



स्वामी रामानंद तीर्थ  
मराठवाडा विद्यापीठ, नांदेड

॥ सा विद्या या विमुक्तये ॥

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

'ज्ञानतीर्थ', विष्णुपुरी, नांदेड - ४३१ ६०६ (महाराष्ट्र राज्य) भारत

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

'Dnyanteerth', Vishnupuri, Nanded - 431 606 (Maharashtra State) INDIA

Established on 17th September, 1994, Recognized By the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'B++' grade

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विज्ञान व तंत्रज्ञान विद्याशाखेतील बी.  
व्होक. (व्होकेशनल कोर्सेसचे) पदवी  
द्वितीय वर्षाचे अभ्यासक्रम शैक्षणिक वर्ष  
२०२१-२२ पासून लागू करणे बाबत.

## प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, मा. विद्यापरिषदेच्या दिनांक २५ जून २०२२ रोजीच्या बैठकीतील ऐनवेळाचा विषय क्रमांक ०२/५४-२०२२ च्या ठरावानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील B. Voc. Chemical & Petrochemical Applied Analytical Chemistry II year या विषयाच्या अभ्यासक्रमांस शैक्षणिक वर्ष २०२१-२२ पासून लागू करण्यास मान्यता देण्यात आली आहे.

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या [www.srtmun.ac.in](http://www.srtmun.ac.in) या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी. ही विनंती.

जा.क्र.:शैक्षणिक-१/परिपत्रक/व्होकेशनल अभ्यासक्रम/N-  
२०२१-२२/४३१

दिनांक : १३.०७.२०२२

प्रत माहिती व पुढील कार्यवाहीस्तव :

- १) मा. मा अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
- २) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
- ३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
- ४) अधीक्षक, परीक्षा विभाग विज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
- ५) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ याना देवून कळविण्यात येते की, सदरील परिपत्रक व अभ्यासक्रम विद्यापीठ संकेतस्थळावर प्रसिध्द करण्यात यावे.

स्वाक्षरित

सहा कुलसचिव

शैक्षणिक (१-अभ्यासमंडळ) विभाग

**Swami Ramanand Teerth Marathwada  
University, Nanded**



**BOS IN CHEMICAL SCIENCES**

**Syllabus for the  
Second Year Bachelor of Vocation (Sem. III & IV)**

**Program: B.Voc.  
(UGC Recognized)**

:: Course Title ::

**“Chemicals & Petrochemicals Applied  
Analytical Chemistry”**

(Credit Based Semester and Grading System  
with effect from the academic year 2021–2022)

## **-: Preamble:-**

B.Voc. is introduced with the needs of the economy so as to ensure that the graduates of higher education system have adequate knowledge and skill for employment and entrepreneurship. The higher education system has to incorporate the requirements of various industries in its curriculum, in an innovative and flexible manner while developing a holistic and well groomed graduate.

The University Grants Commission (UGC) has launched a scheme on skill development based higher education as part of college/university education, leading to Bachelor of Vocation (B.Voc.) Degree with multiple exits such as Diploma / Advanced Diploma under the NSQF. The B.Voc. Program is focused on universities and colleges providing undergraduate studies which would also incorporate specific job roles and their NOSs along with broad based general education. This would enable the graduates completing B.Voc. is to make a meaningful participation in accelerating India's economy by gaining appropriate employment, becoming entrepreneurs and creating appropriate knowledge.

### **Objectives**

- To provide judicious mix of skills relating to a profession and appropriate content of General Education.
- To ensure that the students have adequate knowledge and skills, so that they are work ready at each exit point of the program.
- To provide flexibility to the students by means of pre-defined entry and multiple exit points.
- To integrate NSQF within the undergraduate level of higher education in order to enhance employability of the graduates and meet industry requirements. Such graduates apart from meeting the needs of local and national industry are also expected to be equipped to become part of the global workforce.
- To provide vertical mobility to students coming out of 10+2 with vocational subjects.

### **Levels of Awards**

The certification levels will lead to Diploma/Advanced Diploma/B. Voc. Degree in one or more vocational areas and will be offered under the aegis of the University. Award Duration Corresponding NSQF level

- Diploma 1 Year
- Advanced Diploma 2 Years
- B.Voc. Degree 3 Years

### **Eligibility and Fees for Admission in B.Voc.**

The eligibility condition for admission to B.Voc. programme shall be 10+2 or equivalent, in any stream.

**Bachelor of Vocation (B.Voc.) (Chemicals & Petrochemicals Applied Analytical Chemistry)**  
**Syllabus for the Year: 2021 – 2022**

<b>Semester - III</b>		
<b>Course No.</b>	<b>Title</b>	<b>No. of Credits</b>
<b>General Components</b>		
CPAC-13	Chemistry of S & P block elements	04
CPAC-14	Method of Analysis-I	04
CPAC-15	Basics of Biochemistry	04
<b>Skill Components</b>		
CPAC-16	Laboratory Course-VII	06
CPAC-17	Laboratory Course-VIII	06
CPAC-18	Laboratory Course-IX	06
<b>Semester - IV</b>		
<b>Course No.</b>	<b>Title</b>	<b>No. of Credits</b>
<b>General Components</b>		
CPAC-19	Chemistry of d & f block elements	04
CPAC-20	Petrochemistry-II	04
CPAC-21	Methods of Analysis-II	04
<b>Skill Components</b>		
CPAC-22	Laboratory Course-X	06
CPAC-23	Laboratory Course-XI	06
CPAC-24	Laboratory Course-XII	06

**Semester - III**

**Swami Ramanand Teerth Marathwada University, Nanded  
Certificate, Diploma, Advanced Diploma and B.Voc Degree  
(Chemical & Petrochemicals Applied Analytical Chemistry)**

**Second Year (Semester III) Semester Pattern**

**Paper-XIX: Chemistry of S &P block elements (CPAC-13)**

**Maximum Marks: 100**

**Credits: 4**

**Periods: 45**

<b>Unit-1</b>	<b>s-Block Elements (Alkali and Alkaline Earth Metals) (Periods : 20)</b> Group 1 and Group 2 Elements. General introduction, electronic configuration, occurrence, anomalous properties of the first element of each group, diagonal relationship, trends in the variation of properties (such as ionization enthalpy, atomic and ionic radii), trends in chemical reactivity with oxygen, water, hydrogen and halogens, uses. Preparation and Properties of Some Important Compounds: Sodium Carbonate, Sodium Chloride, Sodium Hydroxide and Sodium Hydrogencarbonate, Biological importance of Sodium and Potassium, Calcium Oxide and Calcium Carbonate and their industrial uses, biological importance of Magnesium and Calcium
<b>Unit-2</b>	<b>General Introduction to p -Block Elements</b> <b>Group 13 Elements: (Periods : 15)</b> General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous properties of first element of the group, Boron - physical and chemical properties, some important compounds, Borax, Boric acid, Boron Hydrides, Aluminium: Reactions with acids and alkalies, uses.  <b>Group 14 Elements: (Periods : 10)</b> General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous behaviour of first elements. Carbon-catenation, allotropic forms, physical and chemical properties; uses of some important compounds: oxides. Important compounds of Silicon and a few uses: Silicon Tetrachloride, Silicones, Silicates and Zeolites, their uses.

**Reference book**-Text book of F. Y. & S. Y. B.Sc.

**Semester - III**  
**Swami Ramanand Teerth Marathwada University, Nanded**  
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**Second Year (Semester III) Semester Pattern**

**Paper-XX: Method of Analysis -I (CPAC-14)**

**Maximum Marks: 100**

**Credits: 4**

**Periods: 45**

<b>Section-I (Pharmaceutical Analysis)</b>		<b>(Periods : 25)</b>
<b>Unit - 1</b>	<b>Acid-Base titrations</b> - Introduction, Examples (Any Four), Key Terms	
<b>Unit - 2</b>	<b>Non-aqueous titrations</b> - Theory, Types and Application (Any Five)	
<b>Unit - 3</b>	<b>Precipitation titrations –</b> -Definition, Methods and Applications (Any Five)	
<b>Unit - 4</b>	Gravimetry -Definition and steps -Types, Facts and Applications (Any Five)	
<b>Unit - 5</b>	Redox titration – Principle and Examples -Redox Specific Titrator -Applications (Any Five)	
<b>Section-II (Electrochemical Analysis)</b>		
Unit- 1	-Cyclic Voltammetry -Chronoamperometry/Chronocoulometry -Pulse Voltammetry -Stripping Voltammetry -Digital Simulation -Microelectrodes -Glucose Detection -Electrochemical Polymerization -Electrochemical Impedance Spectroscopy -Corrosion	
Unit - 2	Polarography -Principle, Instrumentation, Working and Applications	

**Reference Book :** Analytical Instrumentation-Chittan  
Instrumental Methods of Chemical Analysis- Chatwal-Anand

**Semester - III**  
**Swami Ramanand Teerth Marathwada University, Nanded**  
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**Second Year (Semester III) Semester Pattern**  
**Paper-XXI: Basics of Biochemistry (CPAC-15)**

**Maximum Marks: 100**

**Credits: 4**

**Periods: 45**

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<b>Unit - 1</b>	<b>Carbohydrates:</b> <span style="float: right;"><b>(Periods : 15)</b></span> -Definition, classification, reaction of monosaccharide (glucose)- oxidation, reduction, osazone and ester formation, isomerization, Killiani-Fischer synthesis and Ruff degradation, Configuration of D/L configuration of (+) Glucose, Fischer-Haworth and chair formulae. -Brief account of disaccharides: Sucrose, cellobiose, maltose and lactose. -Polysaccharides: Starch, cellulose and glycogen.
<b>Unit - 2</b>	<b>Amino acids:</b> <span style="float: right;"><b>(Periods : 15)</b></span> Fischer projection, relative configuration, classification, structures and reactions of amino acids, Properties and chemical reactions with amino and carboxylic group.
<b>Unit - 3</b>	<b>Proteins:</b> <span style="float: right;"><b>(Periods : 15)</b></span> Formation of Peptide linkage, -helical conformation, -plated structure, primary, secondary, tertiary and quaternary structure of proteins. <div style="text-align: center;">□ □</div>

**Reference Book-** Biochemistry- Lehninger

**Semester - III**  
**Swami Ramanand Teerth Marathwada University, Nanded**  
**Certificate, Diploma, Advanced Diploma and B.Voc Degree**  
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**Second Year (Semester III) Semester Pattern**

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**Paper-XXII: Laboratory Course-VII (CPAC-16)**

**Maximum Marks: 150**

**Credits: 6**

**Periods: 90**

<b>1</b>	<b>Distillation of organic compounds and Solvents (Any 3)</b>
<b>2</b>	Organic Preparations (Any 4) Benzimidazole, Acetamide, Schiff-base, Phthalimide
<b>3</b>	Analysis of essential Oil (Any 4)
<b>4</b>	Analysis of Fixed oils, Fats and Waxes (Any 4)

**Paper-XXIII: Laboratory Course-VIII (CPAC-17)**

**Maximum Marks: 150**

**Credits: 6**

**Periods: 90**

<b>1</b>	Analysis of Talcum powder
<b>2</b>	Determination of Glucose in blood sample.
<b>3</b>	Determination of Vitamin-C from Orange Juice.
<b>4</b>	Estimation of proteins by Biurate Method
<b>5</b>	Estimation of Aspirin by potentiometry
<b>6</b>	Limit Test (Any 4) i) For Chloride ii) Sulphate iii) Iron iv) Heavy Metals V) Volatile oils

**Refence Book.**

Experiments in Chemistry- D.V. Jahagirdar, Himalaya Publishing House  
 Pharmaceutical Chemical Analysis, Volume-I- A. V. Kasture, Mahadik, Wadodkar & More  
 Purification of laboratory Chemicals- D. D. Perrin & W. L. F. Armarego

**Paper-XXIV: Laboratory Course-IX (CPAC-18)**

**Maximum Marks: 150**

**Credits: 6**

**Periods: 90**

	<b>Section: Skill Components</b>
<b>Unit -1</b>	Project/ Industrial Training or Visit



**Semester - IV**

**Swami Ramanand Teerth Marathwada University, Nanded  
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(Chemical & Petrochemicals Applied Analytical Chemistry)**

**Second Year (Semester IV) Semester Pattern**

**Paper-XXVIII: Chemistry of d & f block elements (CPAC-19)**

**Maximum Marks: 100**

**Credits: 4**

**Periods: 45**

<b>Unit - 1</b>	<b>d-block elements</b> -General introduction. -Position of d-block elements in periodic table. -Electronic configuration. -Explanation & Properties, trends in properties of these elements w.r.t.(a) size of atoms & ions (b) reactivity (c) catalytic activity (d) oxidation state (e) complex formation ability (f) colour (g) magnetic properties (h) non-stoichiometry (i) density, melting & boiling points.	<b>(Periods : 20)</b>
<b>Unit - 2</b>	<b>f-Block Elements</b> -General introduction. -Electronic configuration, occurrence and characteristics of transition metals, general trends in properties of the first row transition metals - metallic character, ionization enthalpy, oxidation states, ionic radii, colour, catalytic property, magnetic properties, interstitial compounds, alloy formation, preparation and properties of K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> and KMnO <sub>4</sub> . -Lanthanoids - Electronic configuration, oxidation states, chemical reactivity and lanthanoid contraction and its consequences. -Actinoids - Electronic configuration, oxidation states and comparison with lanthanoids.	<b>(Periods : 25)</b>

**Reference Book** -Text books of T. Y. B. Sc. Chemistry

**Semester - IV**  
**Swami Ramanand Teerth Marathwada University, Nanded**  
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**(Chemical & Petrochemicals Applied Analytical Chemistry)**

**Second Year (Semester IV) Semester Pattern**

**Paper-XXIX: Petrochemistry (CPAC-20)**

**Maximum Marks: 100**

**Credits: 4**

**Periods: 45**

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<b>Unit - 1</b>	<b>Petroleum Products and Refinery</b> <span style="float: right;"><b>(Periods : 10)</b></span> Crude oil reserve in India, composition of petroleum and petroleum products, Classification of petroleum. Indian petroleum refinery, equipment and component of refinery, refinery products and its properties.
<b>Unit - 2</b>	<b>Distillation Process in Refinery</b> <span style="float: right;"><b>(Periods : 15)</b></span> Primary treatment of Crude Oil: Dehydration and Desalting of crude. Atmospheric distillation of crude. Vacuum distillation of crude, Fractions obtained from crude oil with their boiling range. Properties of petroleum products: Flash point, fire point, aniline point, Calorific value, Carbon residue, smoke point, drop point, octane number, cetane number, pour point, cloud point, carbon residue. Pensky Marten's apparatus, Abel's apparatus, smoke point apparatus, aniline point apparatus.
<b>Unit - 3</b>	<b>Processes in Refinery</b> <span style="float: right;"><b>(Periods : 10)</b></span> Definition of cracking types of cracking (Thermal and Catalytic cracking): Vis breaking and delayed coking, Fixed and fluidized bed catalytic cracking. Reforming, catalytic reforming. Hydrocracking and isomerization. Alkylation process: sulfuric acid and Hydrofluoric acid alkylation process. Esterification and hydration.
<b>Unit - 4</b>	<b>Petrochemical Products</b> <span style="float: right;"><b>(Periods : 10)</b></span> List of chemicals From C <sub>1</sub> , manufacturing of methanol and formaldehyde, esterification. List of chemicals from C <sub>2</sub> , manufacturing of Ethanol, Vinyl chloride, Ethylene oxide and Styrene from C <sub>2</sub> . List of chemicals from C <sub>3</sub> . Manufacture of Propylene oxide and acetaldehyde.

**Reference book:**

Modern Petrochemical Refining Process: Rao, B.K. Bhaskara. Oxford-IBH publications, Delhi.

Petroleum Refinery Engineering: Nelson, W.L. McGraw Hill, New York

A Text Book on Petrochemicals: B.K. Bhaskara, Rao. Khanna Publishers, Delhi.

Petroleum refining Technology and Economics: Gary, James H, Glenn E Handwork, Mark J Kaisen. CRC Press, USA

**Semester - IV**

**Swami Ramanand Teerth Marathwada University, Nanded  
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(Chemical & Petrochemicals Applied Analytical Chemistry)**

**Second Year (Semester IV) Semester Pattern**

**Paper-XXX: Methods of Analysis-II (CPAC-21)**

**Maximum Marks: 100**

**Credits: 4**

**Periods: 45**

Unit- 1	<b>Analytical techniques and analytical methods (Periods : 25)</b> -Introduction -Analytical techniques and analytical methods -Analytical Techniques in pharmaceutical analysis -Analytical Techniques for Chemical Analysis -Separation techniques used for analysis, <b>Electrophoresis</b> : Introduction, principle, facts, types and applications
Unit – 2	<b>Units of measurements : (Periods : 20)</b> -Concentration units quality standards -Block diagram of analytical instrumentation -Methods of calibration in instrumental analysis : Calibration curve method, standard addition method and internal standard method -Future of modern instrumentations.

**Reference Book**-Analytical Instrumentation-Chittan

**Semester - IV**  
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**Second Year (Semester IV) Semester Pattern**

**Paper-XXXI: Laboratory Course-X (CPAC-22)**

**Maximum Marks: 150**

**Credits: 6**

**Periods: 90**

<b>Unit -1</b>	<b>Solvent extraction method</b> Determination of salts of organic acids and bases. Determination of alkaloids in crude drug and galenicals Determination of unsaponifiable matter Indicator extraction titrations.
<b>Unit -2</b>	<b>Miscellaneous methods</b> Determination of cineole. Determination of ethanol in liquid galenicals. Mercury-metric titration. Determination of phenols as alkali soluble matter.

**Paper-XXXII: Laboratory Course-XI (CPAC-23)**

**Maximum Marks: 150**

**Credits: 6**

**Periods: 90**

Unit- 1	<b>A) Synthesis of TiO<sub>2</sub></b> <b>B) Organic Preparations:</b> a. Acetanilide from aniline b. Benzoic acid from benzamide c. Phenyl benzoate from phenol d. P-bromo acetanilide from acetanilide e. Picric acid from phenol
Unit -2	<b>Simple Gravimetric Determinations:</b> 1. Determination of Silver as Silver Chloride 2. Determination of sulphate as barium sulphate 3. Determination of barium as barium sulphate. 4. Determination of nickel as nickel-DMG complex

**Reference books.**

Experiments in Chemistry- D.V. Jahagirdar, Himalaya Publishing House  
 Pharmaceutical Chemical Analysis, Volume-I- A. V. Kasture, Mahadik, Wadodkar & More  
 Purification of laboratory Chemicals- D. D. Perrin & W. L. F. Armarego

**Paper-XXXIII: Laboratory Course-XII (CPAC-24)**

**Maximum Marks: 150**

**Credits: 6**

**Periods: 90**

	<b>Section: Skill Components</b> <b>Credit:</b>
<b>Unit -1</b>	Project/ Industrial Training or Visit

### **Reference books-**

- Text book of F. Y. & S. Y. B.Sc.
- Analytical Instrumentation-Chittan
- Instrumental Methods of Chemical Analysis- Chatwal-Anand
- Biochemistry- Lehninger
- Experiments in Chemistry- D.V. Jahagirdar, Himalaya Publishing House
- Pharmaceutical Chemical Analysis, Volume-I- A. V. Kasture, Mahadik, Wadodkar & More
- Purification of laboratory Chemicals- D. D. Perrin & W. L. F. Armarego
- Text books of T. Y. B. Sc. Chemistry
- Modern Petrochemical Refining Process: Rao, B.K. Bhaskara. Oxford-IBH publications, Delhi.
- Petroleum Refinery Engineering: Nelson, W.L. McGraw Hill, New York
- A Text Book on Petrochemicals: B.K. Bhaskara, Rao. Khanna Publishers, Delhi.
- Petroleum refining Technology and Economics: Gary, James H, Glenn E Handwork, Mark J Kaisen. CRC Press, USA
- Analytical Instrumentation-Chittan

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