॥ 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

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

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 विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरण–२०२० नुसार पदवी तृतीय वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२६–२७ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, दिनांक २२ एप्रिल २०२६ रोजी संपन्न झालेल्या मा.विद्यापरिषद बैठकीतील विषय क्र.०८/६४–२०२६ च्या ठरावानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील राष्ट्रीय शैक्षणिक धोरण–२०२० नुसार पदवी तृतीय वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२६–२७ पासून लागू करण्यास मा.विद्यापरिषदेने मान्यता प्रदान केली आहे. त्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील बी.एस्सी. तृतीय वर्षाचे खालील विषयाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२६–२७ पासून लागू करण्यात येत आहे.

01	B.Sc. III Year Food Science (Affiliated Colleges)
02	B.Sc. III Year Biophysics (Affiliated Colleges)

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या www.srtmun.ac.in या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी, ही विनंती.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.:शै–१/परिपत्रक/पदवी/बीएस्सी/२०२६–२७/ ११७
दिनांक : २४.०७.२०२६
27

उपकुलसचिव
शैक्षणिक (१–अभ्यासमंडळे) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :–
१) मा. कुलगुरू महोदयांचे कार्यालय, प्रस्तुत विद्यापीठ.
२) मा. प्र.कुलगुरू महोदयांचे कार्यालय, प्रस्तुत विद्यापीठ
३) मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
४) मा. संचालक, परिक्षा व मुल्यमापन मंडळ, प्रस्तुत विद्यापीठ.
५) मा. प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.

SWAMI RAMANAND TEERTHMARATHWADA UNIVERSITY, NANDED - 431 606 (MS)

(Credit Framework and Structure of Four Year UG Program with Multiple Entry and Exit Option as per NEP-2020)

UNDERGRADUATE PROGRAMME OF

SCIENCE & TECHNOLOGY

Major in **BIOPHYSICS** and Minor in **DSM** (Subject)

Under the Faculty of Science & Technology

(Revised as per the Govt. of Maharashtra circular dt. 13th March 2024)

W.E.F. AY-2026-27

Preamble:

The education in India, in general, is expanding manifolds. It is the challenge to ensure its quality to stakeholders to meet this challenge. The issue of quality needs to be addressed and taken forward in a systematic manner. For this we Biophysicist tried to modify our subject curriculum according to National Education Policy (NEP) 2020 to explore future brightness of stakeholders.

As I am Chairman, Board of Studies in Biophysics, Swami Ramanand Teerth Marathwada University, Nanded, happy to state here that we all members made a curriculum and finalized it. The Program Educational Objectives were finalized for undergraduate programs in Biophysics. I am thankful to our Dean of Science and Technology Dean Dr. M. K. Patil who has given us this opportunity.

The Program Educational Objectives finalized for under graduate program in Biophysics are listed below:

Program Educational Objectives (PEO):

PEO1: Students should be able to understand the fundamentals of biophysical techniques and implement them.

PEO2: To develop a interdisciplinary view for better understanding and analytic ability.

PEO3: Fundamental Knowledge: Apply fundamental principles of physics, chemistry, mathematics and biology to understand biological systems and their organization at molecular, cellular and organismal levels.

PEO4: The ability to communicate effectively in terms of technical and non-technical audiences.

Program Outcomes (PO):

PO1: Have fundamental knowledge and understanding of biophysical theory at an applied level in the subject.

PO2: Acquire the **s**trong foundation of biophysical concepts which will benefit them to become good academicians.

PO3: Use acquired biophysical tools and techniques to address various life science problems.

PO4: Gain the knowledge of software which has the wide range of opportunities in the various sectors viz., biotechnological sector Quality control in industries, Business, Government and private sector etc.

PO5: Qualify various National / State level competitive exams viz. DSO, GATE, NET,SET,MPSC, UPSC, etc.

Program Specific Outcomes (PSO):

On successful completion of the program students will able to:

PSO1: Interdisciplinary Knowledge: Understand and implement biophysical methods.

PSO2: Handle and analyse life science problems with laboratory skills.

PSO3: Experimental Competence: Demonstrate practical skills in biophysical, biochemical, molecular biological and instrumental techniques for investigation of biological systems.

PSO4: Quantitative & Computational Analysis.

PSO5: Research & Innovation.

Course Outcomes (for all courses):

The courses in the Biophysics programme are designed to provide students with fundamental and advanced knowledge of biophysical principles and their applications in biological systems. Students will develop theoretical understanding, practical laboratory skills, quantitative and computational abilities, and competence in analyzing biological data. The courses will also enhance scientific thinking, problem-solving, research aptitude, interdisciplinary learning, and the ability to apply biophysical concepts in biotechnology, genomics, proteomics, medical sciences, and related fields.

Chairman,
Board of Studies of the Biophysics
Swami Ramanand Teerth Marathwada University, Nanded.

B.A. / B.Sc. Third Year (SEMESTER-V) *(Level 5.5)*

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ Week)	
			Theory	Practical	Total	Theory	Practical
Major	SBPHCT1301	Bioinformatics & structural biology	03	--	**12**	03	--
	SBPHCT1302	Radiation biophysics	03	--		03	--
	SBPHIKS1303	Biophysics in Indian knowledge system	02	--		02	--
	SBPHCP1301	Practical VII	--	02		--	04
	SBPHCP1302	Practical VIII	--	02		--	04
Major (Elective) **(Select any one)**	SBPHET1301	Genomics & Proteomics	02	--	**02**	02	--
	SBPHEP1301	Practical-I	--	02	**02**	--	04
	SBPHET1302	**Bioelectronics and medical instrumentation**	02	--	**02**	02	--
	SBPHEP1302	Practical-II	--	02	**02**	--	04
Skill Based Course	SBPHVC1301	Biophysical Technique .	--	02	**02**	--	04
Field Project	SBPHFP1301	Field Project	--	04	**04**	--	08
		Total Credits	**10**	**12**	**22**	**10**	**22**

B.A. / B.Sc. Third Year (SEMESTER-V)*(Level 5.5)*

Examination Scheme

[40% Continuous Assessment (***CA***) and 60% End Semester Assessment (***ESA***)]***(For illustration we have considered a paper of 02 credits, 50 marks, need to be modified depending on credits assigned to individual paper)***

Subject (1)	Course Code (2)	Course Name (3)	Theory						Practical		Total Col (6+7+8+9) / Col (10+11) (12)
			Continuous Assessment (CA)					ESA			
			Test I (4)	Test II (5)	Average of T1 & T2 (6)	Assignment, Presentation, Viva, Quiz, Open Book, etc. (7)	Attendance (8)	Total (9)	CA (10	ESA (11)	
Major	SBPHCT1301	Bioinformatics & structural biology	15	15	15	9	6	45	--	--	75
	SBPHCT1302	Radiation Biophysics	15	15	15	9	6	45	--	--	75
	SBPHCT1303	Biophysical technique in Indian knowledge system	10	10	10	6	4	30	--	--	50
	SBPHCP1301	Practical VII	10	10	10	6	4	--	20	30	50
	SBPHCP1302	Practical VIII	10	10	10	6	4	--	20	30	50
Major (Elective)	SBPHET1301	Genomics & Proteomics	10	10	10	6	4	30	--	--	50
	SBPHEP1301	Practical-I	10	10	10	6	4	--	20	30	50
	SBPHET1302	Bioelectronic & medical instrumentation	10	10	10	6	4	30	--	--	50
	SBPHEP1302	Practical-II	10	10	10	6	4	--	20	30	50
Skill Based Course (related to Major)	SBPHVC1301	Biophysical technique	10	10	10	6	4	--	20	30	50
Field Project	SBPHFP1301	Field Project	20	20	20	12	8	--	40	60	100

B.A. / B.Sc. Third Year (SEMESTER-VI)*(Level 5.5)*

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	SBPHCT1351	Design of Experiments	03	--	12	03	--
	SBPHCT1352	Operations Research	03	--		03	--
	SBPHCT1353	Demography	02	--		02	--
	SBPHCP1351	Practical IX	--	02		--	04
	SBPHCP1352	Practical X	--	02		--	04
Major (Elective)	SBPHET1351	Introduction to Stochastic Process	02	--	**02**	02	--
	SBPHEP1351	Practical-III	--	02	**02**	--	04
	SBPHET1352	Introductory Clinical Trials	02	--	**02**	02	--
	SBPHEP1352	Practical-IV	--	02	**02**	--	04
Skill Based Course	SBPHVC1351	Data Analysis using SPSS Software	--	02	**02**	--	04
Field Project	SBPHFP1351	OJT (On the Job Training)	--	04	**04**	--	08
		Total Credits	**10**	**12**	**22**	**10**	**22**

B.A. / B.Sc. Third Year (SEMESTER-VI)*(Level 5.5)*

Examination Scheme

[40% Continuous Assessment (CA) and 60% End Semester Assessment (ESA)](For illustration we have considered a paper of 02 credits, 50 marks, need to be modified depending on credits assigned to individual paper)

Subject (1)	Course Code (2)	Course Name (3)	Theory						Practical		Total Col (6+7+8+9) / Col (10+11) (12)
			Continuous Assessment (CA)					ESA			
			Test I (4)	Test II (5)	Average of T1 & T2 (6)	Assignment, Presentation, Viva, Quiz, Open Book, etc. (7)	Attendance (8)	Total (9)	CA (10	ESA (11)	
Major	SBPHCT1351	Design of Experiments	15	15	15	9	6	45	--	--	75
	SBPHCT1352	Operations Research	15	15	15	9	6	45	--	--	75
	SBPHCT1353	Demography	10	10	10	6	4	30	--	--	50
	SBPHCP1351	Practical IX	10	10	10	6	4	--	20	30	50
	SBPHCP1352	Practical X	10	10	10	6	4	--	20	30	50
Major (Elective)	SBPHET1351	Introduction to Stochastic Process	10	10	10	6	4	30	--	--	50
	SBPHEP1351	Practical-III	10	10	10	6	4	--	20	30	50
	SBPHET1352	Introductory Clinical Trials	10	10	10	6	4	30	--	--	50
	SBPHEP1352	Practical-IV	10	10	10	6	4	--	20	30	50
Skill Based Course	SBPHVC1351	Data Analysis using SPSS Software	10	10	10	6	4	--	20	30	50
Field Project	SBPHFP1351	OJT (On the Job Training)	20	20	20	12	8	--	40	60	100

B.A. / B.Sc. Third Year (SEMESTER-V) *(Level 5.5)*

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	SBPHCT1351	Design of Experiments	03	--	12	03	--
	SBPHCT1352	Operations Research	03	--		03	--
	SBPHCT1353	Demography	02	--		02	--
	SBPHCP1351	Practical IX	--	02		--	04
	SBPHCP1352	Practical X	--	02		--	04
Major (Elective)	SBPHET1351	Introduction to Stochastic Process	02	--	**02**	02	--
	SBPHEP1351	Practical-III	--	02	**02**	--	04
	SBPHET1352	Introductory Clinical Trials	02	--	**02**	02	--
	SBPHEP1352	Practical-IV	--	02	**02**	--	04
Skill Based Course	SBPHVC1351	Data Analysis using SPSS Software	--	02	**02**	--	04
Field Project	SBPHFP1351	OJT (On the Job Training)	--	04	**04**	--	08
		Total Credits	**10**	**12**	**22**	**10**	**22**

B.Sc. Third Year (SEMESTER-V)

SBPHCT1301 DSEBP-X: Bioinformatics & Structural Biology

(Maximum No. of Periods 45)

Programme: Degree Course in Biophysics Class: B.A./B.Sc. III	Year: Third Level 5.5	Course Type DSC	Semester: V
Prerequisites: This course does not require any pre-requisite.			
Course Code: **SBPHCT1301**	Course Title: Bioinformatics & Structural Biology		
Course Objectives: The course objectives are: • To provide fundamental knowledge of biophysical principles and biological systems. • To develop practical skills in biophysical, biochemical and molecular techniques. • To enhance quantitative, computational and analytical abilities in biological sciences. • To promote research aptitude, problem-solving and interdisciplinary learning. **Course Outcomes(CO's):**At the end of the course the student should be able to: • Students will explain fundamental concepts and principles of biophysics and their biological applications. • Students will perform and interpret basic biophysical, biochemical and molecular experiments. • Students will analyze biological data using quantitative, statistical and computational approaches. • Students will apply biophysical knowledge to solve scientific problems and develop research-oriented solutions.			
Credits: 03	DSC-13		
Max. Marks: 75	Min. Passing Marks:30		
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 3-0-0			

Module No.	Unit No.	Topic	No. of Lectures
1.0	**1**	Introduction to Bioinformatics	**12**
	1.1	Bioinformatics-Definition aims and tasks of bioinformatics, applications of bioinformatics.	
	1.2	Data bases – Major Bioinformatics Resources: Nucleic acid sequence databases: NCBI, EMBL, DDBJ; GenBank;.	
	1 .3	Protein sequence databases: Uniprot-KB: SWISS-PROT, Structure classification database: CATH, SCOP;	
	1.4	Genome Databases at NCBI, SANGER ;3D Structure Database - PDB.	
	1 .5	Chemical Structure database: Pubchem; Gene Expression database: GEO, ExPASy Server.	
2.0	**2**	Genomics and Phylogenetics	**10**
	2.1	Genomics: Introduction, why analyze DNA, cDNA libraries and ESTS, PCR, Micro-array technology and its applications .	
	2.2	Sequence Alignment Goals and type of alignment: Pair wise and multiple sequence alignment, FABPH and BLAST	
	2.3	Phylogenetics, cladistics and ontology, building phylogenetic trees, Interpreting results. Molecular approaches to phylogeny, Phylogenetic analysis databases.	
3.0	**3**	Structural Biology	**13**
	3.1	Conformational principles Biological macromolecules: Protein and Nucleic acid.	
	3.2	rotation angles, hydrogen bonding, hydrophobic interactions and water structures; ionic interactions, disulphide bonds,	
	3.3	Ramachandran plot, Protein folding and flexibility. Supra-molecular interactions: Proteinprotein and protein-nucleic acid interactions..	
	3.4	Neyman's allocation Vs simple random sampling,Efficiency of stratified random sampling over simple random sampling, Gainin precision due to Stratifications.	
4.0	**4**	Bioinformatics in Drug Designing	**10**
	4.1	Molecular Modeling: Introduction, method, homology modeling, energy minimization, molecular visualization tool (RASMOL, PyMOL).	
	4.2	Role of bioinformatics in drug discovery target and lead compounds identification and validation .	
	4.3	pharmacoinformatics, chemical libraries, docking and prediction of drug quality. Bioinformatics companies.	
		Total No. of Lectures =	**45**

Text Books:

1. Bioinformatics (2006) N.Gautham John Garland, Publication Inc Narosa publications.
2. Biophysics (2002) Vasantha Pattabhai and N.Gautham Narosa Publishers.
3. Physical Chemistry (2001):Tinoco, I., Jr., Sauer, K., Wang, J. C., & Puglisi, J. D.
4. Principles and Applications in Biological Sciences, 4th ed. Prentice Hall.
5. Introduction to Protein Structure, by Branden and Tooze

Reference Books:

6. Basic Bioinformatics by S. Ignacimuthu, S. J. Narosa Publishing House,2005.
7. Bioinformatics: Sequence and Genome analysis by David W. Mount, Cold Spring Harbour Laboratory Press, 2001. 3. Protein structure, stability and folding (2001) K.P.Murphy Humana press.
8. Introduction to protein architechcture (2001) Arthur M.Lesk Oxford University Press.
9. Introduction to Macromolecular Crystallography (2003) McPherson John wiley Publications.
10. Introduction to Protein Structure, (1991) Carl Branden and John Tooze

B.Sc. Third Year (SEMESTER-V)

SBPHCT1302 DSEBP -IX: Radiation Biophysics

(Maximum No. of Periods 45)

Programme: Degree Course in Biophysics Class: B.A./B.Sc. III	Year: Third Level 5.5	Course Type DSC	Semester: V
Prerequisites: This course does not require any pre-requisite.			
Course Code: **SBPHCT1302**	Course Title: Radiation Biophysics		

Course Objectives:

- To introduce the fundamental concepts, scope, and applications of radiation biophysics.
- To develop the ability to formulate real-world in life science and radiobiology.
- To understand and apply graphical and simplex methods for solving optimization problems.
- To provide knowledge of special optimization techniques such as transportation and assignment models.

Course Outcomes (CO's): After completion of the course students will able to:

- **CO1:** Understand the basic concepts, scope, phases, and limitations of Operations Research and apply them in decision-making problems.
- **CO2:** Formulate real-life problems as Linear Programming Problem models and identify feasible and optimal solutions.
- **CO3:** Analyse and solve Transportation Problem using methods such as North-West Corner Rule, Least Cost Method, and VAM, and test optimality
- **CO4:** Apply techniques to solve Assignment Problem using the Hungarian method and handle unbalanced cases.

Credits: 3	DSC-14
Max. Marks: 75	Min. Passing Marks:30
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 3-0-0	

Module No.	Unit No.	Topic	No. of Lectures
1.0	**1**	Basics of Radiation Biophysics	**12**
	1.1	Atomic structure models, Constituents of atomic nuclei, Isotopes, Isobars, Isotones, Radioactivity, law of Radioactivity, General properties of alpha, beta and gamma radiations .	
	1.2	Radiation measurement units, Interaction of radiation with matter: Excitation and ionization, Photo electric effect, Compton Effect, pair production.	
	1.3	Non-ionizing radiations-UV, IR, Microwaves & Radio waves, their characteristics, interactions & implications in bio system	
2.0	**2**	Basics of Radiochemistry	**13**
	2.1	Radiolysis of water, Production of free radicals and their interactions	
	2.2	Direct and indirect effects of radiation. Radiation chemical yield and G value, Target theory,	
	2.3	Single hit & Multi hit theory, Effect of radiation on Nucleic acids, Proteins, Enzymes.	
3.0	**3**	Basics of Radiobiology	**10**
	3.1	Action of radiation on living system – Viruses, Prokaryotic & Eukaryotic cells Cellular effects of radiation, somatic & genetic effects	
	3.2	Inhibition of Mitosis, survival curves, concept of LD50, acute and chronic (whole body) effects of radiation	
	3.3	Radiation syndrome in human beings. Radiation Detection & Measurement.	
4.0	**4**	Radioisotopes in biology	**10**
	4.1	Basic Principles of Radiation protection, Maximum permissible dose (MPD). Applications in Medicine (Therapy & diagnosis)	
	4.2	Agriculture & plant physiology, Biological applications of radioisotope: Radio-labeling & Tracer techniques, Food irradiation	
	4.3	radiation sterilization of medical product. Autoradiography - Principle procedure and Application of autoradiography	
		Total No. of Lectures =	**45**

Text Books:

.

Reference Books:

1. Introduction to Experimental Nuclear Physics: R.M. Singru.
2. Radiation Biophysics: E.L. Alpen.
3. Nuclear Structure: Preston and Bhaduri.
4. Radiation Detection and Measurement: G.F. Knoll.
5. Edward L. Alpen Radiation Biophysics, Second Edition
6. Biophysics by Glaser Rowland (2001). Springer Verlag, Berlin
7. Bushong, Stewart, Radiologic Science for Technologists, C. V. Mosby, 2009,9th edition.
8. NCRP Report 105. Radiation Protection for Medical & Allied Health Personnel.
9. NCRP Report 116. Limitation of Exposure to Ionizing Radiation.
10. NCRP Report 102. Medical X-ray, Electron Beam, and Gamma-Ray Protection.

B.A. / B.Sc. Third Year (SEMESTER-V)

(Maximum No. of Periods 30)

<table>
<tr><td>Programme: Degree Course in Biophysics
Class: B.A./B.Sc. III</td><td>Year: Third
Level 5.5</td><td>Course Type
DSC</td><td>Semester: V</td></tr>
<tr><td colspan="4">Prerequisites: This course does not require any pre-requisite.</td></tr>
<tr><td>Course Code:
SBPHCT1303</td><td colspan="3">Course Title: Biophysics in Indian knowledge system.</td></tr>
<tr><td colspan="4">Course Objectives: The course objectives are:
To introduce the fundamental concepts and importance of Statistical Quality Control in maintaining product and process quality. To develop the ability to construct and interpret control charts for variables and attributes.To provide knowledge of sampling inspection methods and quality standards.To familiarize students with modern quality improvement approaches such as Six Sigma and Total Quality Management.
Course Outcomes (CO’s): At the end of the course the student should be able to:
CO1: Understand the concepts of quality, process control, and causes of variation in Statistical Quality Control.
CO2: Construct and interpret control charts for variables such as X-bar, R-chart, and sigma chart to monitor process performance.
CO3: Apply acceptance sampling techniques, including single and double sampling plans, and evaluate quality using AQL, LTPD, and OC curves.
CO4:Understand and apply modern quality improvement tools such as Six Sigma, Total Quality Management, and Taguchi methods.</td></tr>
<tr><td colspan="2">Credits: 2</td><td colspan="2">DSC-15</td></tr>
<tr><td colspan="2">Max. Marks: 50</td><td colspan="2">Min. Passing Marks:20</td></tr>
<tr><td colspan="4">Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 2-0-0</td></tr>
<tr><td colspan="4"></td></tr>
</table>

Module No.	Unit No.	Topic	No. of Lectures
1.0	**1**	Introduction to Indian knowledge system in biophysics	
	1.1	Concept and definition of IKS ,meaning and scope of IKS ,Evolution of Indian scientific tradition, objective of IKS	
	1.2	Historical development ,ancient Indian contributions to science , vedic and post vedic knowledge system ,contribution of ancient scholar .	**7**
	1.3	Relevance to modern science – interdisciplinary approach , role in education and research ,integration with contemporary science .	
	2	Biophysical basis of traditional practices	
	2.1	Physiological effect f yoga – cardiovascular system , respiratory system , nervous system , musculoskeletal system .	
	2.2	Biophysical measurements – heart rate, blood pressure, oxygen consumption , lung function .	**8**
	2.3	Instrumentation – electrocardiogram(ECG), electroencephalogram (EEG),electromyography (EMG), spirometer, pulse oximeter .	
	3	Indian Concepts of health and Lifestyle	
	3.1	Dinacharya ()- daily routine , personal hygiene , physical activity .	
	3.2	Ritucharya ()- seasonal adaptation , diet according to seasons , lifestyle modifications .	**7**
	3.3	Ahara () – balanced diet , nutrition in ayurveda , healthy eating practices .	
	3.4	Preventive healthcare – disease prevention , immunity promotion, healthy lifestyle .	
2.0	**4**	Scientific validations of IKS	
	4.1	Yoga research -clinical studies ,physiological outcomes ,	
	4.2	Meditation research – brain function , stress reduction	**8**
	4.3	Ayurveda Research -herbal medicines , evidence based studies .	
	4.4	Integrative medicines – traditional and modern healthcare , holistic medicine .	
		Total No. of Lectures =	**30**

Text Books:

1. Datta, B., & Singh, A. N. (1962). History of Hindu Mathematics: A Sourcebook. Asia Publishing House.
2. Plofker, K. (2009). Mathematics in India. Princeton University Press.
3. J. K. Ghosh, P. Maiti, T. J. Rao, and B. K. Sinha. (1999). Evolution of Biophysics in India. International Statistical Review, ISI.
4. Singh, A.K. & Kapoor, K. (2021). Indian Knowledge Systems - Vol 1 & 2.

5. Mahalanobis, P.C. (1944). On large-scale sample surveys. Philosophical Transactions of the Royal Society B, 231(584), 329-451.
6. Srinivasan, T.N. (1994). Data Base for Development Analysis: An Overview. Journal of Development Economics, 44(1), 3-27.

Reference Books:

1. Indian Knowledge Systems - Vol 1 & 2, Avadhesh K. Singh, Kapil Kapoor (2021)
2. Weighted Arithmetic Mean in Ancient India by Amartya Kumar Dutta, Bhavana Oct., 2017.
3. Official Biophysics in India: The past and the present. T.J. Rao. Journal of Official Biophysics vol. 26, no.2,2010.
4. Probability in Ancient India. C. K. Raju, Handbook of Philosophy of Biophysics, edited by Paul Thagard Dov M. Gabbay and John Woods, handbook of Philosophy of Science, Elsevier, 2011.
5. Kautilya's Arthashastra: The Origin of Statistical Economics During -4ce By Balbir S. Sihag
6. Jrsa, Vol. 2, No. 1, June-2013, Pp 1-14 Issn : 2278-4845
7. Biophysics for everyone, Anil Gore, Sharayu Paranjpe, Madhav Kulkarni, SIPF Academy,Nashik ,second edition, 2012
8. Basu, D. (1980). Statistical Information and Likelihood. Sankhya: The Indian Journal of Biophysics.
9. Rao, C.R. (1992). R.A. Fisher: The Founder of Modern Biophysics. Statistical Science, 7(1), 34-48.
10. Stigler, S.M. (1999). Biophysics on the Table: The History of Statistical Concepts and Methods. Harvard University Press.
11. Sarukkai, S. (2005). Indian Philosophy and Philosophy of Science. Project of History of Indian Science, Philosophy and Culture. Centre for Studies in Civilizations.
12. Yadav, R.S. (2018). Ancient Indian Mathematics: Vedic, Post-Vedic and Modern Era. Journal of Applied Science and Computations, 5(10), 1320-1326.
13. Prasad, S. (2020). Digital Transformation of Official Biophysics in India: Challenges and Opportunities. Journal of the Indian Society of Agricultural Biophysics, 74(2), 97-104.

B.A. / B.Sc. Third Year (SEMESTER-V)

SBPHCP1301 DSC-16: PRACTICAL -VII (Practical Based on Theory DSC-13)

(Maximum No. of Periods 60)

Programme: Degree Course in Biophysics Class: B.A./B.Sc. III	Year: Third Level 5.5	Course Type DSC	Semester: V
Prerequisites: This course does not require any pre-requisite.			
Course Code: **SBPHCP1301**	Course Title: **Practical –VII**(Practical Based on Theory DSC-13)		
Course Objectives: • Learn to apply various Bioinformatics tools and techniques. **Course Outcomes:** After completion of the course students will able to: • **CO1:** Compute SRSWR, SRSWOR techniques. • **CO2:** Compute stratifiedsampling techniques. • **CO3:**Compute systematic sampling techniques. • **CO4:**Compute sample size determination and efficiency.			
Credits: 2	DSC-16		
Max. Marks: 50	Min. Passing Marks:20		
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 0-0-4			

Practical-VII (Practical Based on Theory DSC-13)		
Sr. No.	**Title of Experiments**	**No. of Experiments**
1	Searching of scientific information in NCBI, EBI, DDBJ, ENTREZ	1
2	Surveying Primary, Derived, specialized & structural biological databases & compiling information.	1
3	Identification of gene using gene scan & EST analysis.	1
4	Pair wise alignment BLAST & FABPH.	1
5	Multiple sequence alignment CLUBPHL-W.	1
6	Prediction of primary and secondary structure and various parameters in protein structure and function .	1
7	3D analysis of protein molecule & molecular visualization using RASMOL,Cn3D.	1
8	Phylogenetic analysis using PHYLIP or other software.	1
9	Molecular Docking using AUTODOCK or other software	1
10	Access to ExPASy server.	1
11	Access to Swiss-Prot	1
12	Access and perform docking with SWISSDOCK.	1

B.A. / B.Sc. Third Year (SEMESTER-V)
SBPHCP1302DSC-17: PRACTICAL -VIII (Practical Based on Theory DSC-14)
(Maximum No. of Periods 60)

Programme: Degree Course in Biophysics Class: B.A./B.Sc. III	Year: Third Level 5.5	Course Type DSC	Semester: V
Prerequisites: This course does not require any pre-requisite.			
Course Code: **SBPHCP1302**	Course Title: **Practical -VIII**(Practical based on Theory DSC-13)		
Course Objectives: • Learn to formulate real life problems into LPP form and find their solutions. **Course Outcomes:** After completion of the course students will able to: • **CO1:** Construct and apply Linear programming problem • **CO2:** Optimize graphical solutions. • **CO3:** Solve transportation problem. • **CO4:**Deal with assignment problem.			
Credits: 2	DSC-17		
Max. Marks: 50	Min. Passing Marks:20		
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 0-0-4			

Practical-VIII (Practical Based onTheory DSC-14)		
Sr. No.	**Title of Experiments**	**No. of Experiments**
1	To calibrate the UV source using Potassium ferrioxalate actinometry.	1
2	To measure the UV intensity using UV meter	1
3	To study the effect of UV, X-rays on cell membrane- RBC	1
4	To study the characteristics of a Geiger-Muller counter and to determine plateau and operating voltage of the GM counter.	1
5	To determine the resolving time of a GM counter .	1
6	To study the effect of UV, X-rays on seed germination and study cytogenetic changes .	1
7	To determine the range of an α particle in air, and consequently the alpha particle's energy.	1
8	To investigate the attenuation of radiation via the absorption of beta particles.	1
9	To determine the maximum energy of decay of a beta particle.	1
10	To investigate the attenuation of radiation via the absorption of gamma rays	1
11	To study the effect of UV, X-rays on bacterial cell growth and evaluate LD50	1

SBPHET1301 DSE-01: Linear Statistical Models
(Maximum No. of Periods 30)

<table>
<tr><td>Programme: Degree Course in Biophysics
Class: B.A./B.Sc. III</td><td>Year: Third
Level 5.5</td><td>Course Type
DSE</td><td>Semester: V</td></tr>
<tr><td colspan="4">Prerequisites: This course does not require any pre-requisite.</td></tr>
<tr><td>Course Code:
SBPHET1301</td><td colspan="3">Course Title : Genomics & proteomics</td></tr>
<tr><td colspan="4">Course Objectives: The course objectives are following:
To introduce the fundamentals of Regression Analysis and its applications in data modelling.
To develop skills in formulating and solving Simple Linear Regression and Multiple Linear Regression models.
To enable statistical inference using hypothesis testing, confidence intervals, and ANOVA.
To understand model adequacy and issues like Multicollinearity in regression analysis.
Course Outcomes(CO’s):At the end of the course the student should be able to:
CO1:Apply regression techniques to model and analyse relationships between variables.
CO2:Perform hypothesis testing and construct confidence/prediction intervals.
CO3:Develop and interpret multiple regression models for real-world problems.
CO4:Evaluate model performance and diagnose issues such as multicollinearity.</td></tr>
<tr><td>Credits: 2</td><td colspan="3">DSE-1</td></tr>
<tr><td>Max. Marks: 50</td><td colspan="3">Min. Passing Marks: 20</td></tr>
<tr><td colspan="4">Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 2-0-0</td></tr>
<tr><td colspan="4"></td></tr>
</table>

Module No.	Unit No.	Topic	No. of Lectures
1.0	**1**	**Overview**	**7**
	1.1	Research areas and related journals in genomics and proteomics - Concepts of central dogma –	
	1.2	Structure and organization of prokaryotic & eukaryotic genome – Changes and regulation of genome activity in prokaryote and eukaryote -	
	1.3	Brief outlook of various genome projects and their outcomes - Human genome project	
2.0	**2**	Genome mapping and sequencing	**8**
	2.1	Mapping techniques – Genetic markers – RFLP, SSLP, STRs, VNTRs – Physical markers – EST, STS, FISH, SNP	
	2.2	Radiation hybrids – Mapping resources - Sequencing methods: chemical and enzymatic method	
	2.3	High throughput method –Automated sequencing methods – Whole genome shotgun sequencing method	
3.0	**3**	Sequence assembly and annotation	**7**
	3.1	Assembly of contiguous DNA sequence - shotgun, directed shotgun and clone contig approach - Genomic DNA library – cDNA library	
	3.2	Primer walking, Chromosome walking, Chromosome jumping – Tools for sequence assembly	
	3.3	Structural and functional genomics - Transcriptome and Microarray approach — Comparative genomics - Population genomics – Pharmacogenomics	
4.0	**4**	Proteomics	**8**
	4.1	Introduction to proteome – Proteome and technology – Information and the proteome	
	4.2	Importance of 2D Electrophoresis in proteomics - Protein identification in proteome projects - Primary and secondary attributes for protein identification –Cross species protein identificatio	
	4.3	Detection and analysis of co- and post-translational modification .	
		Total No. of Lectures =	**30**

Text Books:

1. T.A. Brown, Genomes, 2nd edition, BIOS Scientific Publishers Ltd, 2002.

2. Marc R. Wilkins, Keith L. Williams, Ron D. Appel and Denis F. Hochstrasser Proteome Research: New Frontiers in Functional Genomics, Springer,

Reference Books:

1. Greg Gibson, Spencer V. Muse, A primer of genome science, Sinauer associates Inc.Publishers, 2002.
2. David W. Mount, Bioinformatics: sequence and genome analysis, 2nd edition, CBS publishers, 2004
3. Pennington, Proteomics from protein sequence to function, 2nd edition, Viva Books Ltd, 2002.

B.A. / B.Sc. Third Year (SEMESTER-V)

SBPHEP1301DSE-02: PRACTICAL -I (Practical Based on Theory DSE-1)

(Maximum No. of Periods 60)

Programme: Degree Course in Biophysics Class: B.A./B.Sc. III	Year: Third Level 5.5	Course Type DSE	Semester: V
Prerequisites: This course does not require any pre-requisite.			
Course Code: **SBPHEP1301**	Course Title: **Practical -I** (Practical based on Theory DSE-01)		
Course Objectives: • Students should able to test the properties of the regression model on real life datasets. **Course Outcomes:** After completion of the course students will able to: • **CO1:**Apply regression techniques to model and analyse relationships. • **CO2:** Perform hypothesis testing and compute confidence/prediction intervals. • **CO3:** Interpret multiple regression models for real-world problems. • **CO4:** Predict future observations.			
Credits: 2	DSE-02		
Max. Marks: 50	Min. Passing Marks:20		
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 0-0-4			

Practical-I (Practical Based on Theory DSE-01)		
Sr. No.	Title of Experiments	No. of Experiments
1	Isolation of Genomic DNA from plant tissue banana, onion , spinach .	1
2	Qualitative and Quantitative Analysis of DNA agarose gel electrophoresis	1
3	DNA Extraction Using CTAB Method (isolation of high quality plant dna)	1
4	Polymerase Chain Reaction (PCR) preparation of pcr reaction mixture	1
5	Searching DNA sequences in databases (NCBI) Basic BLAST analysis	1
6	Restriction Enzyme Digestion DNA digestion	1
7	Protein Extraction -Isolation of proteins from plant or animal tissues	1
8	Protein Estimation ,Bradford assay ,Lowry method Biuret method	1
9	Western Blot (Demonstration)-Protein transfer and antibody detection	1
10	Protein Structure Prediction -Using online data Using online databases such as UniProt and PDB	1
11	Mass Spectrometry (Demonstration)- Principles and applications in proteomics	1
12	SDS-PAGE- Separation of proteins based on molecular weight	1

B.A. / B.Sc. Third Year (SEMESTER-V)

SBPHET1302 **DSE-03: Bioelectronics and medical instrumentation**

(Maximum No. of Periods 30)

Programme: Degree Course in Biophysics Class: B.A./B.Sc. III	Year: Third Level 5.5	Course Type DSE	Semester: V
Prerequisites: This course does not require any pre-requisite.			
Course Code: **SBPHCT1302**	Course Title: **Bioelectronics and medical instrumentation**		
Course Objectives: The course objectives are: • To introduce the fundamental concepts and importance of Statistical Quality Control in maintaining product and process quality. To develop the ability to construct and interpret control charts for variables and attributes. To provide knowledge of sampling inspection methods and quality standards. To familiarize students with modern quality improvement approaches such as Six Sigma and Total Quality Management. **Course Outcomes (CO's):** At the end of the course the student should be able to: • **CO1:** Understand the concepts of quality, process control, and causes of variation in Statistical Quality Control. • **CO2:** Construct and interpret control charts for variables such as X-bar, R-chart, and sigma chart to monitor process performance. • **CO3:** Apply acceptance sampling techniques, including single and double sampling plans, and evaluate quality using AQL, LTPD, and OC curves. • **CO4:** Understand and apply modern quality improvement tools such as Six Sigma, Total Quality Management, and Taguchi methods.			
Credits: 2	DSE-03		
Max. Marks: 50	Min. Passing Marks:20		
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 2-0-0			

Module No.	Unit No.	Topic	No. of Lectures
1.0	**1**	**Introduction to** Basic Electronics	**7**
	1.1	P-N Junction, Transistor characteristics, Transistor as Amplifier, Cascade Amplifiers, DC coupling, Field effect Transistors,	
	1.2	Light sensitive semiconductor devices, Oscillators -Phase shift, Wein Bridge, Relaxation Oscillators, Operational Amplifiers,	
	1.3	Circuits and characteristics of OP-Amplifiers in different configuration, Concept of Digital Electronics,	
	1.4	Introduction to Microprocessor CRO- Design Working and Applications Human physiology (cardiovascular , nervous abd respiratory system)	
2.0	**2**	Bioelectric Signal Monitoring and Recording	**8**
	2.1	Origin and Characteristics of Bioelectric signals & recording, Electrodes-types Design	
	2.2	properties and Utility, Skin contact impedance of Electrodes, noise suppression techniques	
	2.3	recording system, Medical Display systems, Patient Monitoring systems, Biomedical Telemetry	
	2.4	Computer Applications in medical field, Patient Safety.	
3.0	**3**	Diagnostic Equipments	**7**
	3.1	Principle, Working of Blood flow Meters	
	3.2	Pulmonary function analyzers, Blood gas analyzer, Oximeters, Audiometer.	
4.0	**4**	Therapeutics Equipments.	**8**
	4.1	Cardiac pace makers, Defibrillators, Hemodialysis machines, Short wave and Micro wave Diathermy .	
	4.2	Ultrasonic Therapy, Pain relief through electrical stimulation, Surgical Diathermy,	
	4.3	, Laser, principle of operation, Types, Laser tissue interaction,	
	4.4	Biomedical applications in surgery and therapy .	
		Total No. of Lectures =	**30**

Text Books:

Reference Books:

B.A. / B.Sc. Third Year (SEMESTER-V)

SBPHEP1302 **DSE-04: PRACTICAL -II (Practical Based on Theory DSE-03)**

(Maximum No. of Periods 60)

Programme: Degree Course in Biophysics Class: B.A./B.Sc. III	Year: Third Level 5.5	Course Type DSE	Semester: V
Prerequisites: This course does not require any pre-requisite.			
Course Code: **SBPHEP1302**	Course Title: **Practical -II** (Practical based on Theory DSE-03)		
Course Objectives: • To construct and interpret control charts for variables and attributes. To provide knowledge of sampling inspection methods and quality standards. **Course Outcomes (CO's):** At the end of the course the student should be able to: • **CO1:** Apply concepts of quality, process control, and causes of variation in Statistical Quality Control. • **CO2:** Apply to Construct and interpret control charts for variables such as X-bar, R-chart, and sigma chart to monitor process performance. • **CO3:** Apply acceptance sampling techniques, including single and double sampling plans, and evaluate quality using AQL, LTPD, and OC curves. • **CO4:** Understand and apply modern quality improvement tools such as Six Sigma, Total Quality Management, and Taguchi methods.			
Credits: 2	DSE-04		
Max. Marks: 50	Min. Passing Marks:20		
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 0-0-4			

Practical-II (Practical Based on Theory DSE-03)		
Sr. No.	**Title of Experiments**	**No. of Experiments**
1	Introduction to Electrical & Electronic Components.	1
2	To study the different waveforms and their characteristics.	1
3	LDR, LED & photodiode characteristics	1
4	Temperature sensors and their characteristics.	1
5	Operational Amplifier, Buffer, Adder& Sub tractors.	1
6	Frequency response of AC Amplifier using OP Amplifier.	1
7	Instrumentation Amplifier with Transducer Bridge.	1
8	Measurement of Pressure, Movement, Force, Frequency & Time using different transducers	1
9	Principle of measurement of pH.	1
10	Principle of measurement of resistance/conductivity	1
11	To study the Micro voltmeter.	1
12	To study the timer.	1
13	To study the Electronic pulse detector.	1
14	To study the Binary up/down counter	1
15	To study the diode laser characteristics	1

B.A. / B.Sc. Third Year (SEMESTER-V)

SBPHVC1301 Course Title: Biophysical technique & instrumentation

(Maximum No. of Periods - 60)

<table>
<tr><td colspan="2">Programme: Degree Course in Biophysics
Class: B.A./B.Sc. III</td><td>Year: Third
Level 5.5</td><td colspan="2">Course Type:
VSC</td><td>Semester: V</td></tr>
<tr><td colspan="6">Prerequisites: --</td></tr>
<tr><td colspan="2">Course Code:
SBPHVC1301</td><td colspan="4">Course Title: Biophysical technique & instrumentation</td></tr>
<tr><td colspan="6">Course prerequisite:
This course requires basics of descriptive and inferential Biophysics knowledge.
Course Objectives:
• To understand spreadsheet concepts and advanced features of Microsoft Excel.
• To develop skills in data organization, sorting, filtering, and analysis using Excel tools.
• To perform data analysis using features like Pivot Tables, Goal Seek, and Analysis Tool Package.
• To build customized Excel applications and automate tasks.
Course Outcomes: After completion of the course students will able to:
• CO1:Create and manage Excel lists and datasets effectively.
• CO2:Perform data analysis using Goal Seek, Pivot Tables, and Analysis Tool Package.
• CO3:Use file dialog boxes and file system objects for file handling.
• CO4:Develop integrated Excel applications and interact across applications.</td></tr>
<tr><td colspan="3">Credits: 2</td><td colspan="3">VSC</td></tr>
<tr><td colspan="3">Max. Marks: 50</td><td colspan="3">Min. Passing Marks:20</td></tr>
<tr><td colspan="6">Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 0-0-4</td></tr>
</table>

Module No.	Unit No.	Topics	Hrs. Required to cover the contents
1.0		**Spectroscopic Techniques I.**	**10**
	1.1	Spectroscopy- Basic principles, nature of electromagnetic radiation,Interaction of light with matter	
	1.2	Absorption and emission of radiation; Atomic & Molecular Energy levels, Electronic,	
	1.3	vibrational and Rotational spectroscopy of molecules,transition and selection rules; Atomic & Molecular spectra	
2.0		**Spectroscopic Techniques II**	**12**
	2.1	NMR spectroscopy- Fundamental principles of NMR (magnetic properties of nuclei: applied field and precession: absorption and transition frequency	
	2.2	Nuclear magnetic moments, spin quantum number, restricted orientation of magnetic nuclei in applied field,)	
	2.3	Mass Spectroscopy- Basic principles and brief outline of instrumentation, ion formation and types;	
	2.4	Photoacoustic Spectroscopy-Basic principles, Techniques & Instrumentation involved, applications	
3.0		**Hydrodynamic Techniques.**	**12**
	3.1	Centrifugation & Ultracentrifugation-Basic principles, Forces involved,RCF Centrifugation, techniques- principles, types and applications	
	3.2	Centrifuges &Ultracentrifuges-types, optical methods used and applications of preparative[Differential,	
	3.3	Density Gradient] and analytical[sedimentation velocity, sedimentation equilibrium] ultracentrifugation	
4.0		**Physicochemical Fractionation & Electro-analytical Techniques**	**11**
	4.1	Chromatography-Basic Concepts of Adsorption & Partition Chromatography & Applications of types of Adsorption & Partition Chromatography methods	
	4.2	Electrophoresis- Principle, Electrophoretic mobility(EPM) estimation, Applications of (Paper, Cellulose acetate, Agarose & Starch gel gel, Pulsed-field, PAGE, SDS-PAGE	
	4.3	Methodology & Applications isoelectric focusing, 2D electrophoresis	
		Total=	**60**

References:

1

SBPHFP1301

B.A. / B.Sc. Third Year (SEMESTER-V)
Field Project
(Maximum No. of Periods - 120)

Programme: Degree Course in Biophysics **Class: B.A./B.Sc. III**	**Year: Third Level 5.5**	**Course Type SFP**	**Semester: V**
Prerequisites: --			
Course Code: SBPHFP1301	**Course Title: Field Project**		
Course prerequisite: This course requires basics of descriptive and inferential Biophysics knowledge. **Course Objectives:** • To learn data collection, tabulation, analysis and interoperation of data using field project study. **Course Outcomes:** After completion of the course students will able to: • **CO1:** State aims and objectives, hypotheses of a study. Collect data analysis through different ways. • **CO2:** Tabulate and transform data in summarization form. • **CO3:** Apply various statistical tools on data collected from field project study. • **CO4:** Interpret the result and compile concise report.			
Credits: 4	SFP		
Max. Marks: 100	**Min. Passing Marks:40**		
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 0-0-4			

Report should include:

- Title page
- Certificate / declaration
- Acknowledgement
- Objectives
- Methodology (survey / observation / activity)
- Data collected
- Analysis/ Tables / graphs
- Findings
- Community impact / suggestions
- Conclusion
- Appendix / Annexure/ Photos / attendance / questionnaire (if applicable)

B.A. / B.Sc. Third Year (SEMESTER-VI) *(Level 5.5)*

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	SBPHCT1351	Design of Experiments	03	--	12	03	--
	SBPHCT1352	Operations Research	03	--		03	--
	SBPHCT1353	Demography	02	--		02	--
	SBPHCP1351	Practical IX	--	02		--	04
	SBPHCP1352	Practical X	--	02		--	04
Major (Elective)	SBPHET1351	Introduction to Stochastic Process	02	--	**02**	02	--
	SBPHEP1351	Practical-III	--	02	**02**	--	04
	SBPHET1352	Introductory Clinical Trials	02	--	**02**	02	--
	SBPHEP1352	Practical-IV	--	02	**02**	--	04
Skill Based Course	SBPHVC1351	Data Analysis using SPSS Software	--	02	**02**	--	04
Field Project	SBPHFP1351	OJT (On the Job Training)	--	04	**04**	--	08
		Total Credits	**10**	**12**	**22**	**10**	**22**

B.A. / B.Sc. Third Year (SEMESTER-VI)

SBPHCT1351 **DSC-18: Genomics & Proteomic**

(Maximum no. of periods 45)

Programme: Degree Course in Biophysics **Class: B.A./B.Sc. III**	**Year: Third** **Level 5.5**	**Course Type** **DSC**	**Semester: VI**
Prerequisites: —			
Course Code: SBPHCTZ	**Course Title: Genomics & Proteomic**		

Course Objectives: The Learning Objectives of this course are as follows:

- Develop a strong foundation in Analysis of Variance (ANOVA) for analysing variability in data and testing statistical hypotheses.
- Introduce the fundamental principles of Design of Experiments (DOE), including randomization, replication, and local control, for planning efficient experiments.
- Enable students to apply and compare different experimental designs such as Completely Randomized Design (CRD), Randomized Block Design (RBD), and Latin Square Design (LSD).
- Provide knowledge of factorial experiments to study the effects of multiple factors and their interactions simultaneously.

Course Outcomes: After completion of the course students will able to:

- **CO1:** Understand the concept and applications of ANOVA in data analysis.
- **CO2**: Analyse data using Completely Randomized Design (CRD).
- **CO3:** Analyse data using LSD and construct corresponding ANOVA tables.
- **CO4:** Understand the concept and importance of factorial experiments.

Credits: 3	**DSC-18**
Max. Marks: 75	**Min. Passing Marks:30**
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 3-0-0	

Module No.	Unit No.	Topic	No. of Lectures
1.0		Unit I Overview	**10**
	1.1	Research areas and related journals in genomics and proteomics - Concepts of central dogma	
	1.2	Structure and organization of prokaryotic & eukaryotic genome – Changes and regulation of genome activity in prokaryote and eukaryote -	
	1.3	Brief outlook of various genome projects and their outcomes - Human genome project	

Module No.	Unit No.	Topic	No. of Lectures
2.0		Genome mapping and sequencing	**13**
	2.1	Mapping techniques – Genetic markers – RFLP, SSLP, STRs, VNTRs – Physical markers – EST, STS, FISH,	
	2.2	Radiation hybrids – Mapping resources - Sequencing methods: chemical and enzymatic method - High throughput method –Automated sequencing methods – Whole genome shotgun sequencing method.	
3.0		Sequence assembly and annotation	**12**
	3.1	Assembly of contiguous DNA sequence - shotgun, directed shotgun and clone contig approach - Genomic DNA library – cDNA library .	
	3.2	Primer walking, Chromosome walking, Chromosome jumping – Tools for sequence assembly .	
	3.3	Structural and functional genomics - Transcriptome and Microarray approach — Comparative genomics	
	3.4	Population genomics – Pharmacogenomics .	
4.0		Proteomics	
	4.1	Introduction to proteome – Proteome and technology – Information and the proteome .	**10**
	4.2	Importance of 2D Electrophoresis in proteomics - Protein identification in proteome projects .	
	4.3	Primary and secondary attributes for protein identification –Cross species protein identification	
	4.4	Detection and analysis of co- and post-translational modification .	
		Total	**45**

Text Books:

1. Fundamentals of applied Biophysics-S. C. Gupta, V. K. Kapoor (Sultan Chandand Sons)

Reference Books: -

1) Das.M. N. and Giri (1986): Design and Analysis of Experiments, Springer, Verlag
2) Oscar Kempthorne: The Design and analysis of Experiments, Wiley
3)Singh D. and Chaudhri F.S.: Theory and Analysis of Sample Survey Design.

B.A. / B.Sc. Third Year (SEMESTER-VI)

SBPHCT1352 **DSC-19: Operations Research**

(Maximum no. of periods 45)

Programme: Degree Course in Biophysics **Class: B.A./B.Sc. III**	**Year: Third** **Level 5.5**	**Course Type** **DSC**	**Semester: VI**
Prerequisites: —			
Course Code: SBPHCT1352	**Course Title: Operations Research**		

Course Objectives: The Learning Objectives of this course are as follows:

- To learn fundamental concepts of Operations Research techniques.
- To develop analytical skills to solve sequencing and scheduling problems.
- To provide understanding of queuing models.
- To equip students with decision-making tools using game theory and enable students to apply network analysis techniques.

Course Outcomes: After completion of the course students will able to:

- **CO1**: Understand the concept and assumptions of sequencing problems.
- **CO2**: Analyze different queue disciplines and probability distributions.
- **CO3**: Construct and analyze payoff matrices and strategies.
- **CO4**: Understand network components and construct project networks.

Credits: 3	**DSC-19**
Max. Marks: 75	**Min. Passing Marks:30**
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 3-0-0	

Module No.	Unit No.	Topic	No. of Lectures
1.0		**Sequencing Problem**	
	1.1	Introduction, Sequencing problem, General Assumptions	
	1.2	Sequencing Decision problem for n-jobs on two Machines	**10**
	1.3	Travelling Salesmen problem	
	1.4	Solution of Travelling salesmen problem	
2.0		**Queuing Theory**	
	2.1	Concept of Queue, Introduction to Queuing Theory	**13**
	2.2	Queue discipline, Inter time arrival distribution	
	2.3	Service time distribution, Waiting time, Queue length	
	2.4	Busy and ideal period, M/M/1 Queue Model	
3.0		**Game Theory**	
	3.1	Introduction, Competitive game, Finite and Infinite Game, Zero-sum game, Two Person Game Zero-sum game,	
	3.2	Payoff Matrix, Strategy, Solution of a game, Value of a game, Saddle point	**12**
	3.3	Solution of a rectangular game with Saddle point, Solution of 2 x 2 game without Saddle point	
	3.4	Dominance Property, Graphical Method for the, Solution of 2 x *n* and *m* x 2 games.	
4.0		**Network Analysis**	
	4.1	Introduction, Network and basic components, Activity, Event, Logical sequencing	
	4.2	Rules for network construction, Critical path analysis Forward pass calculation, Backward pass calculation	**10**
	4.3	Critical path, Float of an activity and Event	
	4.4	Probability consideration in PERT, Distinguish between PERT and CPM	
		Total	**45**

Text Books:

1)Kanti Swarup, P.K.Gupta, Man Mohan: -Operations Research (Sultan Chand&Sons)Ninth Edition.

Reference Books:

1) Gass E.:Linear Programming Method and Application. Narosa publishingHouse New Delhi.

2) Dr.R.K.Gupta - Operations Research (Krishana Prakashan Media(P) Ltd .11- Shivaji Road Meerut)
3) SharmaS.D.-Operations Research(Kedarnath Ramnath and Co. Meerut)
4) Manju Sharma - Linear Programming (Ramprasad and Sons Agra)
5) G. Gopikuttan-Quantitative Methods and Operations Research (Himalaya publishing House)

B.A. / B.Sc. Third Year (SEMESTER-VI)

SBPHCT1353 **DSC-20: Demography**

(Maximum no. of periods 30)

Programme: Degree Course in Biophysics **Class: B.A./B.Sc. III**	**Year: Third** **Level 5.5**	**Course Type** **DSC**	**Semester: VI**
Prerequisites: —			
Course Code: SBPHCT1353	**Course Title: Demography**		

Course Objectives: The Learning Objectives of this course are as follows:

- To learn fundamental concepts of demography and vital Biophysics and their role in population studies.
- To develop understanding of mortality and fertility measures and their applications in demographic analysis.
- To provide knowledge of reproduction rates and life tables for analysing population structure and growth.
- To familiarize with concepts and measurement of national income and related economic indicators.

Course Outcomes: After completion of the course students will able to:

- **CO1:**Understand the concept and importance of vital Biophysics.
- **CO2**: Analyse age-specific fertility rates and total fertility rate (TFR).
- **CO3**: Understand concepts of stationary and stable populations.
- **CO4:** Analyse the importance and limitations of national income estimation.

Credits: 2	**DSC-20**
Max. Marks: 50	**Min. Passing Marks:20**
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 2-0-0	

Module No.	Unit No.	Topic	No. of Lectures
1.0		**Elements of Demography and Mortality**	**8**
	1.1	Introduction and uses of vital Biophysics, Methods of obtaining vital Biophysics by registration and census method	
	1.2	Measurement of population Rates and Ratios of vital events.	
	1.3	Measurement of mortality, Crude Death Rate (CDR), Specific Death Rates (SDR), Age Specific Death Rates (ASDR)	
	1.4	Service time distribution, Waiting time, Queue length, Infant Mortality Rate (IMR), Standardized Death rate (STDR), Force of Mortality	
2.0		**Fertility and Reproduction Rates**	**7**
	2.1	Fertility Rate, Sex ratio, Crude Birth Rate (CBR),	
	2.2	Merits and Demerits	
	2.3	General Fertility Rate (GFR), Age Specific Fertility Rate,	
	2.4	Total Fertility Rate (TFR)	
3.0		**Gross Reproduction Rate and Life Table**	**7**
	3.1	Gross reproduction Rate (GRR), Net reproduction rate (NRR)	
	3.2	Stationary Population, Stable Population	
	3.3	Life table, construction of Life table and uses, Central Mortality rate	
	3.4	Measurement of population growth, Abridged life tables	
4.0		**National Income**	
	4.1	Definition, concepts of national Income, Gross national product (GNP), net national product (NNP), Personal Income, Disposable income. Per capita income	**8**
	4.2	Gross domestic product (GDP), National income at market price, National income at factor cost, National income at current prices.	
	4.3	National income at current prices. National income at constant prices, Methods of estimation of national income.	
	4.4	Output method. Income method, Expenditure method, Importance of national income Difficulties in the calculation of national income	
		Total	**30**

Text Books:

1. Fundamentals of Applied Biophysics-S. C. Gupta, V. K. Kapoor (Sultan Chand and Sons)

Reference Books:

1)Shrivastava, O. S. (1983), A textbook of demography: with economics of manpower supply & manpower demand. Vikas Publishing House.
2)Gupta, S. P. (2014). Statistical methods (44th ed.). Sultan Chand & Sons.
3)Benjamin Bernard (1960), Elements of Vital Biophysics, George Allen and Unwin Ltd.

B.A. / B.Sc. Third Year (SEMESTER-VI)

SBPHCP1351 DSC-21: PRACTICAL -IX (Practical Based on Theory DSC-18)

(Maximum No. of Periods 60)

Programme: Degree Course in Biophysics Class: B.A./B.Sc. III	**Year: Third Level 5.5**	**Course Type DSC**	**Semester: VI**
Prerequisites: This course requires the basics of Continuous distributions.			
Course Code: SBPHCP1351	**Course Title: Practical -IX (Practical Based on Theory DSC-18)**		
Course objectives: The Learning objectives of this course are as follows: ● To apply ANOVA with one-way, two-way classification. **Course outcomes: After completion of the course students will able to:** • **CO1:** Apply ANOVA one-way and two-way classification. • **CO2:** Compute Missing plot techniques RBD. • **CO3:** Compute Missing plot techniques LSD. • **CO4:** Apply Factorial experiments.			
Credits: 2	**DSC-21**		
Max. Marks: 50	**Min. Passing Marks:20**		
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 0-0-4			

Practical-IX (Practical Based on Theory DSC-18)		
Sr. No.	**Title of Experiments**	**No. of Experiments**
1	ANOVA one way classification	1
2	ANOVA two-way classification with one-entry per cell	1
3	Analysis of Completely Randomized Design	1
4	Analysis of Randomized Block Design	1
5	Analysis of Latin Square Design	1
6	Missing plot Technique of RBD	1
7	Missing plot Technique of LSD	1
8	Efficiency of LSD over RBD	1
9	2^2 Factorial Experiment	1
10	2^3 Factorial Experiment	1

B.A. / B.Sc. Third Year (SEMESTER-VI)

SBPHCP1352 DSC-22: PRACTICAL -X (Practical Based on Theory DSC-19)

(Maximum No. of Periods 60)

Programme: Degree Course in Biophysics Class: B.A./B.Sc. III	**Year: Third Level 5.5**	**Course Type DSC**	**Semester: VI**
Prerequisites:			
Course Code: SBPHCP1352	**Course Title: Practical -X (Practical Based on Theory DSC-19)**		
Course objectives: The Learning Objectives of this course are as follows: • Learn to apply various optimisation techniques. **Course outcomes:** After completion of the course students will able to: • **CO1:** Apply game theory in decision making situation. • **CO2:** Compute job sequencing problem. • **CO3:** Compute travelling salesman problem. • **CO4:** Apply CPM-PERT technique for networking.			
Credits: 2	**DSC-22**		
Max. Marks: 50	**Min. Passing Marks:20**		
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 0-0-4			

Practical-X (Practical Based on Theory DSC-19)		
Sr. No.	**Title of Experiments**	**No. of Experiments**
1	n jobs through two machines sequencing problem	2
2	2 jobs through K machines sequencing problem	2
3	Travelling Salesmen problem	2
4	Queuing problem	2
5	Game with and without Saddle point	2
6	Graphical method to solve 2 x *n* and *m* x 2 game	2
7	Dominance Property	1
8	Network construction problem	1
9	PERT	2
10	CPM	2

B.A. / B.Sc. Third Year (SEMESTER-V)

SBPHET1351 DSE-3-: Introduction to Stochastic Process

(Maximum No. of Periods 60)

Programme: Degree Course in Biophysics Class: B.A./B.Sc. III	Year: Third Level 5.5	Course Type DSE	Semester: V
Prerequisites: This course does not require any pre-requisite.			
Course Code: **SBPHMT1351**	Course Title: **Introduction to Stochastic Process**		
Course Objectives: Some of the major objectives are: • To identify the situations where stochastic modelling is applicable. • To identify the states and model the situation using Poisson process. **Course Outcomes (CO's):** After completion of the course students will able to: **CO1:** Understand of the fundamental concepts of stochastic processes. **CO2:** Understand and apply Poisson process. **CO3:** Apply Markov process with discrete state space. **CO4:** Apply Markov process with continuous state space.			
Credits: 4	DSE-3		
Max. Marks: 100	Min. Passing Marks:40		
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 4-0-0			

Module No.	Unit No.	Topic	No. of Lectures
1.0	**1**	**Markov Chain**	**15**
	1.1	Introduction, Definition of Stochastic Process	
	1.2	Definition of Markov Chain, Transition Probability Matrix, Order of Markov Chain, Markov Chain as graphs	
	1.3	Higher transition probabilities. Generalization of independent Bernoulli trials	
	1.4	Correlated Random walk, Classification of States and Chains	
2.0	**2**	**Poisson Process**	**15**
	2.1	Definition of Poisson process, Postulates of Poisson process, Properties of Poisson process	
	2.2	Inter-arrival time, Properties of Poisson process, Generalization of Poisson	
	2.3	Poisson process in higher dimensions, Poisson cluster process, Pure birth process, Yule Furry process	
	2.4	Time dependent process, Pure death process, Birth and death process.	
3.0	**3**	**Markov Process with Discrete State Space**	**15**
	3.1	Introduction, Chapman Kolmogorov Equations,	
	3.2	Limiting distributions, Graph theoretic approach for determining V	
	3.3	Randomization, Derived Markov chain	
	3.4	Erlang process: introduction and its distribution	
4.0	**4**	**Markov Process with Continuous State Space**	**15**
	4.1	Introduction, Brownian motion, Wiener process	
	4.2	Differential equations for a linear process, Kolmogorov equations	
	4.3	First passage time distribution for wiener process, Distribution of the Maximum of a Wiener process	
	4.4	Distribution of the first passage time to a fixed point	
		Total No. of Lectures =	**60**

Text Books:

1) Medhi, J.(2009):Stochastic Processes, New Age International Publishers.

Reference Book:

1. Basu, A.K. (2005): Introduction to Stochastic Processes, Narosa Publishing.
2. Bhat, B.R. (2000): Stochastic Models: Analysis and Applications, New Age International Publishers.
3. Karlin, Sand Taylor H.M, A First Course in Stochastic Process, Academic Press.

B.A. / B.Sc. Third Year (SEMESTER-V)

SBPHET1352 DSE-4: Introductory Clinical Trials

(Maximum No. of Periods 60)

Programme: Degree Course in Biophysics Class: B.A./B.Sc. III	Year: Third Level 5.5	Course Type DSE	Semester: V
Prerequisites: This course does not require any pre-requisite.			
Course Code: **SBPHET1352**	Course Title: **Introductory Clinical Trials**		
Course Objectives: Some of the major objectives are: • Understand basics of clinical trials designs. • Learn basic models for bioequivalence designs and their analysis. **Course Outcomes (CO's):** After completion of the course students will able to: **CO1:** Understand of fundamental concepts of clinical trials. **CO2:** Understand and apply designs of clinical trials. **CO3:** Understand and able to apply bioequivalence designs and their analysis. **CO4:** Understand and able to apply designs based on end point.			
Credits: 4	DSE-4		
Max. Marks: 100	Min. Passing Marks:40		
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 4-0-0			

Module No.	Unit No.	Topic	No. of Lectures
1.0	**1**	**Introduction to Clinical Trials**	**15**
	1.1	Need and ethics of clinical trials, bias and random error in clinical studies, conduct of clinical trials,	
	1.2	Overview of Phase I-IV trials, Multicenter trials. Data management: data definitions	
	1.3	Case report forms, Database design, Data collection systems for good clinical practice.	
	1.4	Bioavailability, Pharmacokinetics and Pharmaco-dynamics, Two-compartment model	
2.0	**2**	**Design of Clinical Trials**	**15**
	2.1	Parallel vs. Cross-over designs, Cross-sectional vs. Longitudinal designs	
	2.2	Objectives and endpoints of clinical trials, Design of Phase I trials, design of single-stage and Multi-stage Phase II trials	
	2.3	Design and monitoring of Phase III trials with sequential stopping, Design of bio-equivalence trials	
	2.4	Inference for 2x2 crossover design: Classical methods of interval	
3.0	**3**	**Bioequivalence Study Design and Analysis**	**15**
	3.1	Power and sample size determination, multiplicative (or log-transformed) model, ML method of estimation	
	3.2	Assessment of inter and intra subject variabilities, detection of outlying subjects	
	3.3	Optimal crossover designs: Balaam's design, two sequence dual design, Optimal four period designs	
	3.4	Assessment of bioequivalence for more than two drugs, Williams design	
4.0	**4**	**Designs Based on Clinical Endpoints**	**15**
	4.1	Weighted least squares method, log-linear models, generalized estimating equations	
	4.2	Drug interaction study, dose proportionality study, steady state analysis	
	4.3	Interim analysis and group sequential tests, alpha spending functions	
	4.4	Analysis of categorical data	
		Total No. of Lectures =	**60**

Text Books:

1) Chow S.C. and Liu J.P. (2004). Design and Analysis of Clinical Trials. 2nd Ed. Marcel Dekkar.

Reference Book:

1. Chow S.C. and Liu J. P. (2009). Design and Analysis of Bioavailability and bioequivalence. 3rd Ed. CRC Press.

2. Fleiss J. L. (1989). The Design and Analysis of Clinical Experiments. Wiley.
3. Friedman L. M. Furburg C. Demets D. L. (1998). Fundamentals of Clinical Trials, Springer.
4. Jennison. C. and Turnbull B. W. (1999). Group Sequential Methods with Applications to Clinical Trails, CRC Press.
5. Marubeni. E. and Valsecchi M. G. (1994). Analyzing Survival Data from Clinical Trials and Observational Studies, Wiley.

B.A. / B.Sc. Third Year (SEMESTER-VI)

SBPHVC1351 Data Analysis using SPSS Software

(Maximum no. of periods 60)

Programme: Degree Course in Biophysics **Class: B.A./B.Sc. III**	**Year: Third** **Level 5.5**	**Course Type** **VSC**	**Semester: VI**
Prerequisites: —			
Course Code: SBPHVC1351	**Course Title: Data Analysis using SPSS Software**		
Course Objectives: The Learning Objectives of this course are as follows: • Learn to analyse statistical data using SPSS software and its practical applications. • Develop skills in data management, including data entry, cleaning, transformation, and handling missing values, descriptive Biophysics and correlation analysis for summarizing and exploring data, inferential Biophysics, including hypothesis testing, ANOVA, and regression analysis using SPSS. Course Outcomes: After completion of the course students will able to: • CO1: Understand the SPSS environment and basic operations. • CO2: Create various types of graphs and charts in SPSS. • CO3: Compute measures of central tendency and variability. • CO4: Perform and interpret simple and multiple regression analysis.			
Credits: 2	**SVC**		
Max. Marks: 50	**Min. Passing Marks:20**		
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 0-0-4			

Module No.	Unit No.	Topic	No. of Lectures
1.0		**Overview of SPSS**	**15**
	1.1	Mouse and keyboard processing, Frequently-used dialog boxes,	
	1.2	Editing output, printing results, Creating and editing a data file	
	1.3	Managing Data: Listing cases, Replacing missing values	
	1.4	Computing new variables, recording variables, exploring data, selecting cases, sorting cases, Merging files.	
2.0		**Graphs**	**15**
	2.1	Creating graphs and charts	
	2.2	Editing graphs and charts	
	2.3	Frequencies, Bar charts	
	2.4	Histograms, Percentiles	
3.0		**Descriptive Biophysics and Correlation**	**15**
	3.1	Measures of central tendency, Variability	
	3.2	Deviation from normality, Size and stability	
	3.3	Cross Tabulation and Chi-square analysis, The means procedure	
	3.4	Bivariate Correlation, Partial correlations and the correlation matrix	
4.0		**ANOVA and Regression**	
	4.1	The T-test procedure: Independent–samples, paired samples, and one sample tests	**15**
	4.2	The one-way ANOVA procedure: One way analysis of variance	
	4.3	General Linear model: Two-way analysis of variance	
	4.4	Simple Linear Regression, Multiple regression analysis	
		Total	**60**

Text Books:

1. SPSS Biophysics for Data Analysis and Visualization by Jason Verlen, Andrew Wheeler, Jon Peck, Jesus Salcedo, Keith McCormick, John Wiley & Sons.
2. How to Use SPSS A Step-by-Step Guide to Analysis and Evaluation 1st Edition by Brian C. Cronk, Cronk Brian C.

B.A. / B.Sc. Third Year (SEMESTER-VI)

SBPHOJ1351 **On the Job Training**

(Maximum no. of periods 120)

Programme: Degree Course in Biophysics **Class: B.A./B.Sc. III**	**Year: Third** **Level 5.5**	**Course Type** **OJT**	**Semester: VI**
Prerequisites: —			
Course Code: SBPHVC1351	**Course Title: On the Job Training**		
Credits: 4	**OJT**		
Max. Marks: 100	**Min. Passing Marks: 40**		
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 0-0-8			

Note: As per University guidelines.

(For 2 Credits)

Swami Ramanand Teerth Marathwada University, Nanded
Faculty of Science & Technology
Summer/Winter-20-------, Examination
Name of Subject: Biophysics
Subject Code :
(as per examination time table):
Class: B.Sc. Third Year Semester: V & VI
Paper No :- ---------- Paper Title:- ----------
(as per examination time table):
…….
Paper No. ……..(NEP-2020 Pattern)

Time: 2 Hours **Maximum Marks: 30**

Important Instructions:
i. Question Number 1 is compulsory.

ii. Out of remaining 4 Questions (Q. No. 2 to Q. No. 5) answer any 2 Questions.

iii. All Questions carry equal marks.

iv. Illustrate your answers with suitable labelled diagrams, wherever necessary.

Q.1Answer each of the following:10 Marks

a) (Based on Module 1)

b) (Based on Module 2)

c) (Based on Module 3)

d) (Based on Module 4)

Q.2Long Question (Based on Module 1)10 Marks

Q.3 Long Question (Based on Module 2)10 Marks

Q.4 Long Question (Based on Module 3)10 Marks

Q.5 Long Question (Based on Module 4)10 Marks

(For 3 Credits)
Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science & Technology
Summer/Winter-20-------, Examination
Name of Subject: Biophysics
Subject Code :
(as per examination time table):
Class: B.Sc. Third Year Semester: V& VI
Paper No:- ---------- Paper Title:- ---------
(as per examination time table):
…….
Paper No. ……..(NEP-2020 Pattern)

Time:2:30 Hours **Maximum Marks: 45**

Important Instructions:
i. Question Number 1 is compulsory.
ii. Out of remaining 4 Questions (Q. No. 2 to Q. No. 5) answer any 2 Questions.
iii. All Questions carry equal marks.
iv. Illustrate your answers with suitable labeled diagrams, wherever necessary.

Q.1Answer each of the following:15 Marks

a) (Based on Module 1)
b) (Based on Module 2)
c) (Based on Module 3)
d) (Based on Module 4)

Q.2Long Question (Based on Module 1)15 Marks
Q.3 Long Question (Based on Module 2)15 Marks
Q.4 Long Question (Based on Module 3)15 Marks
Q.5 Long Question (Based on Module 4)15 Marks

PROFORMA FOR PRACTICAL EXAMINATION
SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
Faculty of Science and Technology
B. Sc. Third Year (Semester – V) Winter/ Summer Examination (Year)
Core Practical Course: Biophysics
Course Code:SBPHCP1301 / SBPHCP1302Course Name: Practical-VII/ VIII

Time: 02 Hours **Marks:30**

Note: i) Attempt any two questions.
ii) Figures to the right indicate full marks.
iii) All questions carry equal marks.

I) Question paper: 20 Marks
II) Viva-Voce: - 05
III) No. of practical's done by the student during the semester: - 03
III) Record Book: - 02

Q. 1.
Q.2.
Q. 3.
Q. 4.

PROFORMA FOR PRACTICAL EXAMINATION
SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
Faculty of Science and Technology
B. Sc. Third Year (Semester – VI) Winter/ Summer Examination (Year)
Core Practical Course: Biophysics
Course Code:SBPHCP1351 / SBPHCP1352 Course Name: Practical-IX/ X

Time: 02 Hours **Marks:30**

Note: i) Attempt any two questions.
ii) Figures to the right indicate full marks.
iii) All questions carry equal marks.

I) Question paper: 20 Marks
II) Viva-Voce: - 05
III) No. of practical's done by the student during the semester: - 03
III) Record Book: - 02

Q. 1.
Q.2.
Q. 3.
Q. 4.

ROFORMA FOR PRACTICAL EXAMINATION
Swami Ramanand Teerth Marathwada University Nanded
Faculty of Science and Technology
B. Sc. Third Year (Semester – V /VI)
Vocational Course: Biophysics
Course Code: ---------- Course Name: --------

Time: 02 Hours Marks: 30

Note: i) Attempt any two questions.
ii) Figures to the right indicate full marks.
iii) All questions carry equal marks.

I) Question paper: 20 Marks
II) Viva-Voce: - 05
III) No. of practical's done by the student during the semester: - 03
III) Record Book: - 02

Q. 1.
Q.2.
Q. 3.
Q. 4.