

SHIVAJI UNIVERSITY, KOLHAPUR.



B

Accredited By NAAC

2009

New Syllabus For

B.Sc. III

Biotechnology (Opt./Voc.)

(Sem.-V & VI)

Syllabus to be implemented from June 2012 onwards.

SHIVAJI UNIVERSITY, KOLHAPUR
Biotechnology (Optional/Vocational)
B. Sc III. Biotechnology
(Optional/Vocational)

Semester V (Theory)			
Paper No.	Title of the paper	Theory	Internal.
Paper IX	Biochemical Techniques	40	10
Paper X	Animal Cell Culture.	40	10
Paper XI	Bioprocess Engineering.	40	10
Paper XII	Fermentation Technology.	40	10
Semester VI (Theory)			
Paper XIII	Plant Biotechnology.	40	10
Paper XIV	Environmental Biotechnology.	40	10
Paper XV	Cell Metabolism and Virology.	40	10
Paper XVI	Gene Biotechnology and Bioinformatics	40	10
Practicals			
Practical I	Techniques in Plant and Environmental Biotechnology	50	
Practical II	Techniques in Microbiology and Bioinformatics.	50	
Practical III	Project(Opt.) or Project and On the Job training(Voc.)	50	
Practical IV	Entrepreneurship and Study tour report	50	

Paper IX: Biochemical techniques

Topic No.	Topic	No of Lectures	Marks
	Unit I	12	10
1	1.1 Cell disruption methods-Grinding, abrasive presses, enzymatic method, sonication. 1.2 Centrifugation 1.2.1 Introduction and basic principle of sedimentation 1.2.2 Types of centrifuges 1.2.3 Centrifugation- Differential centrifugation, density gradient centrifugation . 1.3 Separation of proteins by precipitation- 1.3.1 Salt precipitation - Salting out by Ammonium sulphate. 1.3.2 Organic solvent precipitation 1.4 Dialysis		
	Unit II	12	10
2	2.1 Chromatographic methods – Principle, methodology and applications of 2.1.1 Gel Filtration method 2.1.2 Ion exchange chromatography 2.1.3 Affinity chromatography 2.1.4 Gas liquid chromatography (GLC) 2.1.5 High Performance Liquid chromatography (HPLC)		
	Unit III	11	10
3	3.1 Electrophoresis 3.1.1. Introduction, types and general principle 3.1.2 Supporting media – (Agarose. poly acryl amide gel) 3.2 Electrophoresis of nucleic acid 3.2.1 Agarose gel electrophoresis of DNA 3.2.2 DNA sequencing gel 3.2.3 Pulsed field gel electrophoresis 3.2.4 Electrophoresis of RNA 3.3 Electrophoresis of protein 3.3.1 SDS-PAGE electrophoresis- Methodology and applications 3.3.2 Isoelectric focusing		
	Unit IV	10	10
4	4.1 Tracer technique. 4.1.1 Introduction – Radioactivity, radioisotopes,		

	types of radiation (α , β , γ), half life period of radioisotope	
	4.2 Methods of measurement of radioactivity	
	4.2.1 Gas ionization	
	4.2.2 Solvent excitation- Liquid scintillation counter	
	4.2.3 Autoradiography	
	4.3 Applications of radioisotopes in biological systems	

References:-

1. Practical Biochemistry principles and techniques – Wilson and Walkar (edi. VI)
2. Protein purification –Robert Scoop
3. Biophysical Chemistry –Nath Upadhyay
4. Textbook of Biotechnology- R.C.Dubey
5. Textbook of Biotechnology- B.D.Singh

Paper X: Animal Cell Culture

Topic No	Topic	No. of Lectures	Marks
	Unit I	12	10
1	1.1 Introduction to Animal Cell Culture 1.2 Characteristics of Animal Cell Culture 1.3 Substrates for Cell Growth 1.4 Culture media & their properties.- Natural, Synthetic 1.4.1 Serum containing media 1.4.2 Serum Free Media 1.4.3 Balanced Salt Solution (BSS) 1.4.4 Growth factors promoting proliferation of Animal Cell- EGF, FGF, PDGF, IL-1, IL-2, NGF, Erythropoietin 1.5 Sterilization of Glass ware, Reagents, Culture media. 1.6 Equipments used in Animal Cell culture – Laminar Air Flow, Homogenizer, Haemocytometer, Inverted microscope, CO ₂ Incubator		
	Unit-II	11	10
2	2.1 Basic Techniques of Animal Cell Culture 2.1.1 Isolation of Tissue, 2.1.2 Desegregation 2.1.3 Measurement of cell viability, 2.1.4 Maintenance of cell Culture. 2.2 Cell lines-Types of Cell lines- Primary, Secondary, Established 2.3 Scale up of Animal Cell Culture 2.3.1 Bioreactors of Animal cell culture 2.3.2 Roller Bottle		

	Unit-III	10	10
3.	3.1 Organ Culture- Types of organ culture 3.2 Maintenance of Organ culture- Histotypic culture 3.3 Stem cell culture 3.3.1 Types of Stem cells 3.3.2 Transplantation of Stem cells 3.3.3. Applications 3.4 Applications of Animal cell culture 3.4.1 In Transplantation 3.4.2 Monoclonal antibody production 3.4.3 Culture based vaccine 3.4.4 Valuable recombinant products 3.4.5 Cloning. 3.4.6 Cell synchronization		
	Unit IV	12	10
4	4.1 Transfection of Animal cells 4.1.1 Electroporation, microinjection, liposome mediated, gene gun method, virus mediated. 4.1.2 Selection of Transfected cells- Using selective markers- NPT-II, TK, DHFR, XGPRT 4.1.3 Karyotyping 4.2 Transgenic Animals 4.2.1 Production of Transgenic Animals 4.2.2 Examples of Transgenic Animals- sheep, mice, rabbit, cattle, pig, fish 4.2.3 Applications of Transgenic Animals 4.3 Bioethics of Animal Genetic Engineering.		

References:

1. Animal cell culture- Fresheny.
2. Biotechnology – B.D.Singh.
3. Biotechnology- R.C.Dubey.
4. Gene Biotechnology- S.N.Jogdand.

Paper XI: Bioprocess Engineering

Topic No.	Topic	No. of Lectures	
	Unit I	12	10
1.	1.1 Basic design of fermentor 1.2 Construction material used for fermentor 1.3 Accessories associated with fermentor 1.4 Types of fermentors-Tube tower fermentor, bubble cap fermentor, fluidized bed fermentor, air lift fermentor 1.5 Fermentation media 1.6 Sterilization of fermentation media,equipment & air		
	Unit II	12	10
2..	2.1 Screening of industrially important microorganisms 2.1.1 Primary screening 2.1.2 Secondary screening 2.2 Pure culture techniques 2.2.1 Methods of isolation of industrially important microorganisms 2.2.2 Enrichment techniques 2.3 Strain improvement by- 2.3.1 Mutation 2.3.2 Genetic engineering 2.3.3 Genetic recombination 2.4 Maintenance of industrially important microorganisms		
	Unit III	09	10
3.	3.1 Scale up- Bench studies, pilot studies, industrial scale 3.2 Building of inoculum & pitching. 3.3 Computer application in fermentation technology 3.4 Types of fermentations 3.4.1 Continuos fermentation 3.4.2 Batch fermentation 3.4.3 Solid state fermentation		

	Unit IV	12	10
4.	<p>4.1 Down stream processing- Centrifugation, Distillation, Solvent extraction, Filtration, Ultrafiltration, Precipitation, Ion exchange chromatography, Gel filtration, Affinity chromatography, Crystallization & drying</p> <p>4.2 Assays</p> <p>4.2.1 Physico-chemical assays- Gravimetric, Spectrophotometric, Chromatographic</p> <p>4.2.2 Microbiological assays- Diffusion assay, turbidometric assay, metabolic response assay, end point determination assay, enzymatic assay</p>		

References:

1. Comprehensive Biotechnology volume 3 – Murray Moo- Young
2. Basic Biotechnology- Colin Ratledge & Bijon Kritinsen, cambridge university press ,UK
3. Industrial Microbiology - casida
4. Principles of Fermentation technology-Whittekarr
5. Industrial Microbiology- Prescott & dunns
6. Industrial Microbiology- A.H.Patel
7. Industrial Microbiology-Pepler & perlman

Paper XII: Fermentation technology

Topic No.	Topic	No of Lectures	
	Unit I	12	
1.	1.1 Specific fermentations- 1.1.1 Organic acid –Citric acid 1.1.2 Aminoacid- Lysin 1.1.3 Vinegar 1.1.4 Antibiotic-Penicillin		10
	Unit II	12	10
2	2.1 Specific fermentations- 2.1.1 Vitamin- Vitamin B12 2.1.2 Enzyme-Amylase 2.1.3 Therapeutic agent- L-asparaginase 2.1.4 Phytohormone - Gibbrellins 2.1.5 Single cell protein		
	Unit III	12	10
3	3.1 Alcoholic beverages-Wine, Beer fermentation 3.2 Cheese fermentation 3.3 Bread fermentation 3.4 Xanthan gum fermentation 3.5 Lactic acid fermentation		
	Unit IV	9	10
4.	4.1 Fermentation economics 4.2 IPR- 4.2.1-Patents- Introduction, Criteria and process for patenting. 4.2.2 Trdemarks 4.2.3 Trade secrets- 4.2.4. Copyrights.		

References:

1. Comprehensive Biotechnology volume 3 – Murray Moo- Young
2. Basic Biotechnology- Colin Ratledge & Bijon Kritinsen, cambridge university press ,UK
3. Industrial Microbiology - casida
4. Principles of Fermentation technology-Whittekarak
5. Industrial Microbiology- Prescott & dunns
6. Industrial Microbiology- A.H.Patel
7. Industrial Microbiology-Pepler & Perlman

Paper XIII: Plant Biotechnology

Topic No	Topic	No. of Lectures	
	Unit I	12	10
1	1.1 Introduction - History ,concept of cell culture, development of tissue culture, practical applications and recent advances. 1.3 Laboratory organization, Tissue culture media, Aseptic manipulation. 1.4 Clonal propagation (Micropropagation) - Technique, factors affecting, applications, limitations. 1.5 Meristem culture - Principle, protocol, importance.		
	Unit II	10	10
2.	2.1 Callus culture technique - Introduction, principle, protocol, factors affecting, morphology, internal structure, genetic variation, applications, limitations. 2.2 Embryogenesis - Introduction, principle, protocol, factors affecting, importance. 2.3 Organogenesis - Introduction, principle, protocol, factors affecting, applications. 2.4 Artificial seeds - Introduction, method, importance. 2.4 Embryo culture - Introduction, principle, protocol, applications.		
	Unit III	12	10
3	3.1 Haploid production - Protocol for anther and pollen culture, development of androgenic haploids, dplications, problems. 3.2 Endosperm culture - Introduction, technique, applications. 3.2 Somaclonal variation - Introduction, terminology, origin, selection at plant level, selection at cell level, mechanism, assessment, applications, limitations.		

	3.3 Suspension culture technique - Introduction, principle, protocol, different categories, growth and growth measurement , synchronization, applications, limitations.		
	Unit IV	11	10
4.	<p>4.1 Protoplast culture - Introduction, principle, isolation, culture methods, importance.</p> <p>4.2 Somatic hybridization - Protoplast fusion techniques, selection of hybrids, biochemical complementation, visual and morphological methods, cybrid production.</p> <p>4.3 Genetic transformation - <i>Agrobacterium</i> mediated, electroporation, micro projectile, macro injection, pollen mediated, marker genes, expression of transferred genes.</p> <p>4.4 Practical applications of tissue and organ culture - Application in agriculture, application in horticulture and forestry, applications in industries, transgenic plants.</p>		

References:-

1. Introduction to plant tissue culture-M.K.Razdan
2. Plant tissue culture – Theory & practice- S.S.Bhojwani & M.K.Razdan
3. Crop improvement in biotechnology-H.S.Chawala
4. Plant tissue culture-Kalyankumar dey
5. Textbook of biotechnology- R.C.Dubey
6. Plant tissue culture- U .Kumar
7. Biotechnology- B.D.Singh

Paper XIV: Environmental Biotechnology

Topic No.	Topic	No of Lectures	
	Unit I	13	10
1	1.1 Conventional and non conventional fuels and their environmental impacts 1.2 Modern fuels 1.2.1 Methanogenesis and biogas production. 1.2.2 Biohydrogen production 1.2.3 Bioethanol production and Gasohol experiment 1.2.4 Solar energy converters 1.2.1 Biopolymers (PHA, PHB) and Biodiesel 1.3 Global environmental problems 1.3.1 Green house effect and global warming 1.3.2 Ozone depletion 1.3.3 U.V radiations 1.3.4 Acid rain		
		10	10

	Unit II	12	10
2	2.1 Types of wastes: 2.2 Solid waste management 2.2.1 Types of solid waste(hazardous and non hazardous) 2.2.2 Treatment and disposal 2.3 Waste water treatment Methods of treatment- a) Primary - (screening, grinding, grit removal, flocculation, sedimentation, flotation, equalization, coagulation, clarification) b) Secondary - (Aerobic-Trickling filters, activated sludge processes, stabilization ponds)(Anaerobic-Up flow anaerobic sludge blanket reactors), c) Tertiary - (Chemical precipitation,		
	Unit III	12	10
3	3.1 Bioremediation 3.1.1 Definition & types (in-situ & ex-situ) 3.1.2 Bioremediation of hydrocarbons, dyes, heavy metals, pesticides 3.1.3 Agricultural bioremediation-Composting and vermicomposting 3.2 Biopesticides 3.3 Bioaugmentation 3.4 Biosorption 3.5 Bioleaching-Types, chemistry, Bioleaching of Copper & Uranium 3.6 Microbial enhancement of oil recovery 3.3 Phytoremediation		
	Unit IV	10	10

4.	4.1 Biofertilizers 4.1.1 Rhizobial inoculants 4.1.2 Azotobacter inoculants 4.1.3 Azospirillum inoculants 4.1.4 Cyanobacterial inoculants 4.1.5 Phosphate solubilizing bacteria 4.1.6 VAM 4.1.7 Frankia 4.1.4 Azolla 4.2 Methods of Field applications	
----	--	--

References:

1. Environmental biotechnology- Indu Shekhar Thakur.
2. Environmental biotechnology-Chattergy.
3. Environmental biology-Verma & Agarwal.
4. Environmental chemistry-B.K.Sharma.
5. Environmental Pollution- Peavy & Rowe.
6. Environmental problems & solutions- Asthana & Asthana.
7. Environmental science-Siago Canninham.
8. Environmental biotechnology-S.N.Jogdand.
9. Water engineering- Treatment dispose & reuse-Metcalf & Eddy.
10. Environmental Biotechnology-C.S.K Mishra & Juwarkar

Paper XV : Cell Metabolism and Virology.

Topic No.	Name of the topic	No. of Lectures	
	Unit-I	12	10
1	<p>1.1- General Metabolism- Introduction, Definition, Reactions of Metabolic Pathways.</p> <p>1.1.1-Concepts of Free energy</p> <p>1.1.2-Methods for study of Metabolic Pathways by using radioisotopes, by using mutants, in vitro studies.</p> <p>1.2– Metabolism of Carbohydrate and Lipids</p> <p>1.2.1- Carbohydrate metabolism- Reactions, Energetics Significance, Regulation of- Glycolysis & Gluconeogenesis.</p> <p>1.2.2- Reactions, significance of Pentose Phosphate Pathway</p> <p>1.2.3- Reactions & Energetics of TCA Cycle.</p>		
	Unit-II	11	10
2	<p>2.1 Lipid Metabolism</p> <p>2.1.1 Biosynthesis of Saturated Fatty acid- Palmitic Acid</p> <p>2.1.2 β-Oxidation of Fatty acid - Palmitic Acid</p> <p>2.2 – Respiratory ElectronTransport Chain</p> <p>2.2.1 Components of ETC</p> <p>2.2.2 Flow of electrons, Redox values.</p> <p>Mechanism of ATP generation – Chemical coupling hypothesis , Chemiosmotic hypothesis.</p> <p>2.3- Urea Cycle- Reactions & Significance.</p>		
	Unit III	10	10
3	<p>3.1 Introduction to Hormones- Definition, Types of Vertebral Hormones- Steroid, Peptide, Aminoacid</p> <p>3.2 Mode of Action- Hormone cascade mechanism</p> <p>3.2.1- Hormone action at Cyclic nucleotide level</p> <p>3.2.2- Induction of Enzyme synthesis at Nuclear level.</p> <p>3.2.3- Stimulation of Enzyme synthesis at ribosomal level.</p>		

	3.2.4- Direct activation at enzyme level.		
	Unit-IV	12	10
4	4.1 Virology-Inroduction.Types on the basis of Host & Nucleic acid 4.2 General Characteristics of Viruses. 4.3- General Structures of Viruses- TMV, Adeno virus, T ₄ Bacteriophage 4.4- Reproduction of Viruses- 4.4.1- Adeno virus 4.4.2- Bacteriophages- T ₄ , λ- Phage 4.5- Isolation & Cultivation of Plant & Animal Viruses- Tissue culture & Embryonated Eggs		

References:

1. Biochemistry – Lubert Strayer.
2. Principles of Biochemistry- Lehninger.
3. Virology- Luria & Delbruck.
4. Fundamentals of Biochemistry- J.L.Jain S.Chand Publication

Paper XVI: Gene biotechnology and Bioinformatics

Topic No.	Topic	Lectures 45	
1	Unit I	12	10
	1.1 Techniques in gene biotechnology- DNA Finger printing (DNA profiling) 1.1.1 Introduction 1.1.2 Genetic markers 1.1.3 Uses of Minisatellites 1.1.4 Multilocus and single locus probes 1.1.5 Scheme for DNA Finger printing 1.1.6 Applications 1.2 Restriction mapping		
	Unit II	12	10
2	2.1 Chromosome walking and jumping –Introduction and steps 2.2 Gene targeting 2.2.1 Theory 2.2.2 Application 2.2.3 Gene targeting in mice 2.3 Human gene therapy 2.3.1 Introduction 2.3.2 Types of gene therapy- 1. Somatic gene 2. Germ Line 3. Enhancement 4. Eugenic genetic engineering. 2.3.3 Methods for gene transfer –virus vector,non-viral approach 2.3.4 Limitations and requirement in gene therapy 2.4 Antisense therapy- Introduction, principle, applications 2.5 DNA micro array		
	Unit III	10	10
3	3.1 Introduction to Bioinformatics 3.1.1 Definition of Bioinformatics 3.1.2 Use of computer and internet in Biology and Medicine 3.1.3 Definition and classification of databases (primary and secondary)		

	3.1.4 Sequences and nomenclature 3.1.5 Information sources-Introduction, aims and objectives NCBI(National Centre for Biotechnology Information) NLM(National Library of Medicine) NIH (National Institute of Health) SRS(Sequence Retrieval System), EBI, Entrez, DBGet		
	Unit IV	12	10
4	4.1 Introduction to Genomics 4.1.1 Definition 4.1.2 Methods of gene sequencing 1.Direct sequencing of BAC(Bacterial Artificial Chromosome) 2.Random shot gun sequencing 3.Whole genome shot gun sequencing 4.1.3 Gene prediction and gene counting 4.1.4Types of genomics (structural and functional) 4.1.5Applications of genomics 4.2Human Genome Project 4.2.1 Introduction and definition 4.2.2 Difficulties in mapping and sequencing 4.2.3 Technical strategies 1. Physical mapping 2. Genetic mapping 4.3 Introduction to proteomics 4.3.1 Introduction, definition & scope. 4.3.2 Types of proteomics –1.Expression 2.Structural 3.Functional 4.3.3Applications of proteomics		

References:

- 1.Gene Biotechnology -S.N.Jogdand
- 2.Gene Manipulation – Old and Primrose
3. Introduction to Bioinformatics – Rastogi.
4. Introduction to Bioinformatics- T. K. Attwood.

Practical I: Techniques in Plant and Environmental Biotechnology

Sr. no.	Name of the Practical	30 P
1	Preparation of stock Solutions & media	2
2	Callus culture technique- Initiation of culture, callus morphology.	2
3	Suspension culture technique – Initiation, growth measurement	2
4	Initiation of anther culture	2
5	Synthetic seed production	2
6	Initiation of micropropagation- Shoot tip or axillary bud culture technique	2
7	Subculture & multiplication of culture	2
8	Root differentiation	2
9	Acclimatization & hardening	2
10	Determination of BOD of sewage	2
11	Determination of COD of sewage	1
12	Isolation of <i>Rhizobium</i> from root nodules	2
13	Isolation of PSB from soil.	2
14	Isolation of <i>Azotobacter</i> from soil.	2
15	Isolation of <i>Xanthomonas</i> from infected citrus fruits.	2

Practical II: Techniques in Microbiology and Bioinformatics

Sr. no.	Name of the Practical	
1	Bioassay of penicillin	2
2	Bioassay of Vitamin B12	2
3	Immobilization of yeast(<i>Saccharomyces cerevisiae</i>) cells, production of ethanol by using immobilized yeast cells and determination of alcohol content by specific gravity method	4
4	Screening of Amylase Producers from Soil, Production of bacterial amylase by submerged culture method & estimation of amylase by DNSA method	5
5	Production of Xanthan gum using Xanthomonas.	2
6	Estimation of citric acid by Titrimetric method.	1
7	Isolation of Vitamin B ₁₂ mutants.	2
8	Determination of molecular weight of DNA	1
9	Browsing and understanding NCBI Web page, Introduction to literature database- PubMed	1
10	Exploring protein sequence database- Introduction to protein databank(PDB) & RasMol to visualize 3D structure of protein	1
11	Exploring Nucleic acid sequence database, Understanding Human genome project	1
12	Purification of proteins by gel filtration chromatography	1
13	Purification of Proteins by Ion exchange chromatography.	1
14	Transformation of <i>E. coli</i> .	2
15	Isolation of <i>E. coli</i> phages	2

Practical Examination:-

- A) The practical examination will be conducted on three (3) consecutive days for not less than 4 1/2 hours on each day of the practical examination.
- B) Each candidate must produce a certificate from the Head of the Department in his/her college stating that he/she has completed in a satisfactory manner the practical course on the guidelines laid down from time to time by Academic Council on the recommendation of Board of studies and has been recorded his/her observations in the laboratory journal and written a report on each exercise performed. Every journal is to be checked and signed periodically by a member teaching staff and certified by the Head of the Department at the end of year. Candidates are to produce their journal at the time of practical examination. Candidates have to visit at least two (2) places of Biotechnological interest (Pharmaceutical industry, Dairy, Research institutes etc.) and satisfactorily complete project work, job training, and entrepreneurship as per syllabus. The report of the same should be duly certified by the Head of the Department and submit the respective reports at the time of examination.

Practical III:

For Vocational Biotechnology- 1. Project

2. On Job Training Report

For optional biotechnology – Project

Practical IV:

Entrepreneurship

Study Tour Report

Question paper pattern:

**Practical III: Techniques in Plant and Environmental
Biotechnology**

Q.1 Major Experiment	20 Marks
Q.2 Minor Experiment	10 Marks
Q.3 Spotting	10 Marks
Q.4 Journal	5 Marks
Q.5 Oral	5 Marks

Practical IV: Techniques in Microbiology and Bioinformatics

Q.1 Major Experiment	20 Marks
Q.2 Minor Experiment	10 Marks
Q.3 Spotting	10 Marks
Q.4 Journal	5 Marks
Q.5 Oral	5 Marks

Practical V

For Vocational Biotechnology-

Project 35 Marks

On Job Training Report 15 Marks

For optional biotechnology –

Project 50 Marks

Practical VI

Entrepreneurship 35 Marks

Study Tour Report 15 Marks

COMMON NATURE OF QUESTION FOR THEORY PAPER MENTIONED SPERATELY:

**Equivalence for theory papers
(From June 2012)**

Semester V (Theory) Revised Syllabus				Pre Revised Syllabus
Paper No.	Title of the paper	Marks	Lectures / Practical	Equivalence
Paper IX	Biochemical Techniques	50	45 L	BTO 304- Sec I
Paper X	Animal Cell Culture.	50	45 L	BTO 301- Sec II
Paper XI	Bioprocess Engineering.	50	45 L	BTO 303- Sec I
Paper XII	Fermentation Technology.	50	45 L	BTO 303- Sec II
Semester VI (Theory)				
Paper XIII	Plant Biotechnology.	50	45 L	BTO 302- Sec I
Paper XIV	Environmental Biotechnology.	50	45 L	BTO 302- Sec II
Paper XV	Cell Metabolism and Virology.	50	45 L	BTO 301- Sec I
Paper XVI	Gene Biotechnology and Bioinformatics	50	45 L	BTO 304- Sec II
Practicals				
Practical I	Techniques in Plant and Environmental Biotechnology	50	30 P	BTO 305
Practical II	Techniques in Microbiology and Bioinformatics.	50	30P	BTO 306
Practical III	Project(Opt.) or Project and On the Job training(Voc.)	50	30 P	BTO 307
Practical IV	Entrepreneurship and Study tour report	50	30 P	BTO 308