

SYLLABUS

Saurashtra University



DDU Kaushal Kendra Curriculum for BACHELOR of VOCATION in PHARMACEUTICAL ANALYSIS & QUALITY ASSURANCE

(Under UGC – DDU Kaushal Kendra sanctioned to Shree Manibhai Virani & Smt. Navalben Virani Science College-Rajkot)

(Sanction Letter No. 3-43/2015(KAUSHAL) dated 14.08.2015)

B.Voc. - Pharm. Analysis & QA

Semester III & IV

Credit Based Semester System (CBSS)
Effective from June 2016-17

*સી. વી. વી. ૨૦૧૬-૧૭ માં મંજૂર
અનુસૂચિ ૨૦૧૬-૧૭
ફેકલ્ટી ઓફ
ફાર્માસ્યુટિકલ એન્ડ
ક્વોલિટી એસ્યુરન્સ*

B.Voc. Pharm. Analysis & QA

Name of the Program(s) (Diploma, Adv. Diploma, Degree)	Semesters	No. of Credits 30 Cr./Sem	Job Roles and NSQF -Levels
Diploma in Laboratory Techniques in Chemistry	1	60 Credits	NSQF Level 5 Supervisor
	2		
Advance Diploma in Analytical Chemistry	3	60 Credits	NSQF Level 6 Technician / Trainer
	4		
B.Voc. in Pharm. Analysis & Quality Assurance	5	60 Credits	NSQF Level 7 B.Voc. Graduate
	6		

Note: A student has to earn additional 1 credit per year for Universal Human Value Education Course.

**B.Voc.- Pharmaceutical Analysis & QA
Semester-I**

S.N.	Paper No.	Subject	Credit	Marks
1	BVPAQA-101	Pharmaceutical Inorganic Chemistry	3	100
2	BVPAQA-102	Unit Operations- I	3	100
3	BVPAQA-103	Fundamental Analytical chemistry (PA-I)	3	100
4	BVPAQA-104	Functional English & OAT-I	3	100
5	BVPAQA-105	Practical 1, 2, 3 & 4(OAT)	18	300
Total Credit Semester-I			30	700

**B.Voc.- Pharmaceutical Analysis & QA
Semester-II**

S.N.	Paper No.	Subject	Credit	Marks
1	BVPAQA-201	Pharmaceutical Analysis (PA-II)	3	100
2	BVPAQA-202	Pharmaceutical Physical Chemistry	3	100
3	BVPAQA-203	Industrial Hazards, Safety and GLP	3	100
4	BVPAQA-204	Functional English & OAT-II	3	100
5	BVPAQA-205	Training/Project Report	3	150
6	BVPAQA-206	Practical 1, 2 & 4(OAT)	15	250
Total Credit Semester-II			30	800

**B.Voc.- Pharmaceutical Analysis & QA
Semester-III**

S.N.	Paper No.	Subject	Credit	Marks
1	BVPAQA-301	Industrial Analysis	3	100
2	BVPAQA-302	Fundamental Biochemistry	3	100
3	BVPAQA-303	Pharmaceutical organic Chemistry- I	3	100
4	BVPAQA-304	Unit Operations- II	3	100
5	BVPAQA-305	Practical 1, 2, 3 & 4	18	300
Total Credit Semester-III			30	700

**B.Voc.- Pharmaceutical Analysis & QA
Semester-IV**

S.N.	Paper No.	Subject	Credit	Marks
1	BVPAQA-401	Pharmaceutical Engineering	3	100
2	BVPAQA-402	Food & Beverages Analysis	3	100
3	BVPAQA-403	Pharmaceutical organic Chemistry- II	3	100
4	BVPAQA-404	Pharmaceutical Technology-I	3	100
5	BVPAQA-405	Training/Project Report	3	150
6	BVPAQA-406	Practical 1, 2, 3 & 4	15	250
Total Credit Semester-IV			30	800

**B.Voc.- Pharmaceutical Analysis & QA
Semester-V**

S.N.	Paper No.	Subject	Credit	Marks
1	BVPAQA-501	Spectroscopy	3	100
2	BVPAQA-502	Medicinal Chemistry-I	3	100
3	BVPAQA-503	Pharmaceutical Technology -II	3	100
4	BVPAQA-504	Chemistry of Natural Products	3	100
5	BVPAQA-505	Practicals-1, 2, 3 & 4	18	300
Total Credit Semester-V			30	700

**B.Voc.- Pharmaceutical Analysis & QA
Semester-VI**

S.N.	Paper No.	Subject	Credit	Marks
1	BVPAQA-601	Chromatographic Techniques	3	100
2	BVPAQA-602	Medicinal Chemistry-II	3	100
3	BVPAQA-603	QC & QA	3	100
4	BVPAQA-604	Entrepreneurship Development & Soft skill Training	3	100
5	BVPAQA-605	Training/Project Report	3	150
6	BVPAQA-606	Practicals-1, 2 & 3	15	250
Total Credit Semester-VI			30	800

B. Voc. Pharm. Analysis & QA

SEMESTER – III

BVPAQA-301	Industrial Analysis
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Unit-I: Chemistry & analysis of Oil, Fat and Wax

Introduction, soil composition, types of oils, physical and chemical properties of oils and fats, physical and chemical refining, bleaching, deodorization, partial hydrogenation and Vanaspati. Waxes: occurrence, types of waxes, isolation and purification of waxes, composition and industrial applications, Analytical tests: for oils, fats and waxes

Unit-II: Polymer analysis

Introduction and classification of polymers, types of polymerization, Characterization: Molecular structure, chemical tests, thermal method, T_g, molecular weight, distribution, stability. M.Wt. Determination: Atomic weight, mole concept, M.Wt. in colloids, M.Wt. of polymers, method of determining M.Wt., Chemical & Physical methods.

Unit-III: Petroleum Analysis

Petroleum – introduction and composition, Carbon residues, Asphaltene content, density (specific gravity), light hydrocarbons, metallic constituents, salt content, Sulphur content, viscosity, pour point, water & sediment, wax content, miscellaneous tests.

Unit-IV: Water Analysis – Part A

Physical examination of water: pH, temperature, total dissolved solid, suspended solid, acidity, alkalinity, conductivity, colour, taste, order, turbidity, density, hardness of water.

Water-V: Water Analysis – Part B

Nonmetallic inorganic constituents: chloride, sulphate, sulphide, fluoride, phosphate, sulphur, nitrate, nitrite, carbon dioxide, ammonia, cyanide.

Mineral ion: calcium, magnesium, iron, sodium, silver, zinc, manganese.

Toxic ion: lead, mercury, arsenic, beryllium, cadmium, chromium, copper, selenium.

Reference Books:

1. A Textbook of Polymers – Vol I & II, M. S. Bhatnagar, S. Chand Publication
2. Polymer Science, G. Govariker, New Age International
3. Handbook of Petroleum Analysis, James Speight, Wiley International
4. Instrumental Analysis, H H Willard, CBS Publishing Co.
5. Handbook of Water Analysis, Third Edition, Leo M.L. Nollet, Leen S. P. De Gelder, CRC Press, ISBN 9781439889640

B. Voc. Pharm. Analysis & QA

SEMESTER – III

BVPAQA-302	Fundamental Biochemistry
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Unit-I: Biomolecules

1. Biomolecules & the Cell: Introduction, types & constitution of cell, Integration of cellular function: apoptosis.
2. Role of minerals & water in life cycle, macrominerals, microminerals, additional important elements.

Unit-II: Lipids

Introduction, classification, function of lipids, fatty acids, essential fatty acids, purity, analysis of fats & oils, introduction & examples of triglycerols, phospholipids, glycolipids, steroids.

Unit-III: Protein & Amino Acids

Introduction, composition, standards & non-standard amino acids, structure & classification of amino acids, selenocysteine, structure of protein, classification of protein, some biological important peptides.

Unit-IV: Carbohydrates

Introduction, classification, structure of glucose, reaction of monosaccharides, overview of glycosides, disaccharides, homopolysaccharides, heterosaccharides, glycoproteins

Unit-V: Enzymes

Introduction, nomenclature, classification, chemical nature, properties, factors affecting enzyme activity, active site, enzyme inhibition, coenzyme, enzyme catalysis, unit of enzyme activity, non-protein enzymes, application & diagnostic importance of enzymes.

Reference Books:

1. Biochemistry, U. Satyaprakash & U. Chakrapani, Books & Allied (P) Ltd.
2. Biochemistry, Akhilesh Sharma, RBSA Publishers
3. Textbook of Biochemistry – Fourth Edition, S. P. Singh, CBS Publishers & Distributers
4. Fundamentals of Biochemistry, A C Deb, New Central Book Agency (P) Ltd.

B. Voc. Pharm. Analysis & QA

SEMESTER – III

BVPAQA-303	Pharmaceutical Organic Chemistry- I
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Unit-I: Fundamental Concepts of Organic Chemistry

Types of chemical bonds, patterns of bond cleavages, Types of reagents – electrophiles & nucleophiles, Reactive intermediates – carbocation, carbanion and free radicals, Types of reactions – Addition reaction and Substitution reaction involving S_N^1 , S_N^2 , E^1 , E^2

Unit-II: Open-chain and Cyclic Hydrocarbons

IUPAC Nomenclature of Branched and unbranched hydrocarbons, classification of carbon atom, method of formation, physical properties and chemical reactivity. Cyclopropane ring-banana bond, Markownikoff's rule, polymerization of alkynes.

Unit-III: Arenes & Aromaticity

Nomenclature of benzene derivatives, structure of benzene – molecular formula & Kekule structure, Aromaticity: the Huckel rule, Aromatic electrophilic substitution reactions, general mechanism.

Unit-IV: Carboxylic Acid & Derivatives

Nomenclature, structure, physical properties, acidity of C.A., acid strength & factors affecting, preparation and reaction of C.A., HVZ reaction, preparation of acid derivatives, physical properties of acid derivatives, esterification and hydrolysis.

Unit-V: Carbonyl Compounds Aldehyde & Ketone

Nomenclature & structure of carbonyl group, synthesis of aldehydes and ketones, reaction and specific mechanism of carbonyl compounds, physical properties, tautomeric isomerism.

Reference Books:

1. Chemistry for Degree Students – First Year, Dr. R. L. Madan, S. Chand & Co. Ltd.
2. Chemistry for Degree Students – Second Year, Dr. R. L. Madan, S. Chand & Co. Ltd.
3. Chemistry for Degree Students – Third Year, Dr. R. L. Madan, S. Chand & Co. Ltd.
4. The language of Chemistry or Chemical Equations, G. D. Tuli & P. L. Soni, S. Chand & Co. Ltd.
5. Principles of Organic Chemistry, Peter R. S. Murray, CBS Publications

B. Voc. Pharm. Analysis & QA

SEMESTER – III

BVPAQA-304	Unit Operations- II
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Unit-I: Distillation

Introduction, boiling point, driving force, equilibrium stage, vapour- liquid equilibrium, boiling point diagram, Raoult's law, Dalton's law, relative volatility, differential distillation, flash distillation, fractionating column, McCabe-Thiele method, reflux ratio, azeotropic distillation, extractive distillation, types of plate, packed column, types of packing

Unit-II: Crystallisation

Introduction, solubility curve, super saturation, crystal formation, method of super saturation, The Mier's super saturation theory, yield of crystallisation process classification of crystalliser-agitated tank crystalliser, Swenson-walker crystalliser, vacuum crystallisers, material balance of crystalliser, enthalpy balance

Unit-III: Evaporation

Introduction, concentration, foaming, scale, temperature sensitivity, material of construction, performance of tubular evaporator, boiling point elevation, types of evaporator-jacked pan evaporator, horizontal tube evaporator, long tube vertical evaporator, forced circulation evaporator, multi effect evaporator.

Unit-IV: Drying

Introduction, Free moisture, Bound moisture, Drying curve, Equipments, Tray dryer, Rotary dryer, Flash dryer, Fluid bed dryer, Drum dryer, Spray dryer.

Unit-V: Mixing

Introduction, mixing of solid-solid, solid-liquid system and its equipments.

Reference:

1. Industrial Chemistry, Reggel, Reinhold Publication.
2. Unit Operations in chemical Engineering, McCabe & Smith, McGraw Hill Book Comp.
3. Unit Operations I & II, D.D. Kale Pune Vidyarthigriha Prakashan-Pune.
4. Industrial chemistry by B.K. Sharma.
5. Outline of chemical technology, G.E. Dryden; East West press New Delhi.
Introduction to material science and engineering, K.M. Rells, T. Courtney and J. Wulff; Wiley eastern private limited, New Delhi

B. Voc. Pharm. Analysis & QA

SEMESTER – III

BVPAQA-305	Practical
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Laboratory course of B.Voc - Chemical Technology includes practical based on following subjects.

Paper No.	Subject
BVPAQA-301	Industrial Analysis
BVPAQA-302	Fundamental Biochemistry
BVPAQA-303	Pharmaceutical organic Chemistry- I
BVPAQA-304	Unit Operations- II

B. Voc. Pharm. Analysis & QA

SEMESTER – IV

BVPAQA-401	Pharmaceutical Engineering
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Unit-I: Basic chemical calculation

Basis of calculation, equivalent weight, normality, molarity, molality, weight percent, volume percent, mole percent, mole fraction, weight fraction, ideal gas law, gas constant, partial pressure, Dalton's law, Amagat's law, relationship between partial pressure, mole fraction of component gas to total pressure, Raoult's law, Henry's law

Unit-II: Material balance with and without chemical reaction

Classification of material balance process, material balance of distillation, evaporation, absorption, extraction, drying, filtration, mixing/blending, crystallisation

Stoichiometry co-efficient, ratio, proportion, limiting and excess reagent, conversion, yield, selectivity

Unit-III: Recycle operation

Recycle ratio, combined feed ratio, purge ratio, recycle process for drying, reactor, evaporator, crystalliser, filter, calciner

Unit-IV: Energy balance

Energy, energy balance of closed system, relationship between C_v and C_p , mean molal heat capacities of gases, heat capacity of gaseous mixture, heat of reaction, heat of formation, standard heat of formation, heat of combustion, Hess's law, heat of reaction from heat of formation, heat of reaction from heat of combustion, adiabatic process, phase change operation, heat balance during phase change, heat of solution

Unit-V: Combustion

Solid liquid and gaseous fuel, calorific value, air requirement

Reference Books:

1. Introduction to Material Science and Engineering, K.M. Rells, T. Courtney and J. Wulff; Wiley Eastern Pvt. Ltd. New Delhi
2. Pharmaceutical Process Engineering, 2nd Edition, A. J. Hickey, ISBN: 98714200847575
3. Pharmaceutical Engineering, K. Sambamurthy, New Age Int., 2007.
4. A textbook of Pharmaceutical Mathematics, Vol. 1 & 2, N. P. Bali, P. N. Gupta, C. P. Gandhi, Laxmi Publication Pvt. Ltd., 2007

B. Voc. Pharm. Analysis & QA

SEMESTER – IV

BVPAQA-402	Food & Beverages Analysis
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Unit-I: Fundamentals of Food Analysis

Introduction, definition, importance, structure, functional properties and analysis of carbohydrate protein, amino acid, lipid and fiber in food.

Unit-II: Fundamentals of Beverages Analysis

Introduction, chemical component of tea, coffee, cocoa, chocolate and soft drinks, chemical analysis of soft drinks (carbohydrate, acidity, sweetener, antioxidant, colour, alcohol, fragrance, etc), analysis of tea (tannis), chemical analysis of coffee (caffeine).

Unit-III: Chemistry, composition and analysis of Milk

Introduction, composition and nutritive value of milk, determination of moisture and total solid in milk, determination of fat in milk, definition and determination of carbohydrate, protein (casein), lipid(phospholipids), vitamins , mineral and pigment in milk.

Unit-IV: Milk-product Analysis

Introduction, chemical component of milk products like ghee, butter, cheese, paneer, ice cream, curd, yogurt, etc. Chemical analysis of total solid and fat in milk products.

Unit-V: Oil & Fat Analysis

Introduction, properties of oil and fat, classification of oil and fat, determination of iodine value, acid value, saponification value, Reichert-Meissl value, peroxide value and rancidity of oil. Identification and determination of the purity of oil.

Reference Books:

1. Food Analysis, S. Suzanne Nielsen, Springer Publishing, 978-1-4419-1477-4
2. Food Analysis: Theory And Practice, Y. Pomeranz, C. E. Meloan, CBS Publication
3. Methods in Food Analysis, R. M. S. Cruz, I. Khmelinskii, M. Vieira, CRC Press
4. FSSAI Manual of Methods of Food Analysis - Milk & Milk Product Analysis, 2015

B. Voc. Pharm. Analysis & QA

SEMESTER – IV

BVPAQA-403	Pharmaceutical Organic Chemistry- II
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Unit-I: Organic Compounds of Oxygen: Alcohol, Phenol & Ether

Nomenclature and classification, structure and bonding, Physical Properties, preparation, chemical reactions, test for identification.

Unit-II: Organic Compounds of Nitrogen: Amines, Nitroalkanes and Nitroarenes

Amines: Nomenclature, classification, stereochemistry of amines, basicity of amines, preparation, chemical reactivity, test for identification separation of primary, secondary and tertiary amine mixture. Nitroalkanes: Preparation, reduction in different media, picric acid.

Unit-III: Aryl & Alkyl Halides

Nomenclature, classification, method of preparation, substitution reaction of alkyl halides, polyhalogen compounds: chloroform, carbon tetrachloride, application & preparation of DDT and BHC.

Unit-IV: Heterocyclic Compounds

Introduction to five and six member heterocycles, nomenclature, structure and aromatic characteristic of pyrrole, furan, thiophene and pyridine, preparation and reactions of heterocycles, fused heterocycles and heterocycles with more than one heteroatom.

Unit-V: Stereochemistry of Organic Compounds

Concept of isomerism, types of isomerism. **Optical isomerism:** elements of symmetry, molecular chirality, enantiomers, properties of enantiomers, meso compounds, relative and absolute configurations, introduction and example of geometric isomerism and conformational isomerism, difference between configuration and conformation.

Reference Books:

1. Chemistry for Degree Students – First Year, Dr. R. L. Madan, S. Chand & Co. Ltd.
2. Chemistry for Degree Students – Second Year, Dr. R. L. Madan, S. Chand & Co. Ltd.
3. Chemistry for Degree Students – Third Year, Dr. R. L. Madan, S. Chand & Co. Ltd.
4. The language of Chemistry or Chemical Equations, G. D. Tuli & P. L. Soni, S. Chand & Co. Ltd.
5. Principles of Organic Chemistry, Peter R. S. Murray, CBS Publications

B. Voc. Pharm. Analysis & QA

SEMESTER – IV

BVPAQA-404	Pharmaceutical Technology-I
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Unit-I: Size reduction and size separation

Size reduction: Objective, factors affecting, methods of size reduction, hammer mill, ball mill, fluid energy mill, disintegrator. Size separation: introduction, shifting technique, official standard of powders, sedimentation technique, cyclone separator – construction and working.

Unit-II: Homogenization and Filtration

Liquid & powder mixing, mixing of semisolids, Silverson mixer-homogenizer, planetary mixer, triple roller mill, colloid mill and hand homogenizer, double cone mixer. Filtration: theory of filtration, filtration media, selection of filter aids, filter press, sintered filters, filter candles, metafilter.

Unit-III: Extraction Techniques

Galenicals, origin and introduction, percolation and maceration, their modification, continuous hot extraction, application and preparation of tinctures and extracts.

Unit-IV: Cosmeticology and cosmetic preparations

Fundamentals of cosmetic science, formulation, preparation and packaging of cosmetics for skin - Sunscreen, moisturizers, cold cream, and vanishing cream, hair - Shampoo and conditioners, dentifrice- powders, gels, paste and manicure preparations like- nail polish, lipsticks, eye lashes, brief introduction to cosmaceuticals, baby care products, shaving cream, hygienic products

Unit-V: Packing and storage of pharmaceuticals

Introduction, desirable features of containers, types of containers, materials for container – glass and plastics, closer materials, merits and demerits of materials used, introduction to aerosol packaging.

Reference Books:

1. Pharmaceutics-I, PV Kasture, SR Parekh, SB Gokhale, SA Hasan, Nirali Prakashan
2. Pharmaceutics-II, PV Kasture, SR Parekh, SB Gokhale, SA Hasan, Nirali Prakashan

B. Voc. Pharm. Analysis & QA **SEMESTER – IV**

BVPAQA-405	Project / Training Report
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Training / Project Report based on following subjects:

Paper No.	Subject
BVPAQA-401	Pharmaceutical Engineering
BVPAQA-402	Food & Beverages Analysis
BVPAQA-403	Pharmaceutical organic Chemistry- II
BVPAQA-404	Pharmaceutical Technology-I

B. Voc. Pharm. Analysis & QA **SEMESTER – IV**

BVPAQA-406	Practical
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Laboratory course of B.Voc – PAQA includes practical based on following subjects.

Paper No.	Subject
BVPAQA-401	Pharmaceutical Engineering
BVPAQA-402	Food & Beverages Analysis
BVPAQA-403	Pharmaceutical organic Chemistry- II
BVPAQA-404	Pharmaceutical Technology-I

SEMESTER END UNIVERSITY EXAMINATION

THEORY QUESTION PAPER STYLE- Semester III & IV

Time: 2:30 hrs

Theory- Total Marks-70

Que.:1 Objective type Q & A

- 30 Marks

SN	Type	No. of Que.	Weightage	Marks
I	Objective	10	1 mark	10
II	Short Questions	10	2 marks	20
Total				30 marks

Que.:2 Subjective type Q & A

- 20 Marks

Any **Four** out of Six Questions - Each carrying **5 marks**- Total- 20 marks

Que.:3 Subjective type Q & A

- 20 Marks

Any **Four** out of Six Questions - Each carrying **5 marks**- Total- 20 marks

PRACTICAL - Semester III	PRACTICAL - Semester IV
Days: 02 Time: 6 hrs/day	Days: 03 Time: 6 hrs/day
Practical - 250 Marks Viva voce - 50 Marks	Practical - 200 Marks Viva voce - 50 Marks
	Training Report or Project Report - 100 marks Viva voce - 50 Marks