Resolution No. AC/I(19-20).2.RUS2

S.P. Mandali's

Ramnarain Ruia Autonomous College

Syllabus for *S.Y.B.Sc.*

Program: *B.Sc.*

Course: *Biochemistry (RUSBCH)*

(Credit Based Semester and Grading System with effect from the academic year 2019–2020)

Semester III

Course Code	Unit	Topics	Credits	Lectures
Paper I – Enzymology, Physiology & Tools of Biochemistry				
RUSBCH301	I	Enzymes and coenzymes	2	15
	II	Plant Biochemistry		15
	III	Acids, Bases, Buffers and Ionic Equilibria & pH meter		15
Paper II - Fundamentals of Genetics and Physiology				
RUSBCH302	I	Genetics : I	2	15
	II	Genetics : II		15
	III	Transport mechanisms and haematopoesis		15
Paper III -Industrial Biotechnology & Pharmacology				
RUSBCH303	I	Sterilization & Disinfection Techniques and Cell culture	2	15
	II	Fermentation and Downstream processing		15
	III	Industrial Biotechnology		15
RUSBCHP301	Practicals based on the course in theory –RUSBCH301		3	
RUSBCHP302	Practicals based on the course in theory –RUSBCH302			
RUSBCHP303	Practicals based on the course in theory –RUSBCH303			

Semester IV

Course Code	Unit	Topics	Credits	Lectures
Paper I - Enzymology, Physiology & Tools of Biochemistry				
RUSBCH401	I	Physicochemical Principles	2	15
	II	Hormones		15
	III	Tools of Biochemistry		15
Paper II - Fundamentals of Genetics and Physiology				
RUSBCH402	I	Locomotion & Movement	2	15
	II	Neurophysiology		15
	III	Body Fluids		15
Paper III - Industrial Biotechnology & Pharmacology				
RUSBCH403	I	Trends in Biotechnology	2	15
	II	Introduction to Pharmacology		15
	III	Pharmacodynamics and Adverse Drug Reactions (ADR)		15
RUSBCHP401	Practicals based on the course in theory –RUSBCH401		3	
RUSBCHP402	Practicals based on the course in theory –RUSBCH402			
RUSBCHP403	Practicals based on the course in theory –RUSBCH403 and Project work			

Course Code: RUSBCH

Course Title: Biochemistry

Academic year 2019-20

Learning Objectives:

The overall goal of this SYBSc course is to introduce the student to the fields of enzymology, plant biochemistry, genetics, endocrinology, clinical biochemistry, industrial biotechnology, and pharmacology.

Learning Outcomes:

Upon completion of the SYBSc course, the students would understand the following:

1) Enzymology which forms the core of Biochemistry. Enzyme immobilization to study a different aspect of enzyme kinetics.
2) Plant Biochemistry which will introduce the students to metabolism and enable them to study metabolism in plants.
3) Acids, Bases, Buffers and Ionic Equilibria & pH meter; hormones; membrane biochemistry and physicochemical principles which will help them to further understand the biochemical processes of the body.
4) Mendelian Genetics, variations over Mendelian Genetics, Genes and Chromosomes topics which will introduce them to the field of genetics.
5) Haematopoiesis and Body fluids topics to help them understand the basics of clinical biochemistry.
6) Concept of sterilization and disinfection, ATC, PTC & fermentation to enable them to understand the various microbial processes & techniques.
7) Tools of Biochemistry which includes basic instrumentation like Colorimetry, Spectrophotometry, Flame photometry, Fluorimetry and Flow Cytometry.
8) The applied aspects of Biochemistry through Biotechnology, Industrial Biosynthesis, Bioresources and their management.
9) General pharmacology, Pharmacodynamics and Adverse Drug Reactions (ADRs) will introduce the students to pharmacology.
10) All the practicals have been rearranged in accordance with the theory papers at each semester.
11) New experiments are added to cover the practical aspects of the newly added theoretical topics. E.g. colorimetric experiments like Glucose by DNSA method, Proteins by Biuret method and Demonstration of spectrophotometer.
12) Research project has been introduced in Semester IV Practical III to inculcate research culture in the students. This will familiarize them with Research methodology i.e. reference work, experimental work, analysis of experimental data, interpretation of results obtained, writing of project or work and compilation of bibliography in proper order.

Detailed Syllabus

SEMESTER III		
Course Code	**Title**	**Credits**
RUSBCH301	**Enzymology, Physiology & Tools of Biochemistry**	02
Unit I Enzymes and Coenzymes		
1.1	Definition – Enzyme, Apoenzyme, Holoenzyme, Prosthetic group, Active site, Enzyme specificity, Turnover number, Specific activity, Katal, IU, Coenzyme and Cofactor	15 Lectures
1.2	IUB / EC classification upto one digit.	
1.3	Enzyme specificity: Fischer's, lock & key and Koshland's, induced fit theories	
1.4	Activation energy, Mechanism of Enzyme action (concept of active site, single and bi-substrate reaction), Factors affecting enzyme activity – substrate concentration, pH, temperature	
1.5	Enzyme Kinetics – Derivation of Michaelis - Menten equation and Lineweaver Burke plot for monosubstrate reactions and numerical problems based on them	
1.6	Enzyme inhibition – Reversible and Irreversible; Competitive, Non competitive and Uncompetitive, one example of each	
1.7	Problems based on above concept	
Unit II Plant Biochemistry		
2.1	Plant Growth Substances- Structure and Function of- Auxins, Gibberllins, Cytokininis, Ethylene and Abscissic Acid	15 Lectures
2.2	Photosynthesis Light and dark reactions, Z scheme and electron carriers, photophosphorylation [linear and cyclic]; Photorespiration, Photoperiodism Calvin cycle – schematic with enzymes, C_4 and CAM pathway	
2.3	Secondary metabolites of plants – Nitrogen containing compounds (Alkaloids), Terpenes & Phenolic compounds – An introduction to Shikimic acid pathway, Mevalonic acid pathway, MEP Pathway	
Unit III Acids, Bases, Buffers and Ionic Equilibria & pH meter		
3.1	Definition – pH, pK, pKw, Isoelectric pH, Buffer, Buffering Capacity	15 Lectures
3.2	Derivations: Ionic product of water, Hendersen–Hasselbalch equation, Relation between pI, pKa1 and pKa2 for a neutral, acidic and basic amino acid	
3.3	Titration and Ionization of Glycine, Lysine and Aspartic acid; pKa and pI values of these amino acids.	
3.4	pH meter and glass electrode	
3.5	Physiological Buffers: (Hb-HHb, Carbonate-Bicarbonate, Phosphate, and Protein)	
3.6	Numericals on above concepts	
	PRACTICALS	
RUSBCHP301		**Credits 01**
	1) Extraction of β-Amylase from sweet potato 2) Extraction of Urease from horse gram 3) Extraction of Invertase from baker's yeast 4) Preparation of Immobilised Yeast and its use in determination of Invertase activity 5) Determination of Achromic point of Amylase 6) Preparation of Buffers and measurement of pH using paper and pH meter 7) Acid –Base titration of a Polyprotic acid 8) Determination of refractive index using portable refractometer.	

SEMESTER III		
Course Code	**Title**	**Credits**
RUSBCH302	**Fundamentals of Genetics and Physiology**	02

Unit I Genetics : I		
1.1 1.2 1.3 1.4	Mendelian genetics: Mendels experiments, Laws of inheritance Variations over Mendelian Genetics - Incomplete Dominance Co-Dominance, Multiple Alleles, Pleiotropy, Polygenics, Epistasis, Linked Genes, Sex-linked Genes, Environmental influences on Gene Expression (Hormones, Sex-limited & Sex-influenced), Maternal Gene Effects Numericals on above concepts Chromosomal abnormalities (Down's Syndrome, Klinefelter's Sydrome, Turner's Syndrome, Cri-du-chat syndrome, Philadelphia Chromosome)	15 Lectures
Unit II Genetics : II		
2.1 2.2 2.3 2.4 2.5 2.6 2.7	Prokaryotic Genome: Circularity; Single origin Eukaryotic chromosomes: Organization of DNA into chromosomes (upto Solenoid structure) DNA supercoiling, Topoismerase, Chromatin structure, Euchromatin, Heterochromatin, structure of condensed chromatin, Nucleosomes, [Centromere, kinetochrome, telomere], Acetylation & deacetylation of histones, Role of Telomerase Comparison of chromosomal structure in prokaryotes and eukaryotes Transformation: Definition and transformation in S.pneumoniae Transduction: Definition; Explain general features with one example Conjugation: Mechanism , F+ , F- and Hfr strain	15 Lectures
Unit III Transport mechanisms and Haematopoesis		
3.1 3.1.1 3.1.2 3.1.3 3.2 3.2.1 3.2.2	Transport mechanism across Cell Membrane Channel proteins and Carrier proteins Active transport (primary – Na+ & K+ pump; secondary – Glucose) & Passive transport (simple and facilitated diffusion) with suitable examples; concept of symport and antiport. Endocytosis and Exocytosis – with one example each. Haematopoesis RBCs, WBCs, granulocytes & platelets – their development, morphology and maturation (in brief) Biosynthesis of haemoglobin, its regulation and metabolism	15 Lectures
	PRACTICALS	
RUSBCHP302		**Credits 01**
	1) Laws of Mendel 2) A study of Human Karyotypes 3) Effect of organic solvents on cell rupture 4) Isoelectric precipitation of casein 5) Recrystallization of Benzoic acid 6) Estimation of Ascorbic acid Iodometrically 7) Detection of generation of carbon dioxide during fermentation by yeast 8) Sugar fermentation test 9) Assignment – G banding, C banding, Q banding, of chromosomes	

SEMESTER III			
Course Code		**Title**	**Credits**
RUSBCH303		**Industrial Biotechnology& Pharmacology**	02
Unit I Sterilization & Disinfection techniques and Cell culture			
1.1 1.2 1.3	Sterilization and Disinfection techniques Physical Agent of sterilization - Temperature- Pressure (Hot Air Oven, Autoclave), Radiations (UV, Gamma) (examples with mechanism) Chemical agents of sterilization - Alcohol, Halogens, Formaldehyde Animal Tissue Culture: Introduction, Requirements, Culture techniques (Contamination and Sterilization); Culture media: Stem cell culture; Advantages; Applications- Hybridomas, vaccines Plant Tissue-culture: Introduction; Plant breeding; Techniques for maintenance; Genetic culture techniques: Callus regeneration, mutant selection from culture; Protoplast fusion, Transformation: Applications		15 Lectures
Unit II Fermentation and Downstream processing			
2.1 2.2 2.3	Basics: Primary and secondary screening, preparation of inoculum, and fermentation media Fermentors: Types (Batch, Continuous and fluidized bed) and its construction and accessory equipment; Operation of a fermentor; sterilization, inoculation, aeration, agitation; Downstream processing: Introduction, Separation of particles (solidliquid), Cell disruptio n, extraction methods, concentration, Purification and resolution of mixtures, drying		15 Lectures
Unit III Industrial Biotechnology			
3.1 3.2 3.3 3.4	Industrial synthesis - Penicillin, Vit B12, Cheese, Amylase / Protease ; Ethanol ; Acetic Acid Immobilized enzymes: Introduction; Methods of immobilization (entrapment, adsorption, covalent binding, microencapsulation, cross-linking); Stabilization of soluble enzymes: Solvent and substrate stabilization, Enzyme stabilization by polymer, salts, and Chemical modification; Applications and Problems Biosensors: Features of biosensors; Types: Electrochemical, Thermometric, Optical, Piezoelectric, Whole cell, Immunobiosensor; Construction and development, Applications Single cell proteins: Introduction; Bacterial proteins; Yeast proteins; fungal proteins; alg al proteins; Economic aspect; Applications		15 Lectures
		PRACTICALS	
RUSBCHP303			**Credits 01**
	1) Demonstration of the Working of an Autoclave and a Hot Air Oven 2) Sterility Testing of Air by plate exposure technique 3) Study of microbial growth curve using optical density 4) Cell count in a culture medium using optical density 5) A study of culture inoculation methods – Pour plate, Spread plate & Streak Plate 6) Determination of minimum inhibitory concentration of any one disinfectant 7) Flow sheet diagrams of industrial synthesis of a Vitamin, an Antibiotic, a Food item, an enzyme, and alcohol 8) Demonstration of alcohol generated during fermentation by yeast		

SEMESTER IV		
Course Code	**Title**	**Credits**
RUSBCH401	**Enzymology, Physiology & Tools of Biochemistry**	02

Unit I Physicochemical Principles		
1.1	Diffusion and Osmosis	15 Lectures
1.1.1	Explanation of solute concentration (ways of expressing it- mole, molal , normal, percent), activity & ionic strength,	
1.1.2	Diffusion & definition of diffusion coefficient (factors affecting solute diffusion in solution)	
1.1.3	Osmosis- Vant Hoffs law of osmotic pressure (state law & write mathematical expression- no derivation), mechanism of osmosis, Role of osmosis in physiology. Eg. Renal dialysis. Distribution of solute between two immiscible solvents	
1.2	Colloids and Viscosity	
1.2.1	Colloidal state in relation to surface forces, surface area, electrical charge, precipitation and flocculation.	
1.2.2	Surface tension and its measurement, factors affecting surface tension. Eg. Role of bile in digestion	
1.2.3	Viscosity – definition, measurement; Donnan membrane equilibrium, relation between Donnan equilibrium and osmotic pressure	
1.2.4	Adsorption and its characteristics	
Unit II Hormones		
2.1	Definition of Hormones, hormone receptor, endocrine & exocrine glands	15 Lectures
2.2	Classification of hormones on the basis of: i)Distance of target tissue- autocrine, paracrine, endocrine ii) Chemistry - One example for each sub class.	
2.3	Hierarchal organization of the mammalian endocrine system	
2.4	Chemistry, synthesis, secretion & physiological role of thyroxine and insulin (Synthesis from preproinsulin), Diabetes mellitus, Hypothyroidism (cretinism and myxedema), Hyperthyroidism (goiter – simple & toxic)	
2.5	Physiological role of glucocorticoids, oxytocin & vasopressin, FSH, LH, Estrogen, Progesterone (Reproductive cycle)	
2.6	Mode of action of steroid hormones and epinephrine. (amplification cascade with G proteins, cAMP, adenylatecyclase, kinases)	
Unit III Tools of Biochemistry		
3.1	Spectrophotometry and Colorimetry	15 Lectures
3.1.1	Beer-Lambert law, derivation, limitations, application – estimation of sugar(DNSA) and protein (Biuret); concepts of Lambda max; determination of molar extinction coefficient	
3.1.2	Construction and working of a simple colorimeter and spectrophotometer Applications of Beer-Lambert law in the estimation of sugar [DNSA] and protein[Biuret]	
3.1.3	Numericals based on the above concepts	
3.2	Principles and applications of –	
3.2.1	Flame photometry	
3.2.2	Fluorimetry	
3.2.3	Flow cytometry, FRAP, FRET, FLIM	
	PRACTICALS	

RUSBCHP401		**Credits 01**
	1) Adsorption of oxalic acid on activated charcoal 2) Determination of viscosity by Ostwald's Viscometer 3) Determination of density of sugar syrup 4) Demonstration of spectrophotometer 5) Estimation of glucose by DNSA method 6) Estimation of proteins by the Biuret method 7) Estimation of anthocyanin content in vegetable	

	8) Determination of consistency of juices / sauces /squashes / syrup using portable consistometer.	

SEMESTER IV		
Course Code	**Title**	**Credits**
RUSBCH402	**Fundamentals of Genetics and Physiology**	02

Unit I	**Locomotion & Movement**	
1.1 1.1.1 1.1.2 1.2 1.2.1 1.2.2	Muscle contraction Types of muscles – Smooth, Skeletal, Cardiac Structural organization of a muscle fibre, myofibril. Muscle proteins – Actin, Myosin, Troponin, Tropomyosin Contraction and Relaxation of Muscles – mechanisms (Sliding filament theory) Other types of contractions – eg twitch, tetanus, wave summation, Isotonic, Isometric Regulation of Muscle contraction Physiology of plant movements Physical movements – Xerochasy, Hydrochasy Vital movements – Protoplasmic streaming, paratonic movements Tactic movements – Chemotaxis, Phototaxis, Thermotaxis Tropic movements – Chemo / geo / hydro / photo / thigmo tropism Nastic movements – Seismonasty, Nyctynasty, Photonasty, Chemonasty, Thermonasty Spontaneous movements – Ciliary, Amoeboid, Cyclosis	15 Lectures
Unit II	**Neurophysiology**	
2.1 2.2 2.3 2.4	Nervous System – Classification: CNS, PNS; Components: Neurons (3 types) and Neuroglia (6 types) – structure and function, Axonal transport Resting Membrane Potential, ion channels [voltage and ligand gated], Action Potential (depolarization, polarization and refraction period), propagation of action potential (salutatory & continuous conduction) Physiological anatomy of a synapse; Transmission at synapses – Electrical & Chemical synapses, Excitatory & Inhibitory post synaptic potentials, Agonists & Antagonists, Removal of Neurotransmiters Neurotransmitters- acetylcholine and Catecholamines, GABA, Glutamate & Aspartate – structure and function	15 Lectures
Unit III	**Body Fluids**	
3.1 3.2 3.3 3.4	Fluid compartments of the body – ICF and ECF Blood: Composition, characteristics and function; role of plasma proteins, Starlings hypothesis; blood clotting and factors involved [no pathway] Bile: Composition, characteristics and function; storage Lymph : Composition, Formation and Circulation	15 Lectures
	PRACTICALS	

RUSBCHP402		**Credits 01**
	1) Permanent slides of Muscle Tissue 2) Demonstration of Plant Movements 3) Determination of Total WBC count: Haemocytometry 4) Determination of Total RBC count: Haemocytometry 5) Bleeding time 6) Clotting time 7) Effect of Hypotonic, Isotonic and Hypertonic solutions on RBC's 8) Bile Analysis: Detection of Bilirubin & Bile salts 9) Determination of acidity of Vinegar	

SEMESTER IV		
Course Code	**Title**	**Credits**
RUSBCH403	**Industrial Biotechnology & Pharmacology**	02
Unit I Trends in Biotechnology		
1.1	Bioaugmentation, Genetically Engineered Microbes	15 Lectures
1.2	Bioremediation: Introduction; Factors affecting bioremediation; Types; Types of reactions (Aerobic, anaerobic, sequential); Biodegradation of – hydrocarbons, xenobiotics, heavy metals (Uranium); Paper Pulp Industry.	
1.3	Biopesticides, Biofungicide	
1.4	Bioherbicides and agricultural antibiotics	
1.5	Biofertilizers	
1.6	Integrated Pest Management	
Unit II Introduction to Pharmacology		
2.1	Scope of pharmacology	15 Lectures
2.2	Sources, Classification and Nomenclature of drugs	
2.3	Dosage forms and routes of drug administration; Factors affecting dosage and drug delivery	
2.4	Pharmacokinetics : LD 50 , ED 50 Half Life, Loading dose, Maintenance dose (Explanation of terms only), Therapeutic dose, Therapeutic Index, Drug plasma concentration, Volume of distribution, Clearance	
Unit III Pharmacodynamics and Adverse Drug Reactions (ADR)		
3.1	Pharmacodynamics	15 Lectures
3.1.1	Basis of Drug Action	
3.1.2	Drug Receptor Interaction – Receptor Theory of Drug Action, Location of Drug Receptor-G-Coupled Protein receptors	
3.1.3	Drug Acting on enzymes	
3.1.4	Non receptor mechanism	
3.1.5	Placebo effect	
3.1.6	Affinity and Intrinsic Activity	
3.1.7	Intensity of Drug Response – Potency and Efficacy	
3.1.8	Combined Effects of Drug – Synergism, Antagonism	
3.2	Adverse Drug Reactions (ADR)	
3.2.1	Definition and Types of ADR	
3.2.2	Repeated Dosage, Drug dependence, Over dosage, Acute poisoning	
3.2.3	General Principles of Management of Poisoning	
	PRACTICALS	
RUSBCHP403		**Credits 01**
	1) Determination of the amylase exoenzyme secreted by the micro-organisms 2) Determination of the zone of inhibition of microorganisms using the agar well method and disc diffusion method 3) Study of antimicrobial activity of different plant sources. 4) Qualitative determination of reducing sugars formed by starch hydrolyzing micro-organisms.	
	PROJECT WORK	
	GUIDELINE TO CARRY OUT PROJECTWORK 1. The main purpose of introduction of Project Work at SYBSc is to inculcate research culture at under-graduation level. It will also make the students familiar with Research Methodology i.e. reference work, experimental work, analysis of experimental data, interpretation of results obtained,	

writing of project work and compilation of bibliography in proper order.

2. Each student individually or in a group shall complete a small research project during their academic year of SYBSc. However, the initial reference work for the project can be started after the conclusion of FYBSc Semester II examination and summer vacation to SYBSc.
3. **Nature of Research Project:-**Experimental-based involving laboratory analytical work will be considered as the Research Project.
4. **Duration of Project work:-**Using the infrastructure available in the Biochemistry Department, Ramnarain Ruia Autonomous College, the duration to complete the project work will be from the commencement of the project work till the end of January of SYBSc (Sem IV) academic year.
5. **Schedule for Submission of project Work:-**Experimental work must be completed and the report on the same (2 Copies) will have to be submitted by the end of January of SYBSc (Sem IV) academic year.
6. The project should be divided into the following parts:-
   a) Certification of completion of Project Work
   b) Acknowledgement
   c) Introduction
   d) Review of Related Literature
   e) Aims and Objectives
   f) Plan of work
   g) Material and Methods
   h) Results
   i) Discussion
   j) Bibliography
7. The project will be assessed.

GUIDELINE FOR THE ASSESMENT OF PROJECT WORK

1. The practical 403 of Sem IV (Course Code No. RUSBCHP403) shall be exclusively devoted for the project.
2. Each student will complete the project (2 copies) and get both the copies certified by the guiding teacher and the Head of Dept. (HOD) by January of SYBSc (Sem IV) academic year.
3. One copy of the certified project will be submitted to the Department; while the other copy will be retained by the students for his/ her personal record.
4. The candidate is required to present the Research Project to the examiner followed by Viva- Voce examination based on the project work by the examiner.
5. The following Marking Scheme shall be considered while assessing the project work

Particular		Marks
a)	Project Work (Contents Submitted in the bound	10

			form)		
		b)	Presentation of Project Work to examiner	10	
		c)	Viva- voce Exam based on Project Work	05	
		d)	Attendance	05	
			TOTAL	**30**	

References:

Semester III

1) Textbook of Medical Physiology Gyton and Hall, Elsevier publishers
2) David L. Nelson, Michal M. Cox, Lehniger Principles of Biochemistry, W. H. Freeman & company, New york, 4th edition
3) Murry, R. K. & other, Harper's Biochemistry, Appleton & Lange, California, 21st edition
4) J. L. Jain, Fundamentals of Biochemistry, S. Chand & company, 2005 edition
5) Dr. A.C. Deb, Fundamentals of Biochemistry, New central book agency (P) Ltd., 8th edition
6) U. Satyanarayanan, Biochemistry, Books & allied (P) Ltd., Kolkata, 3rd edition
7) Murry, R. K. & other, Harper's Biochemistry, Appleton & Lange, California, 21st edition.
8) J.B.Russel , Genetics
9) Benamin Lewin, Gene VII, Oxford University Press
10) M.W. Strickberger, Genetics
11) William & Wilson

Semester IV

1) Microbiology by Stanier
2) Stanier, Microbiology Pelzer, Essentials of Microbiology
3) Friedfielder, Microbial genetics
   A. H. Patel, Industrial microbiology, Macmillan India Ltd.
4) L. E. Casida, Industrial microbiology, New age international publishers
5) F.S.K Brar, Essentials of Pharmacology, S. Chand Publisher
6) Upadhyay, Biophysical chemistry, Himalayan Publisher
7) Keith Wilson & John Walker, Practical Biochemistry, principle and technique, Cambridge University, 5th edition
8) Biotechnology, by Primrose, Dube
9) Biotechnology, Jodgan
10) U. Satyanarayanan, Biotechnology, Books & allied (

MODALITY OF ASSESSMENT

Theory Examination Pattern:

A) Internal Assessment - 40% :40 marks.

Sr No	Evaluation type	Marks
1	One Assignment/presentation/Quiz	20
2	One class Test (multiple choice questions / subjective)	20

B) External examination - 60 %

Semester End Theory Assessment - 60 marks

i. Duration - These examinations shall be of **2 hours** duration.

ii. Paper Pattern:

1. There shall be **04** questions each of **15** marks. On each unit there will be one question &last question will be based on all 3 units.
2. All questions shall be compulsory with internal choice within the questions.

Questions	Options	Marks	Questions on
Q.1)A)	Any 2 out of 3	04	Unit I
Q.1)B)	Any 2 out of 3 OR Any 4 out of 6	06	
Q.1)C)	Any 1 out of 2	05	
Q.2)A)	Any 2 out of 3	04	Unit II
Q.2)B)	Any 2 out of 3 OR Any 4 out of 6	06	
Q.2)C)	Any 1 out of 2	05	
Q.3)A)	Any 2 out of 3	04	Unit III
Q.3)B)	Any 2 out of 3 OR Any 4 out of 6	06	
Q.3)C)	Any 1 out of 2	05	
Q.4)A)	Any 1 out of 2	04	Unit I, II, III
Q.4)B)	Any 1 out of 2	04	
Q.4)C)	Any 1 out of 2	04	
Q.4)D)	Any 3 out of 5	03	

Practical Examination Pattern:

(A) Internal Examination:

Heading	**Practical I, II & III**
Journal	05
Test	15
Total	**20**

(B) External (Semester end practical examination):

Particulars	**Practical I, II & III**
Laboratory work	25
Viva	5
Total	**30**

PRACTICAL BOOK/JOURNAL

The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.

In case of loss of Journal and/ or Report, a Lost Certificate should be obtained from Head/ Co-ordinator / Incharge of the department; failing which the student will not be allowed to appear for the practical examination.

Overall Examination and Marks DistributionPattern

Semester – III & IV

Course	RUSBCH301			RUSBCH302			RUSBCH303			Grand Total
	Internal	External	Total	Internal	External	Total	Internal	External	Total	
Theory	40	60	100	40	60	100	40	60	100	**300**
Practicals	20	30	50	20	30	50	20	30	50	**150**

Course	RUSBCH401			RUSBCH402			RUSBCH403			Grand Total
	Internal	External	Total	Internal	External	Total	Internal	External	Total	
Theory	40	60	100	40	60	100	40	60	100	**300**
Practicals	20	30	50	20	30	50	20	30	50	**150**