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.

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CBCS-Semester Grading Pattern

B.Sc. SEMESTER - V PHYSICS SYLLABUS

For Theory and Practical

From Academic year 2022-23

Unit	Physics Theory CC-PHY– 501 3 Credit Total 100 Marks Internal 30 Marks External 70 Marks 3 Hrs/Week	Physics Theory CC-PHY – 502 3 Credit Total 100 Marks Internal 30 Marks External 70 Marks 3 Hrs/Week	Physics Theory CC-PHY – 503 3 Credit Total 100 Marks Internal 30 Marks External 70 Marks 3 Hrs/Week	Physics Theory CC-PHY – 504 3 Credit Total 100 Marks Internal 30 Marks External 70 Marks 3Hrs/Week	Elective Subject ES-PHY – 07 ES-PHY- 08 2Credit Total 50 Marks Internal 15 Marks External 35 Marks 2 Hrs/Week	Physics Practical PC:PHY-501 PC:PHY-502 PC:PHY-503 PC:PHY-504 6Credit Total 200 Marks (External) 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 CC-PHY– 601 3 Credit Total 100 Marks Internal 30 Marks External 70 Marks 3 Hrs/Week	Physics Theory CC-PHY– 602 3 Credit Total 100 Marks Internal 30 Marks External 70 Marks 3 Hrs/Week	Physics Theory CC-PHY– 603 3 Credit Total 100 Marks Internal 30 Marks External 70 Marks 3 Hrs/Week	Physics Theory CC-PHY– 604 3 Credit Total 100 Marks Internal 30 Marks External 70 Marks 3 Hrs/Week	Elective Subject ES-PHY – 09 ES-PHY- 10 2Credit Total 50 Marks Internal 15 Marks External 35 Marks 2 Hrs/Week	Physics Practical PC:PHY-601 PC:PHY-602 PC:PHY-603 PC:PHY-604 6Credit Total 200 Marks (External) 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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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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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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CBCS - Semester - Grading Pattern

B. Sc. Semester - V

PHYSICS SYLLABUS (Effective from June-2022)

CC: PHY-501

Mathematical Physics, Classical Mechanics & Quantum Mechanics

Course Objectives:

- To provide concepts of generalized curvilinear coordinates and their vector operators with orthogonal applications.
- To Give basic knowledge of Mathematical Physics and to Provide deep knowledge of various Differential equation for solving certain special classes of physical problems.
- To provide various numerical techniques useful for the scientific data analysis.
- To Understands the concept of Langrangian Formulation and properties of angular momentum and Eulers's equation of motion.
- To study the schrodinger equation, Degeneracy, Eigen value problem and Momentum eigen functions.

UNIT - I MATHEMATICAL PHYSICS

(a) Curvilinear Co-ordinates :

Curvilinear coordinates (10.6), Scale factors & basis factor for orthogonal systems (10.7), General Curvilinear coordinates (10.8), Vector operators in orthogonal Curvilinear Coordinates (10.9)

Note : The expressions for Divergence and curl are not to be derive but directly expressions are to be given.

Related Examples, Problems & Short Questions

Basic Reference: *Mathematical Methods in Physical Sciences 2nd Edition by M.L. Boas. John Wiley & Sons.*

(b) Differential Equations :

Some partial differential Equations Physics (2.1), The method of separation of variables (2.2A), Separation of Helmholtz equation in Cartesian Coordinates (2.2B), Separation of Helmholtz equation in spherical polar Coordinates (2.2C), Separation of Helmholtz equation in cylindrical coordinates(2.2D), Laplace's equation in various coordinate systems(2.2E), Choice of Coordinate system an seprability of a partial differential equation (2.3)

Related Examples, Problems & Short Questions

(c) Second order differential Equations :

Ordinary and singular points (3.1). Series solution around and ordinary point (3.2),

Some Special Functions in Physics : Laguerre Polynomials (5.7), The Gamma Functions (5.8)

Related Examples, Problems & Short Questions

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***Basic Reference** : Mathematical Physics by P. K. Chatopadhyay, New age international publsihers. (Second Edition). {For b & c}*

Other References:

1. Mathematical Physics by B.D.Gupta.
2. Mathematical Physics by H.K.Dass.

UNIT- II CLASSICAL MECHANICS

(a) Lagrangian Formulation :

Constraints (8.1), generalized coordinates (8.2), D'alembert's principle (8.3), Lagrange's equations (8.4), A general expression for kinetic energy (8.5), Symmetries and the laws of conservation (8.6), Cyclic or ignorable coordinates (8.7), Velocity dependent potential of electromagnatic field(8.8), Rayleigh"s Dissipation Function (8.9)

Related Examples, Problems & Short Questions

(b) Moving Coordinate Systems :

Coordinate Systems with relative translational motion (9.1), Rotating Coordinate systems(9.2), The Coriolis force (9.3), Motion on the earth (9.4), Effect of Coriolis force on a freely falling particle (9.5). ***Related Examples, Problems & Short Questions***

***Basic Reference:** Introduction to Classical Mechanics by Takawale and Puranik. McGraw Hill education (india) private limited.*

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

UNIT -III QUANTUM MECHANICS

(a) General formalism of Wave Mechanics :

The Schrodinger equation and Probability interaction for N-particle system (3.1), The fundamental postulates of wave mechanics (3.2), The Adjoint of an operator and self Adjointness, (3.3), The Eigen value Problem; Degeneracy (3.4), Eigenvalues and Eigen Functions of Self-Adjoint Operators (3.5), The Dirac Delta Function (3.6), Observables: Completeness and Normalization of Eigen Functions (3.7), Closure (3.8), Physical Interpretation of Eigen values, Eigenfunction and expansion Co-efficients (3.9), Momentum Eigenfunctions : wave Functions in Momentum Space (3.10), Uncertainly Principle (3.11), States with Minimum Value for Uncertainly Product (3.12), Commuting Observable: Removal of degeneracy (3.13). Evolution of System with Time Constants of the Motion (3.14). Non-Interacting and Interacting Systems. (3.15).

Related Examples, Problems & Short Questions

***Basic Reference** : A text book of Quantum Mechanics by P.M. Mathews and K. Venkateshan, McGraw Hill education (india) private limited.*

Other References :

1. Quantum Mechanics by Ghatak and Loknathan, The Macmillan company of India Ltd..
2. Quantum Mechanics by Fschwabi, Narosa Publishing House, New Delhi.
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

- Understand the basic knowledge of generalized curvilinear coordinates and of various differential equations.
- Learnt the various numerical techniques useful for the scientific data analysis.
- Understand applications of various differential equations and solve certain special physical problems.
- Understand concept of Langrangian Formulation, properties of angular momentum and Euler's equation of motion.
- Get sufficient knowledge of Schrodinger equation, Degeneracy, Eigenvalue problem and Momentum eigen functions. Also knows about Physical interpretation of Eigen values, Eigen function.

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CBCS - Semester - Grading Pattern

B. Sc. Semester - V

PHYSICS SYLLABUS (Effective from June-2022)

CC: PHY-502

STATISTICAL MECHANICS, SOLID STATE PHYSICS & PLASMA PHYSICS

Course Objectives:

- To create awareness about various application of Statistical Mechanics, with knowledge of chemical potential as well as potential energy.
- To provide an exposure to Drude model, Sommarfeld model, Hall co-efficient.
- To create awareness about applications to plasmons, Polaritons and Polarons.
- To learn characteristics of plasma in magnetic field and get sufficient knowledge of various application of plasma. .

UNIT- I STATISTICAL MECHANICS

(a) Some Application of Statistical Mechanics:

Rotating Bodies (6.1), The Probability Distribution for Angular Momenta and Angular Velocities of Rotation of molecules (6.2), Thermodynamics (6.3), Reversible and Irreversible processes (6.3.1), The Laws of Thermodynamics (6.3.2) ((i) Zeros (ii) First Law (iii) Second Law (iv) Third Law), Statistical interpretation of the basics thermodynamic variables (6.4) & (6.4.1 to 6.4.8), Physical Interpretation of α (6.5), Chemical Potential in the equilibrium state (6.6), Thermodynamic functions in terms of grand partition function (6.7), Ideal gas (6.8), Gibbs's Paradox (Inclusive Sackur-Tetrode equation) (6.9), The Equipartition Theorem (6.10), The Statistics of Para magenetism (6.11), Potential Energy of a Magnetic Dipole in a Magnetic Field (6.11.1), Curle's Law (6.11.2), Thermal Disorder in a Crystal Lattice (6.12), Non-Ideal Gases (6.13).

Related Examples, Problems & Short Questions

Basic Reference :*Fundamentals of Statistical Mechanics by B. B. Laud. (Second edition) New Age International Publisher*

Other Reference:

1. Statistical Mechanics and Properties of Matter by E.S.R.Gopa
2. Statistical Mechanics by B K Agarwal & Melvin Eisner, Wiley Eastern
3. Statistical Mechanics - Theory and Application by S K Sinha, TMHPub Co.Ltd. New Delhi
4. Statistical Mechanics by R K Pathariya, Pegramon Press

UNIT-II SOLID STATE PHYSICS

(a) Free Electron Theory of Metals:

The Drude Model (6.1), Electrical Conductivity of Metals (6.1.1), Thermal Conductivity of Metals (6.1.2), Lorentz Modification of the Drude Model (6.2), The Fermy-Dirac (F.D.) Distribution Function (6.3), The Sommerfeld Model (6.4), Density of States(6.4.1), The Free Electron Gas at 0° K (6.4.2), Energy Of Electron at 0° K (6.4.3), The Electron Heat Capacity (6.5), The Sommerfeld Theory of Conduction in Metals (6.6), The Hall Co-efficient(R_H) (6.6.1).Mathiessen's Rule (6.7).

Related Examples, Problems & Short Questions

(b) Application to Plasmons, Polaritons and Polarons:

(Note: Qualitative description of dielectric constant $\epsilon(W)$ should be given equation 10.45 and 10.49)

Dielectric Losses (10.6), Optical Phenomena (10.7), Application to Plasma(10.8), Plasma Ossilations(10.8.1), Transeverse Optical Mode in Plasma(10.8.2), Application to Optical Phonon Modes in Ionic Crystals(10.9), The Longitudinal Optical Mode(10.9.1), Transeverse Optical Mode(10.9.2), The Interaction of Electromagnetic Waves with Optical Modes(10.10), Application to the Motion of Electrons in Polar Crystals (10.11).

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

Other References :

1. Solid State Physics by A. J. Dekker.
2. Introduction to Solid State Physics by C. Kittel. 7th Edition, John Willy and Sons
3. Solid State Physics by S O Pillai (8th Edition), New Age Int. Publishers Limited
4. Fundamental of Solid State Physics by Saxena, Gupta, Saxena & Mandal, Pragati Prakashan

UNIT- III PLASMA PHYSICS

(a) Characteristics of a Plasma in a Magnetic Field:

Description of Plasma as a Gas Mixture (3.1), Properties of Plasma in Magnetic Field (3.2), Force on Plasma in Magnetic Field (3.3), Current in Magnetised Plasma (3.4), Diffusion in a Magnetic Field (3.5), Collisions in Fully Ionized Magneto-Plasma (3.6), Pinch Effect (3.7), Oscillations and Waves in The Plasma (3.8), Plasma Frequency (3.8.1), Maxwell's Equation in a Homogenous Plasma (3.8.2), Electromagnetic or Transeverse Oscillations (Steady Applied Magnetic Field $\overrightarrow{B_a}$=0) (3.8.3), Electrostatic or Longitudinal Oscillations ($\overrightarrow{B_a}$=0) (3.8.4), Oscillations of the Plasma ($\overrightarrow{B_a}\neq$0) (3.8.5), Hydromagnetic Waves (3.8.6), Resonances and Cut-offs or Reflection Points(3.8.7)

Related Examples, Problems & Short Questions

(b) Applications of Plasma:

Controlled Thermonuclear Reactions (7.1), Lawson Criterion (7.1.1), The Coulumb Barrier (7.1.2), Heating and Confinment of the Plasma (A) - Pinch Devices: Z-Pinch and θ- pinch, (B)- Mirror

Machine, (C)- Stellarator, (D)- Tokamak, (E)- levitrone, (7.1.3), Radiation loss of energy (7.1.4), Magneto Hydrodynamic conversion of energy (7.2), Plasma Propulsion (7.3), Other plasma devices (7.4).

Basic Reference: *Elements of Plasma Physics by S. N. Goswami New Central Book Agency (P). Ltd. Calcutta.reprint2011.*

Other References :

1. Introduction to Plasma Physics by F.F.Chen. PlenumPress.
2. Plasma Physics by S. N. Sen, Pragati Prakashan, Meerut.

Learning Outcome:

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

- Various application of Statistical Mechanics and sufficient knowledge of chemical potential as well as potential energy.
- Also earn sufficient knowledge about Thermodynamic functions in terms of grand partition function, Ideal gas, Gibbs's Paradox and The Equipartition Theorem.
- Drude model, Sommarfeld model, Hall co-efficient. Also aware about applications to plasmons, Polaritons and Polarons.
- Characteristics of plasma in magnetic field and get sufficient knowledge of various application of plasma.
- Plasma frequency, Oscillations of plasma, electromagnetic (Transeverse) oscillations

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CBCS - Semester - Grading Pattern

B. Sc. Semester-V

PHYSICS SYLLABUS (Effective from June-2022)

CC: PHY-503

NUCLEAR PHYSICS & MOLECULAR SPECTRA

Course Objectives:

- To make students aware of properties of Nucleus and also familiarize and acquaint Rutherford scattering as well as estimation of Nuclear size.
- To learn different types of spectra and decay of alpha, Beta and Gamaa rays.
- To provide an exposure to Liquid drop model of a nucleus, Nuclear Energy and various Elementary particles
- To learn characteristics of Types of Molecular Energy and Molecular Spectra
- To get sufficient knowledge of Rotational Spectra and Salient Features of Vibrational-Rotational Spectra

UNIT - I NUCLEAR PHYSICS : THE NUCLEUS

(a) Part – I Constituents of the Nucles and Some of Their Properties

Introduction (4.I.1), Rutherford Scattering and Estimation of the Nuclear Size (4.I.2), Measurement of Nuclear Radius (4.I.3), Constituents of the Nucleus and their Properties.(4.I.4).

Part – II Alpha Rays : Spectra and Decay

Range of Alpha Particles (4.II.1), Disintegration energy of Spontaneous Alpha-Decay (4.II.2), Alpha-Decay Paradox-Barrier Penetration(4.II.3).

(b) Part – III Beta Rays : Spectra and Decay

Introduction (4.III.1), Continuous Beta ray spectrum-Difficulties in understanding it (4.III.2), Pauli's Neutrino Hypothesis (4.III.3), Fermi's theory of Beta-dacay (4.III.4), The Detection of Neutrino (4.III.5).

Part – IV Introduction of Gamma(γ) Emission:

Introduction (4.IV.1), Gamma(γ)-ray emission - selection rules (4.IV.2), Internal conversion (4.IV.3). Nuclear Isomerism (4.IV.4).

Related Examples, Problems & Short Questions

Basic Reference :

Nuclear Physics (An Introduction) by S. B. Patel, New age international publishers (second Edition)

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Other References :

1. Nuclear Physics by D C Tayal, Himalaya Publishers.
2. Nuclear Physics by Irvin Kaplan
3. Introduction to Nuclear Physics by H Henge, Addition Wesley.

UNIT-II NUCLEAR PHYSICS

(a) The Liquid drop model of a nucleus

Introduction (5.1), Binding Energies of Nuclei: Plot of B/A Against A (5.2), Weizsacher's Semi-Empirical Mass Formula (5.3), Mass Parabolas: Prediction of Stability Against β - Decay for Members of an Isobaric Family (5.4)

(b) Nuclear Energy

Introduction (6.1), Neutron Induced Fission (6.2), Asymmetrical Fission-Mass Yield (6.3), Emission of Delayed Neutrons by Fission Fragments(6.4), Energy Released in the Fission of ^{235}U (6.5), Fission of Lighter Nuclei (6.6), Fission Chain Reaction (6.7), neutron cycle in a Thermal Nuclear Reactor (6.8), Nuclear Reactors (6.9)

Related Examples, Problems & Short Questions

Basic Reference :

Nuclear Physics An Introduction by S. B. Patel, Willey Eastern Ltd. ***{For a and b}***

(c) Elementary Particles:

Interaction and Particles (13.1), Leptons and Hadrons (13.1.1), Leptons (13.2), Neutrino and Antineutrino (13.2.1), Other Leptons (13.2.3), Hadrons (13.3), Quarks (13.5)

Basic Reference :

Concepts of Modern Physics by Arthur Beiser, S. Mahajan, S R Choudhury ***{For c}***
(Seventh Edition) McGraw Hill Education

Other References :

1. Nuclear Physicsby D C Tayal, Himalaya Publishers.
2. Nuclear Physics by Irvin Kaplan
3. Introduction to Nuclear Physicsby H Henge, Addition Wesley.

UNIT-III MOLECULAR SPECTRA

(a) Types of Molecular Energy and Molecular Spectra :

Separation of Electronic and Nuclear Motion: the Born Oppenheimer Approximation (17.1), Types of Molecular Spectra (17.2), Types of Molecular Energy States and Associated Spectra(17.3)

(b) Pure Rotational Spectra :

Salient Features of Rotational Spectra (18.1), Molecular Requirement for Rotational Spectra (18.2), Experimental Arrangement (18.3), The Molecule as a rigid Rotator: Explanation of

Rotational Spectra (18.4), The Non-rigid Rotator (18.5), The Isotope Effect (18.6).

(c) Vibrational – Rotational Spectra :

Salient Features of Vibrational-Rotational Spectra (19.1), The Molecule as a Harmonic Oscillator (19.2), Anharmonic Oscillator (19.3), Vibrational Frequency and Force Constant for Anharmonic Oscillator (19.4), Isotope effect on Vibrational Levels(19.5)

Related Examples, Problems & Short Questions

Basic Reference: *Atomic & Molecular-Spectra by RajKumar, KedarNathRamNath, Delhi.*

Other References:

1. Molecular spectroscopy by Herz-Berg.
2. Molecular spectroscopy by Banewell
3. Atomic Physics by J B Rajam (7th Edition) S. Chand publication, Delhi
4. Elements of spectroscopy by S L Gupta, V Kumar, R C Sharma, (30th Edition) Pragati Prakashan

Learning Outcome:

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

- Properties of Nulceus also Rutherford scattering as well as estimation of Nuclear size.
- Different types of spectra and decay of alpha, Beta and Gamaa rays.
- Liquid drop model, Nuclear Energy and Fission of Lighter Nuclei and Fission Chain Reaction
- Various Elementary particles like Leptons Hadrons, Neutrions, Antineutrions, Hadrons and Quarks
- Characteristics of Molecular Energy and Molecular Spectra
- Rotational Spectra and Salient Features of Vibrational-Rotational Spectra and applications

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

CBCS - Semester - Grading Pattern

B.Sc.Semester-V

PHYSICS SYLLABUS (Effective From June-2022)

CC: PHY-504

ELECTRONICS & COMPUTER

Course Objectives:

- To provide deep knowledge of Network Transmission and various type of network sections.
- To make students aware about Thyristor and Optoelctric Devices like Triac, Diac, LDR, Solar cell. To learn applications of LDR, Characteristics of Solar cell and of LASER.
- To get sufficient knowledge of basic Transistor amplifier, Multistage amplifier and Regulated power supply.
- To learn about computer, executing a C Program and programming style.
- To provide an exposure to programming C.

UNIT – I

(a) Network Transformations:

Principle of duality (1.3), Reduction of Complicated network (1.4), Conversions between T and π sections (1.5), The bridged-T network (1.6), The Lattice Network (1.7), The Reciprocity theorem (1.9), The compensation theorem (1.12), Driving point impedance, transfer impedance (1.14), The parallel-T network (1.17).

Basic Reference *: Networks, Lines and Fields by J. D. Ryder Prentice Hall.*

(b) Thyristors and Optoelectronic Devices :

Introduction to Thyristors, Triac (2.51), Diac (2.52),
Introduction to Optoelectronic Devices (3.1), LDR (Light Dependent Resistor) or Photo-Conductive Cell (3.2), Applications of LDR (3.3), Photo-Transistor (3.5), Photovoltaic or Solar Cells: construction, working, Characteristic and Efficiency of Solar cell(3.6), Lasers (3.8), Laser Action (3.9), Spontaneous and Stimulated Emission Probabilities and Condition of Population Inversion (3.10), P-N Junction Laser Diode (3.11).

Related Examples, Problems & Short Questions

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

UNIT - II

(a) Basic Transistor Amplifiers:

Current and Voltage amplifiers (6,10), Common Emitter Amplifiers with Emitter Resistor (6.11), Simplified Common Emitter Hybrid Model (6.12), (6.12.1, 6.12.2), Effect of An Emitter Bypass Capacitor in low frequency Response (6.13)

(b) Multistage Amplifiers :

Multistage Transistor Amplifiers (General) (7.1), Terms used in Multistage Transistor Amplifiers (7.1.1), R-C- coupled Amplifiers (7.2), Middle Frequency Range (7.2a), Low Frequency Range and Lower Cut-off Frequency (7.2b) Transformer Coupled Amplifiers (7.4, a, b), Direct coupled Amplifiers (7.5), Effect of cascading on Band width (7.6).

Related Examples, Problems & Short Questions

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

UNIT - III

(a) Overview of C :

History of C (1.1), Importance of C (1.2), Sample Program: Printing a Message (1.3), Basic Structure of C Programs (1.8), Programming Style (1.9), Executing a C Program (1.10).

(b) Constants, Variables & Data Types: (**Programming in C)**

Introduction (2.1), Character Set (2.2), C Tokens (2.3), Keywords and Identifiers (2.4), Constants (2.5), Variables (2.6), Data Types (2.7), Declaration of Variables (2.8), Declaration of Storage Class (2.9), Assigning Values of Variables (2.10), Defining Symbolic Constants (2.11), Declaring a Variable as Constant (2.12), Declaring a Variable as Volatile (2.13), Overflow and Underflow of Data (2.14).

Basic Reference : *Programming in ANSI C by E.Balaguruswami (THM) (3rd Edition)*

(c) Regulated dc power supply

Introduction to regulated power supply, Transistor Series voltage Regulator (25.2.), Negative Feedback Voltage Regulator (25.3), Transistor Shunt Regulator (25.4), Transistor Current Regulator (25.5),

Related Examples, Problems & Short Questions

Basic Reference :

Electronics and Radio Engineering by M. L. Gupta. 9th Enlarged Edition reprint 2002. Dhanpat Rai Publication Co.

Other Reference :

1. Electronic Devices and Circuits by Mottershead Prentice Hall
2. Integrated Electronics by Millimum & Halkias
3. Basic Electronics and Linear Circuits by N N Bhargava, D C Kulshreshtha, S C gupta

Learning Outcome:

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

- The Network Transmission and various type of network sections like T and π sections, the bridged -T network and the Lattice Network.
- Triac, Diac, LDR, Solar cell. To learn applications of LDR, Characteristics of Solar cell and of LASER.
- Basic Current and Voltage amplifiers, Common Emitter Amplifiers with Emitter Resistor and Simplified Common Emitter Hybrid Model. Also Multistage amplifier (R-C- coupled Amplifiers) and Regulated power supply.
- About computer, executing a C Program, programming style and programming C.

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CBCS - Semester - Grading Pattern

B.Sc. Semester-V

PHYSICS SYLLABUS (Effective From June-2022)

LABORATORY EXPERIMENTS

Course Objectives:

- To gain practical knowledge by applying the experimental method to correlate with the Physics theory.
- To provide hands on experience with equipments such as CRO, GM counter, spectrometer, Goniometer, electronic circuits.
- To learn the usage of electrical and optical systems of various measurements.
- To impart practical knowledge by performing experiments based on the principles of theory courses.
- To provide training how to analyze the experimental data and graphical analysis.
- To develop intellectual communication skills and discuss the basic principles of scientific concepts in the group.

PC: PHY-501

1. Acceleration due to gravity (g) using Kater's pendulum(with **MOVABLE** knife edges)
2. Determination of Thermal conductivity 'K' of a rubber tube.
3. I-V Characteristic of solar cell and determination of FF, V. F.& η
4. Velocity of sound in air using CRO
5. G.M. Counter (Plateau Characteristics)

PC: PHY-502

1. Refractive index ' μ ' by total internal Reflection method using Gauss eyepiece
2. Resolving power of grating
3. To study absorption spectra of Iodine gas molecule
4. Goniometer (Determine of Cardinal points)
5. To study absorption spectra of liquid($KMnO_4$)

PC: PHY-503

1. Comparison of capacity (C_1/C_2) using method of mixture
2. Measurement of frequency f and phase difference 'θ' of a.c wave using CRO
3. Calibration of magnetic field
4. Solenoid Inductor (Fixed Current of Secondary Coil)
5. e/m Thomson method

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PC: PHY-504

1. A study of transistorized Hartley Oscillator using CRO/Wavemeter
2. I/P and O/P impedance of a R-C CE amplifier at different frequency using VTVM/CRO
3. A study of Transformer coupled Amplifier using VTVM/CRO
   (voltage gain frequency response and bandwidth)
4. Diac characteristics
5. Characteristic of SCR

Learning Outcomes:

By 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 operational details of CRO, GM counter, spectrometer, electronic circuits etc.
- The experimental design aspects to determine various properties of like gravity, Thermal conductivity, Refractive index, determination of R, analysis of absorption spectra, value of e/m etc.
- The process to analyze the observations and infer the outcome of the experiments.
- How to analyze the experimental data and graphical analysis.

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

CBCS - Semester - Grading Pattern

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

(In force from June 2022)

ES : PHY-07: INSTRUMENTS

Course Objectives:

- To gain deep knowledge of principle, construction, working process of M I.
- To provide hands on experimental aspect to measurement of wavelength and determination of thickness of thin transparent sheet as well as refractive index.
- To develop knowledge of B.C. as well as CRO and usage of it.
- To learn the usage of GM counter and working function of it.

UNIT I

Michelson's Interferometer (15.7) Principle, Construction, Working, Circular fringes, Localized fringes, White light fringes, Visibility of fringes(15.7.1 to 15.7.7), Applications of Michelson Interferometer (15.8)-Measurement of wavelength, Determination of difference in the wavelengths of two waves, Thickness of a thin transparent sheet, Determination of the refractive index (15.8.1 to 15.8.4)
Babinet Compensator (20.21):Construction (20.21.1), Production of polarized light (20.21.2), analysis of elliptically polarized light (20.21.3).

UNIT-II

C.R.O.: CR Tube (3.5), Electrostatic Deflection Sensitivity (3.5.1), Magnetic Deflection Sensitivity (3.5.2), CRT connections (3.5.3), Uses of C.R.O.(3.5.4)
G. M. Counter: Principle, Construction, Working, Dead time, recovery time, True counting rate, Efficiency of counting, Quenching of G M counter, Operation and testing of G.M. counter, Plateau, Applications of GMC, Advantages and limitations of GMC.

Basic references:

1. A Textbook of Optics by Dr. N. Subrahmanyam, Brijlal & Dr.M. N.Avadhanulu, S.Chand (for M.I, B.C.)
2. Hand Book of Electronics by Gupta and Kumar. 30th revised Edition 2002.(for CRO)
3. Refresher Course in Physics Vol-III, S. Chand & Co. Ltd.(7th edition-2006) (for GMC,Ch-28)

Learning Outcomes:

By the end of the course, the students will be able to understand..

- Principle, construction, working process of M I.
- The technique of measurement of wavelength and determination of thickness of thin transparent sheet as well as refractive index.
- The principle, working function and usage of B.C. as well as CRO.
- The usage of GM counter and working function of it.

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CBCS - Semester - Grading Pattern
B. Sc. :: PHYSICS :: SEMESTER-V

ES : PHY-08: ENERGY TECHNOLOGY

Course Objectives:

- To gain deep knowledge of Fundamentals and Applications of Solar Energy.
- To learn the Merits and Limitations of Solar energy conversion and utilization.
- To develop knowledge of Solar energy from satellite station through microwaves to Earth station.
- To provide an exposure to Solar photovoltaic systems: V-I characteristics of a solar cell.

UNIT – I

Fundamentals and Applications of Solar Energy

Introduction (3.1), Applications (3.2), Essential subsystems in a Solar energy plant (3.3), Solar energy chains (routes) and their prospects (3.4), Terms and definitions of some basic entities (3.4.a.), Units of solar power and solar energy (3.5). Merits and Limitations of Solar energy conversion and utilization (3.6), .Energy from the Sun (3.10), Solar constant (3.11).

UNIT- II

Solar Energy Conversion Systems and Thermal Power Plants:

Solar thermal power supply system for space station (4.18), Solar energy from satellite station through microwaves to Earth station (4.19), Solar thermoelectric power (4.20). Solar photovoltaic systems: V-I characteristics of a solar cell (5.6), Inter connections of solar cell (5.7), Efficiency of solar cell (5.8).

Basic Reference:

Energy Technology by S. Rao and Dr. B. B. Parulekar. Khanna Publ., Delhi. 1st edition 1985

Learning Outcomes:

By the end of the course, the students will be able to understand.

- The fundamentals and Applications of Solar Energy.
- Merits and Limitations of Solar energy conversion and utilization.
- The Solar energy from satellite station through microwaves to Earth station.
- The Solar photovoltaic systems and V-I characteristics

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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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HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

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

Sr.	Paper Code	Name of Paper	Credit
1	CC CH-501	INORGANIC CHEMISTRY-I	3
2	CC CH-502	ORGANIC CHEMISTRY-II	3
3	CC CH-503	PHYSICAL CHEMISTRY-III	3
4	CC CH-504	STRUCTURAL -ANALYTICAL CHEMISTRY-IV	3
5	SE CH -505 A	SYNTHETIC DYES	2
	SE CH -505 B	SPECTROPHOTOMETRY	
6	GE CH 506	ELECTIVE (GENEIC) COURSE	2
7	LC CH-507 A	LABORATORY COURSE-I INORGANIC CHEMISTRY PRACTICALS	1.5
	LC CH-507 B	LABORATORY COURSE-II ORGANIC CHEMISTRY PRACTICALS	1.5
	LC CH-507 C	LABORATORY COURSE-III PHYSICAL CHEMISTRY PRACTICALS	1.5
	LC CH-507 D	LABORATORY COURSE-IV VIVA -VOCE	1.5

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HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY

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N. Gujarat. INDIA.

NAAC Accreditation Grade – "B"

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www.ngu patan.org

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. (Ask Questions from Unit-1,2 and 3 With Equal Sharing.)	18 Marks

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B. Sc. Chemistry

Semester : V

Inorganic Chemistry

Paper : CC CH-501

UNIT -I: Reaction Mechanism of Coordination Compounds

- Substitution reaction of square plannar complexes
- Reaction of Platinum Il complexes, the trans effect, theories of trans effect, use of synthesis in trans effect and analysis
- Substitution reaction in octahedral complexes, Possible mechanism reactions, Ligand displacement reaction in octahedral complexes, acid hydrolysis, Base hydrolysis
- Electron transfer reaction, mechanism of redox reaction, mechanism of substitution in square plannar complexes

UNIT- II : Organo Metallic Compounds

- Definition
- Types of O.M.C.
- Classification
- Nomenclature of O.M.C
- Structure and bonding in dihapto and metal olifines complexes. e.g. Ziese's salt complexes, ferrocine structure
- O.M.C. of Li and Al complexes

UNIT- III : Corrosion

- Principle of corrosion
- Types of corrosion
- (I) Wet corrosion
- (II) Dry corrosion
- (III)Galvanic corrosion
- (IV) Atmospheric corrosion
- (V) Pitting corrosion
- (VI) Inner granual corrosion
- (VII) Dezincfication
- Prevention of corrosion: Inhibitors- Definition, type and use of inhibitors.

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 : V

Organic Chemistry

Paper : CC CH-502

UNIT-I : Stereochemistry

- Conformational analysis of mono and di substituted cyclohexanes
- Molecular asymmetry as illustrated by allenes and diphenyls
- Isomerism of oximes.
- Determination of geometrical isomerism of Aldoxime.
- Determination of geometrical isomerism of Ketoxime(Beckmann's transformation)

UNIT- II

(A) Carbohydrates

- Introduction of Disaccharides
- Structure determination of
  (1) Sucrose
  (2) Maltose
  (3) Lactose

(B) Isoprenoids

- Classification
- General methods of structure determination
- Isoprene rule
- Contitution of Citral, α-Terpeneol and Camphor with their synthesis

UNIT- III : Nucleophilic substitution at saturated carbon atom

- The reaction mechanism
- Mechanism of SN^1 and SN^2 reactions
- Stereochemistry of reaction SN^1 and SN^2 reactions
- Relative reactivity in substitution
- Solvent effect variation at carbon site
- Relative leaving group activity
- Neighboring group participation
- Competitive reactions. Elimination E_1, E_2 and E_{1cb} mechanisms

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Books Suggested (Organic Chemistry):

1. Organic chemistry by Morrison & Boyd Vth Edition
2. Advance organic chemistry by R.K.Bansal.
3. Organic chemistry by I.L.Finar Vol. l &.Il Vth Edition
4. Organic chemistry by pine, Hendrikson, Cram and Hammond IVth edition...
5. Outline of chemical technology by Dryden IInd Edition
6. Synthetic organic chemistry by Gurdeep R Chatwal.
7. Advanced organic chemistry by Jerry March.
8. Organic reactions and their mechanisms IInd edition by P.S. Kalsi.
9. Stereo chemistry: conformation and mechanism VIth edition by P.S.Kalsi.
10. Organic chemistry of natural product Vol: I & Il by Gurdeep R. Chatwal.
11. Advanced organic chemistry by Arun Bahal and B.S. Bahal.
12. Organic chemistry Vol, I, II, III by S.M.Mukherjee, S.P.Singh, R.P.Kapoor.
13. Stereo Chemistry by Nasipuri.
14. Advanced Organic Chemistry by L.D.S. Yadav & Jagdambasingh, Pragati prakashan

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B. Sc. Chemistry

Semester : V

Physical Chemistry

Paper : CC CH-503

UNIT-1: Electro Motive Force

- Introduction of Terms
  - Oxidation, Reduction, Redox, Anode, Cathode
  - Electrode, Half cell
  - Oxidation & Reduction Potential
  - Galvanic cell
  - Chemical Cell
  - Electro Chemical Series
  - Nearnst Equstion
- Without Transference with Transference Verification of
- Concentration cell and it's EMF equation.
- Electrolyte concentration cell
  Concentration cell without transference, Concentration cell with transference
- Electrode concentration cell
- Liquid -Liquid junction potential

❖ Application of EMF measurements Determination of

- Degree of hydrolysis of salt Solubility of sparingly soluble salt
- Stability constant of complex
- Equilibrium constant
- pH
- Ionic constant of water
- Dissociation constant of weak acid,
- Numericals

UNIT:-II: Thermodynamics

- Zeroth law of thermodynamics
- Absolute temperature scale
- Nernst heat theorem
- Third law of thermodynamics
- Determination of absolute entropy
- Experimental verification of third law
- Entropy change in chemical reactions.
- Fugacity and Activity
  - The concept of Activity & Activity Coefficient
  - Determination of Fugacity of Gas
  - Fugacity of a gas in a gaseous mixture
  - Fugacity of a Liquid Component in a Solution
  - Physical Significance of fugacity

- Concept of Fugacity and determination of Graphical Method & Approximation method
- Numerical

UNIT- III: The Colloidal State

- Introduction
- Types of Colloidal System
- Classification of Colloids
- Difference between True Solutions, colloidal solution and suspension.
- Preparation of Colloidal Solutions.
  (a) Dispersion Methods.
  (b) Condension Methods.
- Purification of Colloidal Solutions.
  (a) Dialysis
  (b) Ultra-filtration.
- Properties of Colloidal solution.
  (i) Physical
  (ii) Colligative
  (iii) Optical
  (iv) Kinetics
  (v) Electrical
  (vi)Electro kinetics properties (Zeta potential)
- Electro phoresis
- Electro Osmosis
- Stability of Colloid (Rule of Schulze Hardy)
- Gold number
- Donan membrane equilibrium and calculation of molecular Weight
- Gels and Emulsion
- Foams, Theory of Foamstability, Antifoamers.
- Importance and applications of Colloids

Books Suggested (Physical Chemistry):

1. Advance Physical Chemistry by Gurdeepraj.
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.

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B. Sc. Chemistry

Semester : V

Structural - Analytical Chemistry

Paper : CC CH-504

UNIT:-I: Symmetry of molecules

- Symmetry elements & symmetry operations
- Multiplications of symmetry operations
- Multiplication table for C_{2v}, C_{3v}, C_{2h} point groups only
- Classification of schoonflies point groups
- Determination of schoonflies point groups natations
- Symmetry & optical activity
- Symmetry property of orbital's for C_{2v}, C_{3v}, C_{2h} point groups

UNIT- II : NMR spectroscopy

- Introduction
- Proton magnetic resonance (1H NMR) spectroscopy
- Equivalent and non equivalent protons
- Enantiotopic and Diastereotopic Protons
- Nuclear shielding & de-sheilding
- Chemical shift & molecular structure
- Intensity of Signals
- Spin-spin splitting and coupling constant
- Simplification of Complex spectra
    - Double Resonance
    - Deuterium labeling
- NMR Based Examples by Using Spectral Data

UNIT:- III : Acid-Base titration

- Construction of titration curves (Neutralization of weak acid by strong base and weak base by strong acid only)
- Neutralization of polyprotic acid (Dibasic and tribasic acid only) by strong base
- Analysis of Soda Ash
- Titration of Boric acid
- Indicators, Mechanism of Indicators
- Gran's plot
- Buffer Solution, buffer level, buffer range & buffer capacity
- Numericals

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 9 4–2013
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 Vlth edition by P.S.kalsi
9. Organic chemistry by Morrison and Boyd
10. Spectrometric identification of organic compounds IVth 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 : V

Synthetic Dyes

Paper : SE CH-505 A

UNIT :-1:

- Introduction
- Synthetic Dyes
- Chromophores, Chromogens, Oxochroms, Bathochromic shieft, Hypsochromic shieft
- Difference between Dyes and Pigments
- Classification of Dyes
  - According to constitution
  - According to method of coloring the fibres
- Optical Brightners

UNIT :- II : Synthesis and uses

- Congo Red
- Eosin
- Alizarin
- Crystal violet
- Indigo
- Sefronine -T
- Methylene Blue
- Ereochrom Black -T
- Rhodamine
- Rosanilin

References Books :

1. Synthetic Dyes by Venkatramanan
2. Synthetic Dyes by G.R.Chatwal
3. Synthetic Dyes and Drugs by O.P.Agrawal
4. Synthetic Dyes by O. D. Tyagi & M. Yadav
5. Sanshlesit Rangako, Granth Nirman Board

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B. Sc. Chemistry

Semester : V

Spectrophotometry

Paper : SE CH-505 B

Unit-I: - Spectrophotometry

- Introduction, Theory of spectrophotometry and colorimeter. Lambert-Beer's law, Application of Lambert-Beer's Law, Introduction to Colorimetry ,Instrumentation of colorimeter.
- Spectrophotometry: Wavelength selection by prism and diffraction grating, Radiation source, cells, data presentation, single-beam spectrophotometer, Double-beam spectrophotometers, Numericals

Unit-II: - Atomic Spectroscopy

- Introduction, Principle, Flame Emission Spectroscopy (FES) and Atomic adsorption Spectroscopy (AAS), Principal, comparison and applications, Burners (Total consumption burner and Premix burners).

Reference Books

1. Analytical Chemistry by G. D. Christian, et al , Wiley, 6th Ed.
2. Principles of Instrumental Analysis: Holler, Skoog, Crouch 6th Ed. Thomson Publication
3. Modern Analytical Chemistry, David Harvey, Mc-Graw Hill Higher education

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Hemchandracharya North Gujarat University, Patan
B. Sc. Chemistry
Semester : V
Laboratory Course
LC CH-507
(Inorganic, Organic, Physical Chemistry)

This syllabus is to be completed by assigning four laboratory session per week, each of Three periods. The number of students in the laboratory batch should not exceed fifteen (15) the medium of instruction will be English in laboratory course

Inorganic Chemistry practical

(A) Alloy

1) Brass alloy ------- Zn (Gravimetric) and Cu (Volumetric)
2) German silver alloy ------Ni (Gravimetric) and Cu (Volumetric)
3) Bronze alloy ------Sn (Gravimetric) and Cu (Volumetric)

(B) Synthesis by Convention Method

1) Ferrous sulphate or Green vitriol ($FeSO_4$ $7H_20$)
2) Sodium cobaltinitrate Na_3 $[Co(NO_2)_6]$
3) Tetra amine cupric sulphate
4) Hexa thio urea plumbous nitrate
5) Cuprous chloride

Organic Chemistry practical

(A) Qualitative Analysis (Minimum 08)

Analysis of an organic mixture containing two components using water, $NaHCO_3$, NaOH, HCl as a solvent for Separation /or using distillation process for separation and identification with the suitable chemical tests and preparation of suitable derivatives.

Soluble Components:- Oxalic Acid, Succinic Acid, Resorcinol, Urea, Thiourea
(Give water soluble compounds only in solid + solid mixture and water soluble components should not given with same natured compound's mixture)

Separation of two components from Organic Mixture Such as....
Solid-Solid ------Mixture
Solid- Liquid -------Mixture

Liquid-Liquid ------ Mixture

[Liquid component must be neutral in nature]

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Physical Chemistry practical

[A] Instruments: (Minimum 05)

1. To Determine the Normality and Amount of each acid in given mixture of XN ($HCl+CH_3COOH$) by PH metric titration using 0.1 N NaOH.
2. To Determine the Normality and Amount of each acid in given mixture of XN ($HCl+CH_3COOH$) by Potentiometry titration using 0.1 N NaOH.
3. To Determine the Normality and Amount of each acid in given mixture of XN ($HCl+CH_3COOH$) by Conductometry titration using 0.1 N NaOH.
4. To Determine the Solubility & Solubility product of Sparingly Soluble salt $PbSO_4$/$BaSO_4$ by Conductometry.
5. Determine the Concentration of Mn^{+2} ions and Cr^{+3} ions in in a given mixture of ($K_2Cr_2O_7$ + $KMnO_4$).
6. To Determine the Amount of Nickel in the given unknown solution by Colorimetric method.

[B] Chemical Kinetics & Adsorption:

7. To determine the order of reaction between $K_2S_2O_8$ and KI.
8. To determine the order of reaction between H_2O_2 and HI.
9. To study the adsorption of Acetic acid/Oxalic acid on animal charcoal and prove the validity of Freundlich Equation.

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B. Sc. Chemistry

Semester : V

Pattern of University Practical Exam

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

First Day

(A) Inorganic (50 marks)

-Estimation from Alloy (30 marks) and Inorganic Preparation (20 marks)

(B) Organic (50 marks)

- Qualitative analysis of an organic mixture.

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: Certified practical journal is compulsory for practical exam.**

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B. Sc. Chemistry

Semester : V

Suggested batch distribution for practical exam

First Day:

11:00am to 2:00pm	2:30pm to 5:30pm
Inorganic: A Organic: B Physical: C	Inorganic: B Organic: C Physical: A

Second Day :

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

Batch distribution (for maximum 30 students and 3 Examiners)

[Maximum 10 Students per each Examiner]

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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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HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY

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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.

B.Sc. (Mathematics) Semester-5

CC-MAT-501 Group Theory

UNIT-01:

Definition of a Group and Its applications , Elementary properties of a Group, Equivalent definitions of a Group, Generalized form of Associative Law, Finite Groups and their tables, Definition of a Subgroup and Its applications, Lagrange's theorem and its applications.

UNIT-02:

Definition of a Permutation and Its applications, Transpositions and cycle, Definition of a Normal subgroup and its applications, Quotient group, Definition of homomorphism of group and its applications, Kernel of Homomorphism.

UNIT-03:

Isomorphism between groups, Groups of order four and six, cyclic group and its Properties, Isomorphism of cyclic groups, Subgroup of a cyclic group, Generator of a cyclic group, Cayley's Theorem, Fundamental theorem of homomorphism.

The course is covered by the Book: **I H Sheth, Abstarct Algebra**, Prentice Hall of India (PHI) Publication. Chapter 6(6.1 to 6.7), Chapter 7(7.1 to 7.3), Chapter 8(8.1 to 8.3), Chapter 9(9.1 to 9.3), Chapter 10(10.1 to 10.2), Chapter 11(11.1 to 11.5), Chapter 12(12.1 to 12.6)

- **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.

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CC-MAT-502 Mathematical Analysis-I

Unit-01 Number System and Countability of set:
The real field to be developed by ordered set approach, Equivalence of this approach, extended real number system, The complex number system, Euclidean spaces. Finite, Countable and Uncountable sets

Unit-2 Basic Topology:
Metric space, Neighborhoods in metric spaces, Limit point of a set, Open, Closed, Bounded, Compact, Perfect, Connected and Convex subsets of metric spaces.

Unit-3 Sequences and Series:
Convergence sequence, Sub sequences, Cauchy sequences, Upper and lower limits, Special sequences and Series, Series of non negative terms, Roots and Ratio Test. Power Series with Real (Complex) terms, Interval (circle) of convergence and radius of convergence of a power series, Summation by parts, absolute convergence, addition and multiplication of series.

The course is roughly covered by Chapters 1,2,3 (Omit 3.52 to 3.55) 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-503-A DIFFERENTIAL EQUATIONS

Unit-01 Homogeneous linear equations with variable coefficients:
Method of solution, to find C.F., Symbolic notation in θ, definition of $\frac{1}{f(\theta)}X$ to find particular integral, particular case to find $\frac{1}{f(\theta)}x^n$, equations reducible to homogeneous linear equations,

Unit-02 Exact Differential equations and Equations of particular form:
Condition of Exactness of the linear differential equations, Solution of non-linear equations which are Exact, Equations of the form y(n)=f(x), Equations of the form y(2)=f(y), Equation do not contain y directly, Equation that do not contain x directly, Equation in which y appears in only two derivatives whose orders differ by two, Equation in which y appears in only two derivatives whose order differ by unity.

Unit-03 Linear Equation of 2nd order:

Method of solving y(2)+Py(1)+Qy=R when an integral included in the C.F. is known, Method of solving y(2)+Py(1)+Qy=R by changing the dependent variable, y(2)+Py(1)+Qy=R by changing the independent variable, Solution by factorization of the Operator, Method of variation of Parameters, Method of Undetermined Co-efficient.

- The course is covered by "**A text book of Differential Equations**", by N.M.Kapoor, Pitamber publication, New Delhi.
  [Chapters: 5, 6, 7]

- **REFERENCE BOOKS:**

1. Erwin Kreyszing, Advanced Engineering mathematics, By. John Wiley & Sons Inc. New York, 1999.
2. D.A.Murray, Introductory course on Differential Equations, By. Orient Longman,(India), 1967.
3. A.R.Forsyth, A Terastise on Differential Equations, Macmillan and Co.Ltd., London.
4. Ian N. Sneddon, Elements of partial Differential Equations, McGraw-ill Book Compony, 1998. H
5. Fracis B. Hilderbrand, Advanced Calculus for Application, Prentice Hall of India Pvt. Ltd., New Delhi, 1977.
6. Jane Cronin, Differential Equations, Marcel Dekkar, 1994.
7. Frank Ayres, Theory and Problems of Differential Equations, McGraw-Hill Book Compony, 1972.

CC-MAT-503-B Complex Analysis

UNIT-01 Complex Numbers:

Complex Numbers, its conjugates, and moduli, exponential form, basic algebraic and geometric properties, arguments of products and quotients, nth roots of complex numbers. Region in complex plane.

UNIT-02

Functions of complex variable, mappings, limits, Theorems on limits, limits involving the point at infinity, Continuity, derivatives, differentiation formulas, convergence of complex sequences and series.

UNIT-03

Cauchy-Riemann equations, sufficient conditions for differentiability, Cauchy-Riemann equations Polar coordinates form, Analytic functions, harmonic functions.

- **Textbook:** "**Complex Variables and Applications**" Fifth Edition, Ruel V. Churchill and James Ward Brown, Mc Graw Hill Publishing Company.

- **Reference Books :**

1. Complex variables and applications, by R. V. Churchill and J. W. Brown
2. Theory of functions of a Complex variables, by Shantinarayan, Chand & Co.
3. Complex variables, Introduction and applications, by Mark Ablowitz and A. S. Fokas, Cambridge University Press.

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CC-MAT-504-A Discrete Mathematics

UNIT-01:

Relations, Equivalence Relation, Equivalence classes or sets, Partial order Relations, Hasse Diagram, Upper and Lower Bounds, Minimal and Maximal elements ,Binary operations, closure operations, Partially Ordered Set, Totally Ordered Set, Lattices as Posets, Dual Lattice, Meet and Join, Lattice as an algebraic, structure, Direct Product Of two Lattices, Lattice Homomorphism, Lattice Isomorphism.

UNIT-02:

Sub-Lattice, Completed Lattice, Bounded Lattice, Distributive Lattice, Square Free Lattice, Complemented Lattice, Modular Lattice, De Morgan's Law, Boolean Algebra, Boolean Algebra of Switching Circuits, Sub Boolean Algebra, Homomorphism and Isomorphism of Boolean Algebras, Atoms, Unique representation Theorem, Properties Of Set of Atoms, Stone's representation Theorem.

UNIT-03

Boolean Variables, Boolean Expression, Min term, Max term, Representation of Boolean Expression as a sum of Product Canonical Form and as a Product of Sum Canonical Form, Boolean Function Associated With Boolean, Expression, Symmetric Boolean Expression, Representation of Boolean Functions And Minimization of Boolean Expression: Using Truth Table, Cube array Method, Karnaugh's Method, Circuit Diagrams.

- **REFERENCE BOOKS:**

1. An Introduction To Discrete Mathematics -Udayan M.Prajapati, Dr.Ajay S. Gor, Nirav Prakashan
2. Discrete Mathematical Structures with Applications to Computer Science by Trembley I.P.And Mahonar R.
3. Discrete Mathematical Structures With applications to Computer Science by R. Hamming and E.A. Feigenbaum
4. Discrete Mathematical Structures for Computer Science by B. Kolman and R.C.Busy
5. The Essence of Discrete Mathematics by Neville Dean
6. Discrete Mathematics and its Applications with Combinatorics and Graph theory, by – Kenneth H. Rosen, McGraw Hill -2007 7th Edition.

CC MAT-504-B Optimization Techniques

Unit-01

Introduction: Nature and scope of Operations Research, Linear programming: (a) Formulation of LPP, LPP Model and method of solution- Graphical method, Slack-Surplus and unrestricted variables, Simplex Algorithm, Simplex Method.

Unit-02

Artificial Slack variables, Two phase method, Big-M / Penalty method, Variation in simplex method solution- unbounded, infeasible solutions and concept of degeneracy.

Unit-03

(a) Duality Theory:

The essence of duality theory, primal-dual relationships, Duality theorems, Dual simplex method.

(b) Integer Programming:

The need of integer solutions, The concept of the Cutting– Plane, Gomory's Cutting Plane Algorithm.

- **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-MAT-501 to 504

- **Objectives:**
  - Understand the MATLAB Desktop, Command window and the Graph Window.
  - Be able to do simple and complex calculation using MATLAB.
  - Understand the graphics capabilities of MATLAB
  - Be able to carry out mathematical computations using MATLAB Symbolic Toolbox

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PC-MAT-501 Introduction to MATLAB

Starting and ending MATLAB session, MATLAB environment, MATLAB help, types of files, search path, some useful MATLAB commands, data types, constant and variables, operators, built-in functions, assignment statement, illustrative programs.

Vectors and Matrices Scalars and vectors, entering data in matrices, line continuation, matrix subscripts/indices, multi-dimensional matrices and arrays, matrix manipulations, generation of special matrices, useful commands, matrix and array operations, function with array inputs.

PC-MAT-502 Polynomials

Entering a polynomial, polynomial evaluation, roots of a polynomial, polynomial operations - addition and subtraction, multiplication, division, formulation of polynomial equation, characteristic polynomial of a matrix, polynomial differentiation, integration, and curve fitting, evaluation of polynomial with matrix arguments.

PC-MAT-503 MATLAB Graphics

Two-dimensional plots, multiple plots, style options, legend command, subplots, specialized two-dimensional plots, three-dimensional plots.

PC-MAT-504 Symbolic Processing With MATLAB

Symbolic Expressions and Algebra, Algebraic and Transcendental Equations, Calculus, Symbolic Linear Algebra, ordinary and partial differential equation, Symbolic Tutors.

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

- **Coverage from the Text Book:**
  PCMAT-501 Chapter 1: 1.8, Chapter 2: 2.9 Chapter 3: 3.11
  PCMAT-502 Chapter 4: 4.13
  PCMAT-503 Chapter 6: 6.8
  PCMAT-504 Chapter 9: 9.3 only. Additional commands for symbolic toolbox are to be covered from the list given below.

Symbolic Math Toolbox

Functions for Creating and Evaluating Symbolic Expressions	
Class	Returns the class of an expression.
Digits	Sets the number of decimal digits used to do variable precision arithmetic.
Double	Converts an expression to numeric form.
Ezplot	Generates a plot of a symbolic expression.
ezplot3	3-D parametric plot
Ezpolar	plot a 2-D curve in polar coordinates
Findsym	Finds the symbolic variables in a symbolic expression.
numden	Returns the numerator and denominator of an expression.
Sym	Creates a symbolic variable.
Syms	Creates one or more symbolic variables.
Vpa	Sets the number of digits used to evaluate expressions.
Functions for Manipulating Symbolic Expressions	
Collect	Collects coefficients of like powers in an expression.
Expand	Expands an expression by carrying out jpowers.
Factor	Factors an expression.
poly2sym	Converts a polynomial coefficient vector to a symbolic polynomial.
Pretty	Displays an expression in a form that resembles typeset mathematics.
Simple	Searches for the shortest form of an expression.
Simplify	Simplifies an expression using Maple's simplification rules.
Subs	Substitutes variables or expressions.
sym2poly	Converts an expression to a polynomial coefficient vector.
Symbolic Calculus Functions	
Diff	Returns the derivative of an expression.
jacobian	Compute the Jacobian matrix.
Dirac	Dirac delta function (unit impulse).
Heaviside	Heaviside function (unit step).
Int	Returns the integral of an expression.
Limit	Returns the limit of an expression.
symsum	Returns the symbolic summation of an expression.
Taylor	Returns the Taylor series of a function.

Symbolic Linear Algebra Functions	
Det	Returns the determinant of a matrix.
Eig	Returns the eigenvalues (characteristic roots) of a matrix.
Inv	Returns the inverse of a matrix.
Poly	Returns the characteristic polynomial of a matrix.
Symbolic Tutors	
Arclen	Find the arclength of the curve.
composefun	compose two functions
dirdifftool	plot or animate directional derivatives
Eigtool	interactive matrix eigenvalues
gradtool	plot or animate gradient(s)
Linsys	plot a system of 2-D or 3-D linear equations
Ratfun	demonstrate the graphing of rational functions
Rsums	Riemann sum approximate integration tutor
taylortool	taylor approximation tutor

Assignment: The student should submit the electronic copy of 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:

5. **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.**
6. **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.**
7. Use also "PYTHON" Software instead of MATLAB Software.
8. ***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–MA-51 Theory of Equations

Unit-1 :

Relationships between roots and coefficients, Equations with real coefficients and imaginary roots, Equations with rational coefficients and irrational roots.

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Unit-2 :

Symmetric functions of roots, Formation of equations whose roots are given, Transformation of equations, Multiple roots. Method of least square approximation.

- **Reference Books :**
  1. Numerical Methods by Dr. V.N. Vedamurthy, Dr. N.Ch. S.N. Iyengar.
  2. Numerical Methods by S.K. Jain and S.R.K. Iyengar

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