemical Kinetics

- Effect of temperature on rate of reaction (Arhaneous equation)
- Concept of Activation energy
- Theories of reaction rate
  (1) Collision theory
  (2) Transition state theory



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- Comparison of collision and transition state theory
- Theories of Unimolecular reaction
- Lindemann's theory
- Trimolecular reaction
- Trautz's Law
- Primary salt effect
- Secondary salt effect
- Numerical

## Books Suggested (Physical Chemistry) :


1. Advance Physical Chemistry by Gurdeep Raj.
2. Physical Chemistry (Question and Answer) by R. N. Madan, G.D. Tuli, S.Chand.
3. Principal of Physical Chemistry by Puri, Sharma, Pathania.
4. Chemical Thermodynamics by R.P. Rastogi and R.R. Mishra.
5. Physical chemistry by atkins.
6. Essentials of Physical Chemistry by B. S. Bahal, Arun Bahal, G.D.Tuli,
7. Physical Chemistry by P.W. Atkins, 5th edn, Oxford 1994 7th edn-2002.
8. Physical Chemistry by R.A. Albern and R.J.Silby, John Wiley 1995.
9. Physical Chemistry by G.H. Barrow, 5th edn, Mac Graw Hill, 1988,6th edn,1996.
10. Physical Chemistry by W.J.Moore, 4th edn, Orient Longmans 1969

**Hemchandracharya North Gujarat University, Patan**
**B. Sc. Chemistry**
**Semester : VI**
**Structural - Analytical Chemistry**
**Paper : CC CH-604**

## UNIT :-1: Term symbol & spectra of d'-do Octahedral complexes

(A) Term Symbol

- LS coupling
- JJ coupling
- Determination of ground state term by hund's rules
- Determination of term symbol for all state for $p^2$ & $d^2$ configuration by pigeon hole diagram

(B) Spectra of $d^1$ & $d^9$ octahedral complexes

- Selection rules & intensities transitions
- Oral diagram for $d^1$-$d^9$, $d^2$-$d^8$, $d^3$-$d^7$, $d^4$-$d^6$ octahedral & tetrahedral complexes explanation of $d^1$ & $d^9$ spectra(only introduction-no application)

## UNIT :-11: IR spectra & Numericals based on UV, IR and NMR Spectra

(A) **Infrared spectroscopy**.

- Introduction
- Molecular vibrations (Fundamental vibrations of $AX_2$ type molecules)
- Characteristics of IR spectroscopy
- Sample techniques • Fingerprint region
- Effect of IR in geometrical isomerism
- IR spectra & H-bonding • Factor affecting on >C=O group frequencies
- Differentiate two compounds by the IR frequencies.

**(B) Problems pertaining to the structure elucidation of organic compounds using UV, IR & NMR spectroscopic Data**

## UNIT :- III: Chromatography

- Introduction
- Classification of chromatographic techniques
- Column chromatography
- Paper chromatography
- Thin layer chromatography
- lon exchange chromatography
- Gas chromatography : Principle, Plate theory and Rate theory (only introduction)
- Application of chromatographic Techniques



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## Suggested books: (structural chemistry)


1. Chemical application of group theory by F.A.Cotton
2. Chemical bonding and introduction by K.C.Patel, R.D.Patel and Raval
3. Application of group theory to chemistry by Bhattacharya
4. Symmetry in chemistry by Jafle and Orchin
5. Advance inorganic chemistry by cotton & Wilkinson
6. Basic principles of spectroscopy by R.Chand
7. Organic chemistry Vol. 1 by S.M.Mukherji, S.P.Shingh, Kapoor
8. Spectroscopy organic compounds VI$^{th}$ edition by P.S.kalsi
9. Organic chemistry by Morrison and Boyd
10. Spectrometric identification of organic compounds IV$^{th}$ edition by Silverstain, Bassler and Morrill.
11. Application of absorption spectroscopy of organic compounds by John R. Dyer
12. Spectroscopic method in organic chemistry Vth edition by Dudley H. Williams & lan Fleming
13. Physical methods for chemist Ruwssell S. Drago
14. Organic spectroscopy by Williams & Kemp
15. Organic spectroscopy by V.R.Dani
16. Qualitative Analysis R.A.Day & A.L.Underwood
17. Analytical Chemistry G.D. Christain
18. Fundamentals of Analytical Chemistry D.A.Skoog, D.M. West & F.J.Holler
19. Principales of Analytical Chemistry J.H. Kennedy
20. Analytical Chemistry – Principals & Techniques L.G.Hargis

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**B. Sc. Chemistry**
**Semester : VI**
**Polymer Chemistry**
**Paper : SE CH-605 A**

## UNIT:-1: Polymers – 1

- Introduction
- Classification and Nomenclature of polymers
- Isomerism of polymers
- Chain growth polymerization - Introduction
- Mechanism of free-radical, Cationic and Anionic polymerization
- Kinetics of free radical, Cationic and Anionic polymerization
- Mechanism and Kinetics polycondensation

## UNIT:- II : Polymers - 2

- Polymerization Techniques
- Concept of Averages
  -Number average molecular weight
  - Weight average molecular weight
  - Viscosity average molecular weight
- Molecular weight and Degree of polymerization
- Poly dispersity and molecular weight distribution
- Methods for determination of molecular weight
- Membrane Osmometry, Viscometry and Light Scattering

## Reference Books:

1. Principles of polymers Science by P.Bahadur and N.V.Sastry.(Second Edition )
2. Polymer Science by V.R. Gowariker, N.V.Vashwanathan and Jaydev Shreedhar.



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**B. Sc. Chemistry**
**Semester : VI**

## Electro Analytical Techniques
## Paper : SE CH-605 B

### Unit-1

- **Potentiometry-** The scope of potentiometric titrations, Precipitation and neutralization titrations, Graphical method including Gran's plot for selecting end point, Differential titration, Dead stop titration, Ion selective Electrode, various types of Ion selective Electrodes and applications of Ion selective electrodes,
- **pHmetry-** Introduction, types of indicator electrodes and reference electrodes
- **Conductimetry**- Introduction, types of conductance, effect of dilution, conductivity cells, types of titration.

### Unit-2

- **Polarography:** Introduction, Principle, electrode, Types of currents, Determination of half wave potential, Ilkovic equation, methods of determining concentration (Standard addition method and Calibration method), Applications of Polarography.

### Reference Books:


(1) Analytical Chemistry: Gary D. Christian, 6th Edition; Wiley & Sons
(2) Fundamentals of Analytical Chemistry: D. A. Skoog, D. M. West and F. J. Holler, 9th Edition, Cengage Learning.
(3) Instrumental Methods of analysis: (CBS) H.H . Willard, L.L. Mirrit, J.A. Dean
(4) Instrumental Methods of Inorganic Analysis: A.I. Vogel, ELBS
**(5)** The principals of ion-selective electrodes and membrane transport: W.E.Morf Principles of Instrumental Analysis: Douglas A. Skoog., F. James Holler, Stanley R. Crouch, Cengage Learning; 6th Edition.




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# Hemchandracharya North Gujarat University, Patan

## B. Sc. Chemistry

## Semester : VI

## Laboratory Course

## LC CH-607

## (Inorganic, Organic, Physical Chemistry)

## Inorganic Chemistry practical

**Qualitative analysis (Minimum 10)**

Inorganic mixture should be comprised of six radicals.

Candidate if required should be guided once for the wrong group and marks deducted for wrong group. Maximum of five marks can be deducted for wrong group. There shell be no deduction of marks for reporting wrong radicals

## Organic Chemistry practical

**(A) Estimation of functional groups:**

(1) Estimation of Amide

(2) Estimation of Ascorbic acid

(3) Estimation of Aspirin

**(B) Synthesis of Organic Compounds**

(1) Preparation of m-Dinitro benzene from Nitrobenzene

(2) Preparation of p-Nitro acetanilide from Acetanilide

(3) Preparation of Acetanilide from Aniline

(4) Preparation of Aspirine from Salicylic acid

(5) Preparation of Di-benzal acetone from Benzaldehyde



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## Physical Chemistry

**[Instruments): (Minimum 05)**

(1) To Determine the Normality and Amount of each Base in given mixture of XN ($NaOH + NH_4OH$) by pH metric Titration using 0.1 N HCl.

(2) To Determine the normality and amount of KI in given solution of XN KI by Potentiometry titration using 0.1 N KMnO4.

(3) To Determine the formal Redox potential of $Fe^{+2}/Fe^{+3}$ system by Potentiometry titration.

(4) To Determine the Normality and Amount of each Base in given mixture of XN ($NaOH+NH_4OH$) by Conductometry Titration using 0.1 N HCl..

(5) Determine the concentration of $Cu^{+2}$ ions and $CO^{+2}$ ions in in a given mixture of ($CuSO_4\,5H_2O + COCl_2\,6H_2O$).

(6) To Determine the amount of Nitrite in the given unknown Solution by Colorimetric method.

**[B] Kinetics, Adsorption & Polymer**

(7) To Study the Influence of Ionic Strength on Rate of Reaction between $K_2S_2O_8$ and KI.

(8) To Study the reaction between $KBrO_3$ and KI at two different Temperature and Calculate the Temperature Coefficient and Energy of Activation.

(9) To Study the Distribution of Benzoic Acid between Benzene and water at Room Temperature and Prove the Dimerization of Benzoic acid in Benzene.

## Hemchandracharya North Gujarat University, Patan

## B. Sc. Chemistry

## Semester : VI

### Pattern of University Practical Exam

**Time: 11:00am to 5:30pm (Including 30 minutes recess)** **Total Marks: 200**

**First Day**

**(A) Inorganic (50 marks)**

- Inorganic Qualitative Mixture

**(B) Organic (50 marks)**

- Estimation (25 Marks) & Preparation (25 Marks)

**Second Day**

**(C) Physical (50 marks)**

- Any one exercise should be selected for each candidate from syllabus.

**(D) Viva-Voce and Journal**

- **Viva-Voce on practical base (40 marks)**
  - **Inorganic ..... 13 marks**
  - **Organic ..... 13 marks**
  - **Physical ..... 14 marks**

- **Journal (10 marks)**

➢ **Note: Without Certified practical record a student will not be permitted to appear at practical examination.**



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## Hemchandracharya North Gujarat University, Patan

## B. Sc. Chemistry

## Semester : VI

**Suggested batch distribution for practical exam**

**First Day:**

| 11:00am to 2:00pm | 2:30pm to 5:30pm |
|---|---|
| Inorganic: A<br>Organic: B<br>Physical: C | Inorganic: B<br>Organic: C<br>Physical: A |

**Second Day :**

| 11:00am to 2:00pm | 2:30pm to 5:30pm |
|---|---|
| Inorganic: C<br>Organic: A<br>Physical: B | Inorganic viva- All students ( A,B & C batch)<br>Organic viva- All students (A,B & C batch)<br>Physical viva- All students ( A,B & C batch) |

**Batch distribution (for 30 students and 3 Examiners)**

**[Maximu 10 Students per each Examiner]**

*Best wishes*

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Hemchandracharya
North Gujarat University
PATAN

# હેમચંદ્રાચાર્ય ઉત્તર ગુજરાત યુનિવર્સિટી

NAAC A (3.02) State University

પો.બો.નં.–૨૧, યુનિવર્સિટી રોડ, પાટણ (ઉ.ગુ.) ૩૮૪૨૬૫

ફોનઃ(૦૨૭૬૬) ૨૩૭૦૦૦ ફેકસ : (૦૨૭૬૬) ૨૩૧૯૧૭

Email : regi@ngu.ac.in Website : www.ngu.ac.in


**પરિપત્ર ક્રમાંક – ૧૩૦ / ૨૦૨૨**

**વિષયઃ વિજ્ઞાન વિદ્યાશાખાના સ્નાતક કક્ષાના નવા અભ્યાસક્રમો અંગે...**

આ યુનિવર્સિટી સંલગ્ન સાયન્સ કોલેજોના આચાર્યશ્રીઓને જણાવવાનું કે, વિજ્ઞાન વિદ્યાશાખાએ કરેલ ભલામણ અનુસાર નીચેના વિષયોના સ્નાતક કક્ષાના સામેલ પરિશિષ્ટ પ્રમાણેના નવા અભ્યાસક્રમો **જૂન – ૨૦૨૨ થી ક્રમશઃ અમલ માં આવે તે રીતે** એકેડેમિક કાઉન્સિલએ તેની તા. ૧૨/૦૪/૨૦૨૨ ની સભા ના નિર્દિષ્ટ ઠરાવો થી મંજૂર કરેલ છે. જેનો અમલ કરવા સારૂ સંબંધિતોને આ સાથે મોકલવામાં આવે છે, જેનો ચુસ્ત અમલ થવા વિનંતી છે.

| ક્રમનં. | અભ્યાસક્રમ | એકેડેમિક સભાના ઠરાવક્રમાંક | સેમેસ્ટર |
|---|---|---|---|
| ૧ | વનસ્પતિશાસ્ત્ર | ૨૪ | સેમ.–૫ અને ૬ |
| ૨ | ગણિતશાસ્ત્ર | ૨૬ | સેમ.–૫ અને ૬ |
| ૩ | ભૌતિકશાસ્ત્ર | ૩૦ | સેમ.–૫ અને ૬ |
| ૪ | રસાયણશાસ્ત્ર | ૫૩ | સેમ.–૫ અને ૬ |

આ બાબતની સંબંધિત અધ્યાપકો તથા વિદ્યાર્થીઓને આપના સ્તરેથી જાણ કરવા વિનંતી છે.

નોંધઃ (૧) વિદ્યાર્થીઓની જરૂરીયાત માટે પરિપત્રની એક નકલ કોલેજ ના ગ્રંથાલયમાં મૂકવાની રહેશે.
(૨) આ અભ્યાસક્રમ યુનિવર્સિટીની વેબ સાઈટ www.ngu.ac.in પર પણ ઉપલબ્ધ કરાવવામાં આવનાર છે.

સહી/–
અધ્યક્ષ
કા.કુલસચિવ

બિડાણઃ ઉપર મુજબ

નં.–એ કે / અ× સ / ૧૧૭૫ / ૨૦૨૧
તારીખ : ૦૧ / ૦૬ / ૨૦૨૨

પ્રતિ,

૧. અધ્યક્ષશ્રી/ કો.ઓર્ડીનેટરશ્રી –વિજ્ઞાન વિદ્યાશાખા અંતર્ગત અનુસ્નાતક વિભાગો, હેમ. ઉ.ગુ. યુનિવર્સિટી, પાટણ.
૨. સંલગ્ન સાયન્સ કોલેજોના આચાર્યશ્રીઓ
૩. ડૉ. જગદીશ એચ. પ્રજાપતિ (ડીનશ્રી – વિજ્ઞાન વિદ્યાશાખા),સરકારી સાયન્સ કોલેજ, **થરાદ.** જિ. બનાસકાંઠા
૪. પરીક્ષા નિયામકશ્રી, હેમચંદ્રાચાર્ય ઉત્તર ગુજરાત યુનિવર્સિટી, પાટણ. (પાંચ નકલ)
૫. ગ્રંથપાલશ્રી, હેમ.ઉત્તર ગુજરાત યુનિવર્સિટી, પાટણ. ( વિદ્યાર્થીઓના ઉપયોગ સારૂ રેકર્ડ ફાઈલ માટે )
૬. સીસ્ટમ એનાલીસ્ટ, કોમ્પ્યુટર(રીઝલ્ટ) સેન્ટર, હેમ.ઉ.ગુ. યુનિવર્સિટી,પાટણ તરફ વેબસાઈટ પર મૂકવા સારૂ.
૭. પ્રવેશ પ્રશાખા(એકેડેમિક શાખા) હેમચંદ્રાચાર્ય ઉત્તર ગુજરાત યુનિવર્સિટી, પાટણ.
૮. મુખ્ય હિસાબી અધિકારીશ્રી (મહેકમ), હેમ. ઉત્તર ગુજરાત યુનિવર્સિટી, પાટણ તરફ–પરિપત્રની ફાઈલ અર્થે
૯. સિલેકટ ફાઈલે– (૨ નકલ)

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# HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY

# PATAN- 384 265

## Modified Detailed Syllabus of CBCS PROGRAMME Pattern for B Sc Mathematics Semester System

## With Effect from June: 2022

| | | |
|---|---|---|
| FACULTY | : | SCIENCE |
| SUBJECT | : | MATHEMATICS |
| CLASS | : | Bachelor of Science. |
| SEMESTER | : | V to VI |
| TOTAL PAGES | : | 01 TO 20 (WITH COURSE STRUCTURE) |
| DATE | : | June 22, 2022. |

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# B.Sc. in Mathematics: PROGRAMME Structure under CBCS

## With Effect from June: 2022

*Hemchandracharya North Gujarat University, Patan-384265.*

**Mission**: Our mission is to provide opportunities for developing basic-quality mathematical skills and achievement for their betterment of life through scientific and technological development.

**Learning outcomes**: Four major focusing areas: Logical Reasoning & Motivation; Analysis & Problem solving; Information & Technology Proficiency.

**Vision:** To Motivate Individuals to excel in the mathematical basic knowledge-driven environment of the 21st century through curriculum and train integrally human resources through teaching. We **Focus** on quality education.

(1) EDUCATIONAL AIMS:

Mathematics is one of the fundamental disciplines in science. It is the basic for all the disciplines. To make education more effective and learner centric, restructurisation of curriculum becomes essential. As a positive step in this direction and in order to respond to the emerging trends in the global scenario, it is decided to introduce the Choice Based Credit System (CBCS) from the academic year 2011-12 and modified it after three years. Under this system, the academic programme becomes student-oriented, relevant, interdisciplinary and flexible.

*(2) CONDITIONS FOR ADMISSION :*

A candidate who has passed the H Sec-Science Degree examination of the state or any other examinations accepted by the Syndicate as equivalent thereto shall be eligible for admission to this B Sc Programme in Mathematics on full-time basis of study.

**INTAKE** rules for admission are as per University notification from time to time.

Students are allowed to take admissions to successive semesters under carry over benefit facility as per the norm decided by the university .

(3) *LEARNING OUTCOMES :*

The programme leading to this degree provides the opportunities to develop and demonstrate knowledge and understanding in the following areas:

- **Knowledge and understanding :** When one has completed this degree he/she will have knowledge and understanding of the fundamental concepts, principles and techniques from a range of topic areas.
- **Cognitive skills :** When one has completed this degree he/she will be able to understand how to solve some problems using the methods taught and develop abstract mathematical thinking .
- **Practical skills :** When one has completed this degree, he/she will be able to demonstrate the Communicate clearly knowledge, ideas and conclusions about mathematics and improve his/her own learning and performance.

*(4) DURATION OF THE COURSE:*

The CBCS pattern B. Sc. programme with multidisciplinary approach in Mathematics is offered on a full-time basis. The duration of the course is of three academic years consisting of six semesters each of 15 weeks duration.

*(5) TEACHING, LEARNING METHODS :*

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All relevant material is provided and taught in the course texts and through the study of set books. One will build up knowledge gradually, with sufficient in-text examples to support one's understanding. He/She will be able to assess his/her own progress and understanding by using the in-text problems and exercises at the end of each unit in form of practical using computer in computer laboratory.

*(6) COURSE OF STUDY :*

The curriculum has five major components:

1. *Principle/Core Courses ( CC MAT)*
2. *Practical courses ( PC MAT)*
3. *Elective Opt. Disciplinary courses (ES MAT)*
4. *Elective Generic course*
5. *Foundation Course*

*There are at least 144 Credit COURSEs prescribed in the above classification as per the university norms to be studied to acquire B.Sc. Degree in Mathematics.*

⇛ COURSE STRUCTURE ☒

| Course | Courses | Credit /course | Teaching Hrs Total | Total Credits | Examination Internal | Hours | External | Total Marks |
|---|---|---|---|---|---|---|---|---|
| *SEMESTER-I* | | | | | | | | |
| Principle/Core Courses: CC-MAT-111 | 1 | 4 | 4 | 4 | 30 | 2.5 | 70 | 100 |
| Practical/ PC MAT-111 | 1 | 2 | 4 | 2 | - | 5 | 50 | 50 |
| Elective Opt. Disciplinary: ES-MAT –11 Set Theory & Functions | 1 | 2 | 2 | 2 | 15 | 2 | 35 | 50 |
| Elective Generic | 1 | 2 | 2 | 2 | 15 | 2 | 35 | 50 |
| Foundation Course | 1 | 2 | 2 | 2 | 15 | 2 | 35 | 50 |
| *SEMESTER-II* | | | | | | | | |
| Principle/Core Courses: CC-MAT-122 | 1 | 4 | 4 | 4 | 30 | 2.5 | 70 | 100 |
| Practical/ PC MAT-122 | 1 | 2 | 4 | 2 | - | 5 | 50 | 50 |
| Elective Opt. Disciplinary: ESMAT –21 Industrial Mathematics | 1 | 2 | 2 | 2 | 15 | 2 | 35 | 50 |
| Elective generic | 1 | 2 | 2 | 2 | 15 | 2 | 50 | 50 |
| Foundation course | 1 | 2 | 2 | 2 | 15 | 2 | 35 | 50 |
| *SEMESTER-III* | | | | | | | | |
| Principle/Core Courses: CC-MAT-301 | 1 | 3 | 3 | 3 | 30 | 2.5 | 70 | 100 |
| Principle/Core Courses: CC-MAT-302 | 1 | 3 | 3 | 3 | 30 | 2.5 | 70 | 100 |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Practical /PC- MAT-301 | 1 | 1.5 | 3 | 1.5 | - | 5 | 50 | 50 |
| Practical /PC -MAT-302 | 1 | 1.5 | 3 | 1.5 | - | 5 | 50 | 50 |
| Elective Opt. Disciplinary: ES-MAT –31 Numerical Solution of Equations | 1 | 2 | 2 | 2 | 15 | 2 | 35 | 50 |
| Elective generic | 1 | 2 | 2 | 2 | 15 | 2 | 35 | 50 |
| Foundation course | 1 | 2 | 2 | 2 | 15 | 2 | 35 | 50 |
| *SEMESTER-IV* | | | | | | | | |
| Principle/Core Courses: CC-MAT-401 | 1 | 3 | 3 | 3 | 30 | 2.5 | 70 | 100 |
| Principle/Core Courses: CC-MAT-402 | 1 | 3 | 3 | 3 | 30 | 2.5 | 70 | 100 |
| Practical/ PC- MAT-401 | 1 | 1.5 | 3 | 1.5 | - | 5 | 50 | 50 |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Practical/ PC MATH-402 | 1 | 1.5 | 3 | 1.5 | - | 5 | 50 | 50 |
| Elective Opt. Disciplinary: ES-MAT –41 Improper Intrgrals | 1 | 2 | 2 | 2 | 15 | 2 | 35 | 50 |
| Elective generic | 1 | 2 | 2 | 2 | 15 | 2 | 35 | 50 |
| Foundation course | 1 | 2 | 2 | 2 | 15 | 2 | 35 | 50 |
| *SEMESTER-V* | | | | | | | | |
| Principle/Core Courses: CC-MAT-501 | 1 | 3 | 3 | 3 | 30 | 2.5 | 70 | 100 |
| Principle/Core Courses: CC-MAT-502 | 1 | 3 | 3 | 3 | 30 | 2.5 | 70 | 100 |
| Principle/Core Courses: CC-MAT-503 | 1 | 3 | 3 | 3 | 30 | 2.5 | 70 | 100 |
| Principle/Core Courses: CC-MAT-504 | 1 | 3 | 3 | 3 | 30 | 2.5 | 70 | 100 |
| Practical/PC MAT-501 | 1 | 1.5 | 3 | 1.5 | - | 5 | 50 | 50 |
| Practical/PC MAT-502 | 1 | 1.5 | 3 | 1.5 | - | 5 | 50 | 50 |
| Practical/PC MAT-503 | 1 | 1.5 | 3 | 1.5 | - | 5 | 50 | 50 |
| Practical/PC MAT-504 | 1 | 1.5 | 3 | 1.5 | - | 5 | 50 | 50 |
| Elective Opt. Disciplinary: ESMAT –51 Theory of Equations | 1 | 2 | 2 | 2 | 15 | 2 | 35 | 50 |
| Elective generic | 1 | 2 | 2 | 2 | 15 | 2 | 35 | 50 |
| Foundation course | 1 | 2 | 2 | 2 | 15 | 2 | 35 | 50 |
| *SEMESTER-VI* | | | | | | | | |
| Principle/Core Courses: CC-MAT-601 | 1 | 3 | 3 | 3 | 30 | 2.5 | 70 | 100 |
| Principle/Core Courses: CC-MAT-602 | 1 | 3 | 3 | 3 | 30 | 2.5 | 70 | 100 |
| Principle/Core Courses: CC-MAT-603 | 1 | 3 | 3 | 3 | 30 | 2.5 | 70 | 100 |
| Principle/Core Courses: CC-MAT-604 | 1 | 3 | 3 | 3 | 30 | 2.5 | 70 | 100 |
| Practical/PC MAT-601 | 1 | 1.5 | 3 | 1.5 | - | 5 | 50 | 50 |
| Practical/PC MAT-602 | 1 | 1.5 | 3 | 1.5 | - | 5 | 50 | 50 |
| Practical/PC MAT-603 | 1 | 1.5 | 3 | 1.5 | - | 5 | 50 | 50 |
| Practical/PC MAT-604 | 1 | 1.5 | 3 | 1.5 | - | 5 | 50 | 50 |
| Elective Opt. Disciplinary: ES-MAT –61 Business Statistics | 1 | 2 | 2 | 2 | 15 | 2 | 35 | 50 |
| Elective generic | 1 | 2 | 2 | 2 | 15 | 2 | 35 | 50 |
| Foundation course | 1 | 2 | 2 | 2 | 15 | 2 | 35 | 50 |

N.B. : *Work-load depends on the number of students and the number of Batches/Groups , for Practical and Cognitive-skill based Course.*

As the *CBCS has a high probability to be operationalised efficiently and effectively for the elevating learners* , the Essential Requirements for all Mathematical Practical including MATLAB / PYTYHON / SCILAB practicals of Mathematical subjects are as under:

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1. Mathematical Laboratory inbuilt with sufficient number of Computers ( as per the students enrollments and the number of practical batches) and MATLAB / PYTYHON / SCILAB SOFTWARE with basic requirements for the Practicals.

2. Mathematical Laboratory inbuilt with Graphs, Charts, Printer, Physical Models ( two dimensional as well as three dimensional) & Virtual Models ( Higher Dimensional – Computerized) and basic requirements for the same.

3. ***Essential Requirement for Mathematical Computer Laboratory:***

   At least One full time Computer Operator and one Peon for computer laboratory having mathematical ability to run MATLAB / PYTYHON / SCILAB Software and related Computerized Mathematical practicals.

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# B.Sc. (Mathematics) Semester-6

## CC MAT—601 Abstract Algebra

**UNIT-01:**
Definition of a Ring and its applications, Elementary Properties of a Ring, Zero divisors and Integral domain, Characteristic of an Integral Domain, Solution of the equation ax = b in a ring R, Subring and its theorems and examples, Ideals and its properties.

**UNIT-02 :**
Introduction of Polynomials, Integral Domain D[x], Unique factorization of Polynomials, Division Algorithm for Polynomials, Solutions of a Polynomial Equation, Eisenstein Criterion for irreducibility, Gauss Lemma.

**UNIT-03:**
Formation of a Quotient ring and its properties, Homomorphism of rings, Maximal Ideal, Prime Ideal.

The course is covered by the Book : **I H Sheth, Abstarct Algebra**, Prentice Hall of India (PHI) Publication. Chapter 13(13.1 to 13.4), Chapter 14(14.1 to 14.4), Chapter 15(15.1 to 15.4), Chapter 16(16.1 to 16.3), Chapter 18(18.1 to 18.7), Chapter 19(19.1 to 19.4),

- **Reference books :**


1. I N Herstein, Topics in Algebra, Wiley Eastern Ltd.
2. N. Jacobson, Basic Algebra Vol I & II, Hindustan Publishing company
3. Shanti Narayan, A text book of Modern Algebra, S.Chand & Co.
4. P.B.Bhattacharya, S.K.Jain, S R Nagpal, Basics Abstract Algebra, (second Edition), Cambridge University Press.
5. N.S. Gopalkrishna, University Algebra, Wiley Eastern, New Delhi
6. Maclane Saunders and Birkhoff Garrett, Algebra, MacMillan, New York.
7. G.F.Simmons, Introduction to Topology and Modern Analysis, MacGrawHill Inc., U.S.A.


## CC MAT -602 Mathematical Analysis-II

**Unit-01 Limits and Continuity:**
Limits and Continuity for a functions from a metric space into another metric space, continuity of a composite function, Structural properties of continuous functions from a metric space in to Rk, Continuity and Compactness, Continuity and connectedness.

Differentiation: Derivatives of a real function, Continuity and differentiability, Structural properties of the class of differentiable functions, Mean value theorems, Continuity of derivatives, L'Hospital rule.

**Unit-02 The Riemann – Stieltje's Integral:**
Riemann integral and Stieltje's integral,properties of Riemann integral and Stieltje's integral, Integration and Differentiation, Integration of Vector Valued Functions.

**Unit-03 Sequences and Series of functions:**
Sequences of functions, Limit of a Sequence of functions, Uniform convergence, tests for uniform convergence and continuity, Uniform convergence and differentiation.

The course is roughly covered by Chapters - 4,5,6,7 (Omit 5.16 to 5.20 and 7.28 to 7.33) of The book entitled **"Principles of Mathematical Analysis"** by Walter Rudin, McGraw Hill (International Student Edition), 3rd Edition.

- **Reference books:**

1. "A First Course in Mathematical Analysis" by D. Somasundaram & B. Choudhary, Narosa Publishing House.
2. "Fundamentals of Mathematical Analysis" by G. Das & S. Pattnayak Tata Mcgraw Hill Pub.Co.
3. "Fundamental of Real Analysis" by S. L. Gupta & Nisha Rani – Vikas Pub. House Pvt. Ltd. New Delhi-1974.
4. "Principle of Real Analysis "by S.C.Malik , Wiley Eastern Limited New Delhi 1982.
5. "Principle of Mathematical Analysis" by T.M.Apostol

## CC MAT -603 A: General TOPOLOGY

**Unit-01:**
Toplology and topological spaces, Neighbourhoods, Hausdorff space, Closure of a subset of a topological space.

**Unit-02:**
Interior of a subset of topological space , Boundary of a subset of a topological space, Continuity of a function from topological space to topological space, Hoeomomorphism between two topological spaces.

**Unit-03:**
Subspace of a topological space, Connectedness of a topological spaces, Some applications of connectedness, Components of a point of connected topologicalspace.

Text-Book: **An Introduction to topology, by. Bert Mendelson(third addition)**
Ch.No.-3 : 2.1 to 2.4, 3.1, 3.3 , 3.7, 4.2 to 4.15 , 5.1to 5.7 , 5.9 , 6.1 to 6.3 , 6.5 to 6.8
Ch.No.-4 : 2.1 to 2.7 , 4.1 to 4.3 , 5.1 to 5.7

- **REFERENCE BOOKS:**

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1. Introduction to Topology and Modern Analysis, by. “G F Symmons”., New York McGrawHill, 1963
2. General Topology by Kelly J L , NewYork, Van Nostrand 1955
3. Elementary Topology by Beackett D W., New York Academic press, 1967

## CC MAT 603 B: Number Theory

**Unit-01:**

Some Preliminary Consideration: Well-Ordering Principle, Mathematical Induction,the Binomial Theorem & binomial coefficients.

Divisibility Theory: the division algorithm, divisor, remainder, prime, relatively prime, the greatest common divisor, the Euclidean algorithm (Without proof), the least common multiple, the linear Diophantine equation & its solution.

**Unit-02:**

Prime Numbers: Prime and composite number, the Fundamental Theorem of Arithmetic (without proof), canonical form of a number, the Sieve of Eratosthenes.

Theory of Congruence: Definition and basic properties of congruence, Residue class &complete system of residues, special divisibility test, linear congruence, Chinese Remainder Theorem. (without proof)

**Unit-03:**

Fermat’s Theorem: Fermat’s Factorization method, Fermat’s little theorem, Wilson theorem, Euler’s theorem: Euler’s Phi-function $\phi(n)$ and formula for $\phi(n)$, Euler’s theorem (without proof) and only problems on Euler’s theorem.

- **Text Book:**

  Elementary Number Theory - David M. Burton, Sixth Edition, Universal Book stall, New Delhi. [(Chapter 1): 1.1 and 1.2 2) 2.1 to 2.4 3) 3.1 and 3.2 4) 4.1 to 4.3 5) 5.2 and 5.3 7) 7.2 and 7.3 ]

- **Reference Books:**

1. An introduction to the Theory of numbers - Niven and Zuckerman, Wiley Eastern Ltd.
2. Number Theory - S. G. Telang, Tata Mc Graw-Hill Publishing Company Limited, New Delhi
3. Elementary Theory of Numbers - C. Y. Hsiung, Allied Publishers Ltd.-India, ISBN 81-7023-464-6.
4. Number Theory - George E. Andrews, Hindustan Publishing Corporation- Delhi.
5. Elementary Number Theory - Gareth A. Jones & J. Mary Jones, Springer Verlag, ISBN 81- 8128-278-7.
6. Number Theory - J. Hunter, Oliver and Boyd-London.
7. Beginning Number Theory - Neville Robbins, Narosa Pub. House -New Delhi ISBN 978-81-7319-836
8. Introduction to the theory of Numbers - G. H. Hardy & E. M. Wright, Oxford Uni. Press
9. Higher Algebra - S. Barnard & J. M. Child, Macmillan India Ltd.
10. Elements of Number Theory - I. M. Vinogradov , Dover Pub INC

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11. Elementary Number Theory in Nine chapters - James J. Tattersall, Cambridge Uni Press
12. A first course in Theory of Numbers - K. C. Chowdhary, Asian Books Pvt Ltd New Delhi
13. 1001 problems in Classical Number Theory - Jean Marie De Konick Armed Mercier, AMS
14. Number theory by Gurmeet Singh & Narinder Kaur, Pragati Prakashan, Meerut.

## CC MAT-604 A: GRAPH THEORY

**UNIT-01:**

Graphs, Basic Definitions, Undirected Graphs, Mixed Weighted Graphs, Incidence and Degree, Bipartite Graph and Bipartition, Regular and K-regular Graph, Graph Isomorphisms, Sub Graphs,Graph Operations, Walk, Trail, Paths, Circuits.

**UNIT-02:**

Connected Graph, Disconnected Graph, Eccentricity, Radius and Diameter, Adjacency Strong ,Weak and Unilateral Components, Eular Graphs, Hamilton Paths, Trees, Binary Trees And m-array Tree, Spanning Trees.

**UNIT-03:**

Cut set, Internaly Disjoint Paths, Connectivity and Separability, Planar Graphs and their different Representation, Detection of Planarity, Geometric and Combinatorial duals, Vector Space Associated With a Graph, Circuit and Cut set Subspaces, Orthogonal Vectors And spaces.

- **REFERENCE BOOKS :**

1. A first look at Graph theory by John Clark and Derek Allan Holton.
2. An Introduction To Discrete Mathematics, Udayan M.Prajapati Dr.Ajay S. Gor, Nirav Prakashan
3. Graph Theory with Applications to Engineering and Computer Science by Narsing Deo
4. Graph Theory by Harary F.
5. Graph Theory and its applications by B. Harris
6. Discrete Mathematical Structures With applications to Computer Science by R.Hamming and E.A.Feigenbaum
7. The Essence of Discrete Mathematics by Neville Dean
8. Discrete Mathematics and its Applications with Combinatorics and Graph theory, by – Kenneth H. Rosen, McGraw Hill -2007 7th Edition.

## CC MAT-604 B: Operations Research

**Unit-01 Network Models- Concept of Networks:**

Transportation Problem- Introduction, general method of a T.P., unbounded T.P. NWCM, Least cost method, VAM methods to find the initial solution, Dual of a T.P. and MODI method, degeneracy in a T.P., variatons in T.P.- Maximization T.P. and prohibited routes.

**Assignment Problem**- General model of A.P.(A.P. as a special case of a T.P.) Hungarian Method of solving a A.P., variations in a A.P.- maximization, prohibited assignments.

**Unit-02 Sequencing Problem:**
Methods of sequencing, Johnson's Algorithm for a two machine problem, three machine problem and M-machine problem, Processing Two jobs through M-machines

**Unit-03 Game Theory:**
Introduction, Two-person zero games, Minimax and Maximin principles, saddle point theorems, mixed strategies, method for solution of 2×2 game, dominance principles, solution of games without sadddle points by using dominance and then mixed strategies, graphical method of solving 2×m and m×2 game, L.P. solution of games.

- **REFERENCES BOOKS:**

1. Operations Research , by. J.K.Sharma. Macmillan Publishers India Ltd.
2. Operations Research by Nita Shah, Ravi Gor and Hardik Soni, Prentice Hall of India.
3. Operations Research( Principles and Practice) by Pradeep Prabhakar Pai, Oxford University Press.
4. Operations Research by Prof. N.P. agarwal, Ramesh Book Depot, Jaipur.


## PC MATH-601 to 604

- **Objectives:**
  - Ensure the student can competently use the MATLAB programming environment.
  - Understand the capabilities of MATLAB for solving complex mathematical problems.
  - Understand the tools that are essential in solving real-world problems applying appropriate Mathematical concept.

### PC-MAT-601 Input-Output Statements in MATLAB

Data input, interactive inputs, reading/storing file data, output commands, formatted input-output functions.

### PCMAT-602 Programming Techniques

Loops, Branches control structures, MATLAB programming, function subprograms, types of functions, function handles, errors and warnings, MATLAB debugger.

### PCMAT-603 MATLAB Applications:

The content of this unit is to be covered from the list
given in Appendix A.

### PCMAT-604 Practical using MATLAB programming

List of practical is given in Appendix B.

- **Text Book:**
"MATLAB and its Applications in Engineering" Raj Kumar Bansal, Ashok Kumar Goel, Manoj Kumar Sharma, Pearson.

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- **Coverage from the Text Book:**
  **PCMAT-601**Chapter 5: 5.6
  **PCMAT-602** Chapter 7: 7.3, Chapter 8: 8.9
  **PCMAT-603** Appendix A: Table A.1:A.8
  **PCMAT-604** Appendix B

**Appendix A:Table A.1**

| **Discrete Math\Number theoretic functions** | |
|---|---|
| factor | Returns Prime factors |
| factorial | Factorial function |
| nchoosek | All combinations of N elements taken K at a time |
| perms | All possible permutations |
| gcd | Returns the greatest common divisor. |
| lcm | Returns the least common multiple. |
| primes | Generate list of prime numbers |
| isprime | Returns a logical array that is prime numbers. |
| rat, rats | Returns a rational fraction approximation. |
| mod | The mod function is useful for congruence relationships. Returns modulus |
| rem | Returns remainder after division. |

**Table A.2**

| **Coordinate System Conversion** | |
|---|---|
| cart2sph | Transform Cartesian to spherical coordinates |
| cart2pol | Transform Cartesian to polar coordinates |
| pol2cart | Transform polar to Cartesian coordinates |
| sph2cart | Transform spherical to Cartesian coordinates |

**Table A.3**

| **Interpolation Functions** | |
|---|---|
| interp1 | Linear and cubic-spline interpolations of a function of one variable. |
| interp2 | Linear interpolation of a function of two variables. |
| spline | Cubic-spline interpolation. |
| unmkpp | Computes the coefficients of cubic-spine polynomials. |

**Table A.4**

| **Numerical Integration Functions** | |
|---|---|
| quad | Numerical integration with adaptive Simpson's rule. |
| quadl | Numerical integration with adaptive Lobatto quadrature. |
| trapz | Numerical integration with the trapezoidal rule. |
| quadv | Vectorized quadrature |
| dblquad | Numerically evaluate double integral |
| triplequad | Numerically evaluate triple integral |

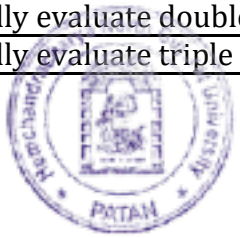

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Table A.5

| Numerical Differentiation Functions | |
|---|---|
| diff(x) | Computes the difference between adjacent elements in the vector x. |
| polyder | Differentiates a polynomial, a polynomial product, or a polynomial |

Table A.6

| ODE Solvers | |
|---|---|
| ode23 | Nonstiff, low-order solver. |
| ode45 | Nonstiff, medium-order solver. |
| ode113 | Nonstiff, variable-order solver. |
| ode23s | Stiff, low-order. |
| ode23t | Moderately stiff, trapezoidal rule solver. |
| ode23b | Stiff, low-order solver. |
| ode15s | Stiff, variable-order solver. |
| odeset | Creates integrator options structure for ODE solvers. |
| deval | Evaluate solution of differential equation problem |
| bvp4c | Solve boundary value problems for ODEs |

Table A.7

| Optimization | |
|---|---|
| fminbnd | Finds minimum of single-variable function. |
| fzero | Finds zero of single-variable function. |
| fminsearch | Multidimensional unconstrained nonlinear minimization |
| lsqnonneg | Linear least squares with nonnegativity constraints |
| fminunc | Find minimum of unconstrained multivariable function |
| fmincon | Find minimum of constrained nonlinear multivariable function |
| linprog | Solve linear programming problems |

Table A.8

| Statistical Functions | |
|---|---|
| erf(x) | Computes the error function *erf* (x). |
| mean | Calculates the average. |
| median | Calculates the median. |
| std | Calculates the standard deviation. |
| var | Calculates the variance. |
| corrcoef | Correlation coefficients |
| cov | Covariance matrix |


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**Appendix B:**

1. Numerical Methods Practical (Lab) using MATLAB programming
2. Linear Algebra
3. Graph Theory
4. Calculus
5. Optimization
6. Problems related to programming given in text book.

**Assignment:** The work should involve programming using MATLAB. The student should submit the electronic copy of .m files or/and diary file showing the execution/output of Matlab session(s).

**N.B.: As the *CBCS has a high probability to be operationalised efficiently and effectively for the elevating learners*, the Essential Requirements for all Mathematical Practical including MATLAB Practicals of Mathematical subjects are as under:**

1. **Mathematical Laboratory inbuilt with sufficient number of Computers ( as per the students enrollments and the number of practical batches) and MATLAB SOFTWARE with basic requirements for the MATLAB Practicals.**
2. **Mathematical Laboratory inbuilt with Graphs, Charts, Printer, Physical Models ( two dimensional as well as three dimensional) & Virtual Models ( Higher Dimensional – Computerized) and basic requirements for the same.**
3. Use also "PYTHON" Software instead of MATLAB Software.
4. ***Essential Requirement for Mathematical Computer Laboratory:***

**(i) Atleast One full time Computer Operator having mathematical ability to run Matlab Software and related Computerized Mathematical Practical.**

**(ii) One Peon for computer laboratory.**

## Subjective Elective
## ES–MAT-61 Business Statistics

**Unit-01 Measures of central tendency:**
Mean, Median, Mode, Harmonic mean, Geometric mean, Arithmetic mean.
**Measure of dispersion:** Range, Quartile Range, Mean Deviation, Standard Deviation, Variance.

**Unit-02 Correlation & Regression analysis:**
Definition of correlation, positive & negative correlation,Scatter diagram, Carl-Pearson's coefficient of linear correlation, Properties of correlation coefficients and its examples, regression coefficient, properties of regression coefficient and its examples.

- **References :**

1. Business Statistics, by J.K.Sharma.
2. Business Statistics , by R.S.Bhadyaj
3. Business Statistics , by Bharat Jhnujhunwala
4. Advanced Practical Statistics, by S.P.Gupta , D.Chand & Co. Ltd, New Delhi.


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