



S-29 Nov., 2013 AC after Circulars from Circular No.55 & onwards

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[31]	B.Sc. Geology	Semester-III & IV,
[32]	B.A. Statistics with minor changes	Semester-I & II,
[33]	B.A. Statistics	Semester-III & IV,
[34]	B.Sc. Statistics with minor changes	Semester-I & II,
[35]	B.Sc. Statistics	Semester-III & IV,
[36]	B.Sc. Industrial Chemistry	Semester-III & IV,
[37]	B.Sc. Horticultural	Semester-I & II,
[38]	B.Sc. Dry land Agriculture	Semester-I & II,
[39]	B.Sc. Microbiology	Semester-III & IV,
[40]	M.Sc. Computer Science	Semester-I to IV,
[41]	M.Sc. Information Technology	Semester-I to IV.

हा सुधारीत व नवीन तयार केलेल्या अभ्यासक्रमाचा आराखडा शैक्षणिक वर्ष २०१४-१५ करिता मर्यादित असेल व विद्यापरिषदेच्या अंतिम मान्यतेनंतर हे परिपत्रक नियमित ठेवण्याबाबत या कार्यालयाद्वारे नवीन परिपत्रक पारीत करण्यात येईल. तसेच सुधारीत व नवीन तयार केलेल्या अभ्यासक्रमाची प्रत विद्यापीठाच्या संकेतस्थळावर उपलब्ध आहे.

करिता, या परिपत्रकाची सर्व संबंधितांनी नोंद घ्यावी.

विद्यापीठ प्रांगण,  
औरंगाबाद-४३१ ००४.  
संदर्भ क्र.एस.यु./सा.शा./सबवि /२०१३-१४/  
६५९९-७०२  
दिनांक :- २७-०५-२०१४.

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संचालक,  
महाविद्यालये व विद्यापीठ  
विकास मंडळ.

या परिपत्रकाची एक प्रत :-

- १) मा. परिक्षा नियंत्रक, परिक्षा विभाग,
  - २) मा. प्राचार्य, सर्व संलग्नीत महाविद्यालये,
  - ३) संचालक, युनिक यांना विनंती करण्यात येते की, सदरील अभ्यासक्रम विद्यापीठाच्या संकेतस्थळावर उपलब्ध करुण देण्यात यावेत.
  - ४) संचालक, ई-सुविधा केंद्र, विद्यापीठ परिसर,
  - ५) जनसंपर्क अधिकारी, मुख्य प्रशासकीय इमारत,
  - ६) कक्ष अधिकारी, पात्रता विभाग, मुख्य प्रशासकीय इमारत,
  - ७) कक्ष अधिकारी, बी.ए. / बी.एस्सी./ बी.सी.एस./एम.एस्सी. विभाग, परीक्षा भवन,
  - ८) अभिलेख विभाग, मुख्य प्रशासकीय इमारती मागे,
- डॉ. बाबासाहेब आंबेडकर मराठवाडा विद्यापीठ, औरंगाबाद.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,  
AURANGABAD.



**REVISED SYLLABUS**

**OF**

***B.Sc. Chemistry***  
***SECOND YEAR***  
***[Optional]***

**Third & Fourth Semester**

**[Effective for - June, 2014-15]**

**DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGBAD**  
**B.Sc. (Chemistry) IN SEMESTER PATTERN FOR THREE YEAR DEGREE**

YEAR	SEMESTER	PAPER NUMBER	PAPER TITLE	Hours	MARKS
First	I	Paper - I	Inorganic Chemistry	45	50
		Paper - II	Organic Chemistry	45	50
		Paper - III	Lab Course I	45	50
	II	Paper – IV	Physical Chemistry	45	50
		Paper – V	Inorganic Chemistry	45	50
		Paper – VI	Lab. Course – II	45	50
Second	III	Paper – VII	Organic Chemistry	45	50
		Paper – VIII	Physical Chemistry	45	50
		Paper - IX	Lab. Course-III	90	100
	IV	Paper – X	Inorganic Chemistry	45	50
		Paper – XI	Physical Chemistry	45	50
		Paper – XII	Lab. Course-IV	90	100
Third	V	Paper - XIII	Physical Chemistry	45	50
		Paper – XIV	Organic Chemistry	45	50
		Paper – XV	Lab. Course-V	90	100
	VI	Paper – XVI	Inorganic Chemistry	45	50
		Paper – XVII	Organic Chemistry	45	50
		Paper – XVIII	Lab. Course-VI	90	100

**B.Sc. Chemistry**  
(Three Year Degree Course)

<b><u>First Year</u></b>		<b><u>First Semester</u></b>
<b>Paper I</b>	<b>Inorganic Chemistry</b>	<b>(45 Hrs)</b> <b>3 Hrs. / Week</b>
I	Atomic Structure	<b>15 Hrs.</b>
II	Periodic Properties	<b>10 Hrs.</b>
III	S - Block Elements	<b>10 Hrs.</b>
IV	P - Block Elements	<b>10 Hrs.</b>
<b>Paper II</b>	<b>Organic Chemistry</b>	<b>(45 Hrs)</b> <b>3 Hrs / Week</b>
I	Structure and Bonding	<b>06 Hrs.</b>
II	Mechanism of Organic reactions	<b>10 Hrs.</b>
III	Stereo - Chemistry	<b>10 Hrs.</b>
IV	Alkanes	<b>04 Hrs.</b>
V	Alkenes	<b>06 Hrs.</b>
VI	Arenes and Aromaticity	<b>05 Hrs.</b>
VII	Alkyl and Aryl Halides	<b>04 Hrs.</b>
<b>Paper III</b>	<b>Lab Course I</b>	<b>(45 Hrs.)</b> <b>3 Hrs / Week</b>

**B.Sc. Chemistry**  
**(Three Year Degree Course)**

<b><u>First Year</u></b>		<b><u>Second Semester</u></b>
<b>Paper-IV</b>	<b>Physical Chemistry</b>	<b>(45 Hrs) 3 Hrs. / Week</b>
I	Mathematical Concepts	<b>06 Hrs.</b>
II	Gaseous State	<b>08 Hrs.</b>
III	Liquid State	<b>06 Hrs.</b>
IV	Solid State	<b>07 Hrs.</b>
V	Colloidal State	<b>08 Hrs.</b>
VI	Chemical Kinetics and Catalysis	<b>10 Hrs.</b>
<b>Paper-V</b>	<b>Inorganic Chemistry</b>	<b>(45 Hrs) 3 Hrs / Week</b>
I	Chemistry of Noble gases	<b>05 Hrs.</b>
II	Chemical Bonding	<b>20 Hrs.</b>
III	Nuclear Chemistry	<b>10 Hrs.</b>
IV	Theory of volumetric analysis.	<b>10 Hrs.</b>
<b>Paper-VI</b>	<b>Lab Course-II</b>	<b>(45 Hrs.) 3 Hrs / Week</b>

## **B.Sc. Chemistry (Three Year Degree Course)**

### **Second Year (Third Semester)**

<b>Paper VII</b>	<b>Organic Chemistry</b>	<b>Third Semester (45 hrs) 3Hrs / Week</b>
1	Alcohols	06 Hrs
2	Phenols	06 Hrs
3	Aldehydes and Ketones	10 Hrs
4	Carboxylic Acids	09 Hrs
5	Organic Compounds' of Nitrogen	14 Hrs
<b>Paper VIII</b>	<b>Physical Chemistry</b>	<b>(45 hrs) 3Hrs / Week</b>
1	Thermodynamics-I	15 Hrs
2	Thermodynamics-II	20 Hrs
3	Chemical Equilibrium	10 Hrs
<b>Paper IX</b>	<b>Lab Course III (Physical / Inorganic)</b>	<b>90 Hrs</b>

**Second Year (Fourth Semester)**

<b>Paper X</b>	<b>Inorganic Chemistry</b>	<b>Fourth Semester (45 hrs) 3Hrs / Week</b>
1	Chemistry of Elements of First Transition series	10 Hrs
2	Coordination compounds	10 Hrs
3	Chemistry of Lanthanides	06 Hrs
4	Chemistry of Actinides	05 Hrs
5	Acids and Bases	06 Hrs
6	Non Aqueous solutions	08 Hrs
<b>Paper XI</b>	<b>Physical Chemistry- II</b>	<b>(45 hrs) 3Hrs / Week</b>
1	Phase Equilibrium	15 Hrs
2	Electro-Chemistry-I	15 Hrs
3	Electro-Chemistry-II	15 Hrs
<b>Paper XII</b>	<b>Lab Course IV (Physical / Organic)</b>	<b>90 Hrs</b>



## B.Sc. (Second Year) (Third Semester)

### Organic Chemistry

### Paper VII

45 Hrs

#### 1) Alcohols:

06 Hrs.

Definition: *Monohydric Alcohols*: Methods of Formation by reduction of Aldehydes, Ketones, Carboxylic Acids and Esters (one e.g. each) Acidic Nature, Reactions of Alcohols.

*Dihydric Alcohols*: Method of Formation of Ethylene Glycol-industrial method and From Alkenes using  $\text{OsO}_4$ , Chemical Reactions of Ethylene Glycol-nitration, Acylation, Oxidation (Using  $\text{Pb}(\text{OAc})_4$  without Mechanism Pinacol-Pinacolone rearrangement, *Trihydric Alcohols*: Preparation of Glycerol from propane, Reactions of Glycerol.

#### 2) Phenols:

06 Hrs.

Preparation of Phenol from Chlorobenzene, Cumene and Benzene Sulphonic Acid, Physical properties, Acidic Nature of Phenol, Resonance stabilization of Phenoxide Ion. Reactions of Phenols-Electrophilic Aromatics Substitution, Acylation, Carboxylation (Without Mechanism) Reactions with Mechanism-intermolecular Fries Rearrangement, Claisen Rearrangement, Gattermann Synthesis and reamer Tiemann Reaction.

#### 3) Aldehydes and Ketones:

10 Hrs.

*Aldehydes*: Preparation of Aldehydes from Acid Chloride, Gattermann-Koch Synthesis *Ketones*-Preparation from Nitriles and from Carboxylic Acid, Physical Properties of Aldehydes and Ketones. Mechanism of Nucleophilic Additions to Carbonyl Group with particular emphasis on Benzoin, Aldol Knoenenagel condensations, Mannich Reactions. Use of Acetals as Protecting Group. Oxidation of Aldehydes using Chromium Trioxide, Baeyer-Villegger Oxidation of Ketones.

**4) Carboxylic Acids:**

**09 Hrs.**

Acidity of Carboxylic Acids, Effects of substituent's of substituents on Acid strength, preparation of Acetic Acid from  $\text{CO}_2$  from Nitriles, from Acid Chloride, Anhydride, Ester and Amide. Physical Properties and reactions of Carboxylic Acids-Synthesis of Acid Chloride, Ester and Amide, Hell-Volhard-Zelinsky Reaction. Reduction using  $\text{LiAlH}_4$ , Mechanism of Decarboxylation, hydroxyl Acids-Malic, Tartaric and Citric Acid. Methods of Formation and Chemical reactions of Acrylic Acid.

**5) Organic Compounds of Nitrogen:**

**14 Hrs.**

Preparation of *Nitroalkanes*. Nitration of Benzene and Their Reduction in Acidic, Neutral and Basic Media.

*Amines*-Basicity of Amines, Amine Salt as PTC. Preparation of Alkyl and Aryl Amines (Reduction of Nitro Compounds', Nitriles) Reductive Amination, Hoffmann Bromamide Reactions. Reactions of Amines-Electrophilic Aromatic Substitution in *Aryl amines*, Reactions of Amines with Nitrous Acid.

## B.Sc. (Second Year) (Third Semester)

**Physical Chemistry      Paper VIII      45 Hrs (3 Hrs/week)**

**1) Thermodynamics: I      15 Hrs.**

Definition: *of Thermodynamic Terms*: System, Surrounding types of system, intensive and extensive properties. Thermodynamic Process, Concept of heat and work. Work done in reversible and irreversible process, concept of maximum work ( $W_{max}$ ), Numerical Problems.

First law of Thermodynamics: Statement, Definition of Internal energy and Enthalpy.

Heat capacity, heat capacities at constant volume pressure and their relationship. Calculation of  $W, q, du$  and  $dH$  for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process, Numerical problems, Hess's law of heat Summation and its application.

**2) Thermodynamic-II:      20 Hrs.**

*Second Law of Thermodynamics*: Need for the law, different statement of the law Carnot Cycle and its efficiency, Numerical Problems. Carnot Theorem.

Concept of Entropy: Definition, Physical significance, Entropy as a State Function, Entropy change in Physical change, Entropy as criteria of Spontaneity & Equilibrium Entropy Change in Ideal Gases. Gibbs and Helmholtz Functions: Gibbs Function ( $G$ ) and Helmholtz Function ( $A$ ) as Thermodynamic Quantities.  $A$  and  $G$  as criteria for Thermodynamic Equilibrium and Spontaneity, their Advantage over Entropy change. Variation  $A$  with  $P, V$  and  $T$ .

**3) Chemical Equilibrium:      10 Hrs.**

Equilibrium Constant and Free Energy. Thermodynamic Derivation of Law of Mass Action. Le Chatelier's Principle. Reaction Isotherm and Reaction Isochore. Clapeyron Equation, Clausius-Clapeyron Equation and its Application.

**B.Sc. (Second Year)**  
**(Third Semester)**

**Lab Course-III**

**Paper IX**

**90 Hrs (6 Hrs/week)**

**Section A (Physical Chemistry)**

***Non Instrumental (Any Five)***

i.	To determine critical solution temperature of Phenol- water system.
ii.	To determine solubility of benzoic acid at different Temperature and determine H of dissolution process.
iii.	To determine heat of neutralization ( $\Delta H_n$ ) of Na OH and HCl
iv.	To determine heat of neutralization ( $\Delta H_n$ ) of Na OH and Acetic acid.
v.	Partition coefficient of Benzene-water system using benzoic acid.
vi.	To determine the equilibrium constant for the reaction: $KI + I_2 \rightleftharpoons KI_3$ .
vii.	Determine the molecular mass of polymer from viscometry measurements.
viii.	To investigate the Kinetics of iodination of Acetone.

**Section B (Inorganic Chemistry)**

***Gravimetric Estimation: (Any Three)***

i.	Estimation of Zinc gravimetrically as Zinc ammonium phosphate ( $ZnNH_4PO_4$ )
ii.	Estimation of Mn gravimetrically as Manganese Ammonium Phosphate ( $MnNH_4PO_4$ )
iii.	Estimation of Nickel gravimetrically as Ni-DMG
iv.	Estimation of Barium gravimetrically as Ba-Chromate ( $BaCrO_4$ )
v.	Estimation of Aluminum as Aluminum Oxinate.
vi.	To determine the equilibrium constant for the reaction: $KI + I_2 \rightleftharpoons KI_3$
vii.	Determine the molecular mass of polymer from viscometry measurements.
viii.	To investigate the Kinetics of Iodination of acetone.

***Complexometric Titration: (Any Two)***

i.	Estimation of Zinc by EDTA solution using EBT indicator.
ii.	Estimation of Nickel by EDTA using Murexide indicator
iii.	Estimation of copper by EDTA using fast sulphon black F indication
iv.	Estimation of Lead By EDTA using Xylenol Orange indicator.

## **B.Sc. (Second Year) (Fourth Semester)**

**(Inorganic Chemistry)      Paper X      45 Hrs (3 Hrs/week)**

**1) Chemistry of Elements of First Transition Series:      10 Hrs.**

General Characteristic features of d-block elements. Properties of the elements of the first transition series: Ionic Size, Atomic Size, Metallic properties, Ionization potential, magnetic properties, Oxidation State.

**2) Co-ordination Compounds:      10 Hrs**

Werner's Co-ordination Theory and its experimental verification effective atomic Number concept, chelates, nomenclature of co-ordination compounds, isomerism in co-ordination compounds, valence bond theory of transition metal complexes.

**3) Chemistry of Lanthanide Elements:      06 Hrs.**

Occurrence and Isolation of Lanthanides, Electronic Configuration Oxidation states, Ionic Radii, Lanthanide Contraction and its Consequences.

**4) Chemistry of Actinides:      05 Hrs.**

Occurrence, Position in the periodic table, Electronic configuration. Oxidation State, chemistry of separation of Np, Pu and Am from U

**5) Acids and Bases:      06 Hrs.**

Arrhenius, Bronsted-Lawry, The Lux-Flood, Solvent System and Lewis Concept of Acids and Bases

**6) Non- Aqueous Solvents:      08 Hrs.**

Physical Properties of a solvent, Types of Solvents and their general Characteristics, Reaction in Non-Aqueous Solvents with reference to liquid  $\text{NH}_3$  and liquid  $\text{SO}_2$ .

**B.Sc. (Second Year)  
(Fourth Semester)**

**Physical Chemistry-II      Paper XI      45 Hrs (3 Hrs/week)**

**1) Phase Equilibrium:      15 Hrs.**

Statement and Meaning of the Terms: *Phase, Component*, Degree of Freedom, Derivation of Phase Rule Equation. Phase Equilibria of the One Component System: Water System. Phase Equilibria of Two Components System: Solid-Liquid Equilibria, Simple Eutectic Pb-Ag. System Desilverisation of Lead.

Solid Solutions: Compound Formation with congruent Melting Point (Mg-Zn) and Incongruent Melting Point ( $\text{FeCl}_3\text{-H}_2\text{O}$ ) System. Freezing Mixture, Acetone-Dry Ice.

Liquid-Liquid Mixture: Raoult's Law and Henry's Law.

Ideal and Non-Ideal system. Azeotropes: HCl-H<sub>2</sub>O and Ethanol-Water System.

Partially Miscible Liquids: Phenol-Water, Trimethyl Amine-Water, Nicotine-water System, Lower and Upper consulate Trimethyl Amine-Water, Nicotine-water system, Lower and Upper Consulate Temperature. Effect of Impurity on Consulate Temperature.

**2) Electro Chemistry-I      15 Hrs.**

Electrical Transport: Conduction in metals and in Electrolyte Solutions. Specific Conductance and equivalent conductance, measurement of equivalent conduction, variation of equivalent and specific conductance with dilution. Numerical problems. Kohlrausch's law and its application. Arrhenius Theory of Electrolyte Dissociation and its limitations. Weak and Strong Electrolytes, Ostwald's Dilution Law, its use and Limitations. Transport Number: Definition, Determination by Hittorfs Method and Moving Boundary Method. Conductometric Titration: Types and its advantages.

### **3) Electrochemistry-II**

**15 Hrs**

Types of Reversible Electrodes: Gas- Metal Ion, Metal-Metal Ion, Metal-Insoluble salt Anion and Redox Electrodes. Nernst Equation, Derivation of Cell, E.M.F. and single Electrode potential, Standard Hydrogen Electrode, Reference Electrodes, Standard Electrode Potential, Sign Conventions, Electro-Chemical Series and its significance. Electrolytic and Galvanic Cells, Reversible and Irreversible Cells, Conventional Representation of Electro Chemical Cells. E.M.F. of a cell and its measurement, Calculation of Thermodynamic Quantities of Cell Reactions (G, H and K)

Definition of pH, pKa-Determination of pH using SHE and Glass Electrode by Potentiometer method. Buffer-Acidic and Basic Buffers, Mechanism of Buffer Action, Henderson-Hasselbalch equation.

Corrosion: Dry (Atmospheric) Corrosion and Wet (Electro-Chemical) Corrosion Electrochemical Theory of Corrosion.

## B.Sc. (Second Year) (Fourth Semester)

Lab Course-IV                      Paper XII                      90 Hrs (3 Hrs/week)

### Section A: Physical Chemistry

#### *Instrumentation: (Any Five)*

- i. To determine normality and strength of HCl using (0.1N) NaOH Solution Conductometrically.
- ii. To determine normality and strength of acetic acid using (0.1N) NaOH solution Conductometrically.
- iii. To determine normality and strength of HCl using (0.1N) NaOH solution by pH-metrically.
- iv. To verify Lambert-Beers Law using  $\text{KMnO}_4$  solution.
- v. To estimate the amount of Sugar using Polarimeter.
- vi. To determine refractive index of ethanol water system.
- vii. To determine indicator constant of indicator colorimetrically.

### Section B: Organic Chemistry

#### Organic Derivatives:-

#### Preparation, Crystallization and Physical Constant. (Any Three)

- |                             |   |                     |                   |
|-----------------------------|---|---------------------|-------------------|
| i. Acetyl Derivatives       | : | a) Aniline          | b) Salicylic Acid |
| ii. Benzoyl Derivatives     | : | a) Aniline          | b) B-naphtol      |
| iii. Hydrolysis Derivatives | : | a) Ethyl Benzoate   | b) Aspirin        |
| iv. Bromo-Derivatives       | : | a) Phenol           | b) Cinnamic Acid  |
| v. Reduction Derivatives    | : | a) M-dinitrobenzene |                   |
| vi. Osazone Derivatives     | : | a) Sucrose          | b) Glucose        |

#### Organic Estimations: (Any Two)

- i. Estimation of nitro group by reduction.
- ii. Estimation of glucose.
- iii. Estimation of ester by hydrolysis.
- iv. Estimation of amides by hydrolysis.



## Pattern of Question Paper

### B.Sc. Second Year

#### Lab Course-III Physical and Inorganic Chemistry.

#### Paper-IX

Time: 06.00 Hours

Max.Marks:100

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#### Section A (Physical Chemistry)

50 marks

- Q.1 a. To determine critical solution temperature of phenol water system. **25 Marks**
- Or
- b) Determine the molecular mass of polymer from viscometer measurements.
- Or
- c) Partition coefficient of Benzene water system using benzene acid.
- Or
- d) To investigate the Kinetics of Iodination of Acetone.
- Q.2.a. To determine solidity of benzene acid at different temperature and determine H of dissolution process **25 Marks**
- Or
- b) To determine Hn of NaOH and CH<sub>3</sub>COOH.
- Or
- c) To determine Hn of NaOH and HCl.
- Or
- d) To determine the equilibrium constant for the reaction  $KI + I_2 \rightleftharpoons KI_3$ .
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### Section B (Inorganic Chemistry)

Q.3 a. Estimation of Zn gravimetrically as  $Zn NH_4 PO_4$  **20 Marks**

Or

b) Estimation of Mn gravimetrically as  $Mn NH_4 PO_4$ .

Or

c) Estimation of Barium gravimetrically as  $BaCrO_4$ .

Or

d) Estimation of Nickel gravimetrically as Ni-DMG.

Or

e) Estimation of Aluminium as Aluminium oxalate.

Q.4. a Estimation of Zinc by EDTA solution using EBT indicator. **20 Marks.**

Or

b. Estimation of Nickel by EDTA solution using Murexide indicator.

c. Estimation of Copper by EDTA Solution using test sulphon black F indicator.

Q.5 Record Book / Viva-Voce **10 Marks.**

## Pattern of Question Paper

### B.Sc. Second Year

#### Lab Course-IV

#### Physical and organic Chemistry

#### Paper-XII

Time: 06.00 Hours

Max.Marks:100

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#### Section A (Physical Chemistry)

50 marks

Q.1 a. To determine normality and strength of HCl using (0.1N) NaOH solution Conductometrically. **25 Marks**

Or

b) To determine normality and strength of  $\text{CH}_3\text{COOH}$  using (0.1N) NaOH solution Conductometrically.

Or

c) To determine Refractive Index of Ethanol-water system.

Or

d) To estimate the amount of sugar using Polarimeter.

Q.2.a. To determine normality and strength of HCl using (0.1N) NaOH solution by pH-metrically. **25 Marks**

Or

b) To Verify Lambert-Beers Law using  $\text{KMnO}_4$  solution.

Or

c) To determine Indicator constant of Indicator colorimetric ally.

**Section B (Organic Chemistry)**

**40 Marks.**

- Q.3 a. Estimation of Nitro group by reduction. Zn gravimetrically as Zn  $\text{NH}_4\text{PO}_4$   
Or
- b) Estimation of glucose Mn gravimetrically as Mn  $\text{NH}_4\text{PO}_4$ .  
Or
- c) Estimation of Ester by hydrolysis.  
Or
- d) Estimation of amide by hydrolysis.
- Q.4. a Preparation of (organic derivative )  
Its crystallization and physical constant of the prepared derivative. **15 Marks.**
- Q.5. Record Book / Viva-Voce 10 Marks

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**S\*/-090414/-**

**S\*/-020514/-**