

AC/I(21-22).2(II).RPS3

S. P. Mandali's
RamnarainRuia AutonomousCollege
(Affiliated to University of Mumbai)



Syllabus for M.Sc Part II

Program: M.Sc

Program Code: Biotechnology(RPSBTK)

(Credit Based Semester and Grading System
for academic year 2022–2023)

GRADUATE ATTRIBUTES

GA	GA Description
GA	A student completing Bachelor's Degree in Science program will be able to:
GA1	Demonstrate in depth understanding in the relevant science discipline. Recall, explain, extrapolate and organize conceptual scientific knowledge for execution and application and also to evaluate its relevance.
GA 2	Critically evaluate, analyze and comprehend a scientific problem. Think creatively, experiment and generate a solution independently, check and validate it and modify if necessary.
GA 3	Access, evaluate, understand and compare digital information from various sources and apply it for scientific knowledge acquisition as well as scientific data analysis and presentation.
GA 4	Articulate scientific ideas, put forth a hypothesis, design and execute testing tools and draw relevant inferences. Communicate the research work in appropriate scientific language.
GA 5	Demonstrate initiative, competence and tenacity at the workplace. Successfully plan and execute tasks independently as well as with team members. Effectively communicate and present complex information accurately and appropriately to different groups. Use an objective, unbiased and non-manipulative approach in collection
GA 6	and interpretation of scientific data and avoid plagiarism and violation of Intellectual Property Rights. Appreciate and sensitive to environmental and sustainability issues and understand its scientific significance and global relevance.
GA 7	Translate academic research into innovation and creatively design scientific solutions to problems. Exemplify project plans, use management skills and lead a team for planning and execution of a task.
GA 8	Understand cross disciplinary relevance of scientific developments and relearn and reskill so as to adapt to technological advancements.

PROGRAM OUTCOMES

PO	Description A student completing Bachelor's Degree in Science program in the subject of Biotechnology will be able to:
PO 1	Perceive the fundamental and advanced concepts in depth in the areas of biochemistry, molecular biology, immunology, medical microbiology and applying the conceptual knowledge to address thereal time problems and exploring plausible solutions.
PO 2	Annotate the vast amount of biological data by retrieving, processing andanalyzing through various tools of bioinformatics and biostatistics.
PO 3	Criticize and assess the phases encountered from laboratory to premarketing stages in clinical research along with reviewing case studies.
PO 4	Identify local and global environmental issues and establish scientific strategies to devise economical solutions converging towards sustainable development
PO 5	Comprehend the process of patent documentation .Employ the relevance of legal and ethical implications in intellectual property rights, GMO ,developmental biology and other fields of biotechnology.
PO 6	Outline, execute ,Analyze experimental procedures and research proposal thus ameliorate their scientific writing temperament and soft skills consequently refining their abilities to troubleshoot any research problems.
PO 7	Deduce the underlying principle of nanotechnological and biotechnological processes and develop the skills to offer contemporary solutions.

PROGRAM OUTLINE

Msc Part –II

MSc	III	RPSBTK301	ATC and PTC	4
		RPSBTK302	Medical Microbiology	4
		RPSBTK303	GMO and Environment	4
		RPSBTK304	Developmental Biology	4
		RPSBTKP301	Practicals based on RPSBTK301	2
		RPSBTKP302	Practicals based on RPSBTK302	2
		RPSBTKP303	Practicals based on RPSBTK303	2
		RPSBTKP304	Practicals based on RPSBTK304	2
MSC	IV	RPSBTK401	Nanotechnology	4
		RPSBTK402	IPR & protection of inventions	4
		RPSBTK403	Clinical Studies	4
		RPSBTK404	Biostatistics	4
		RPSBTKP401 to RPSBTKP404	Project	2 credits each

Msc Part II

(Credit based Semester and Grading system)

SEMESTER III

Course Code: RPSBTK301

Course Title: PTC and ATC

Academic year 2022–23

COURSE OUTCOMES: On course completion, the student should be able to:

COURSE OUTCOME	DESCRIPTION
CO 1	Discuss the basic requirements of a tissue culture laboratory
CO 2	Design and carry out minor experiments in PTC, ATC following the required norms and protocols
CO 3	Make use of the safety and precaution controls in these labs
CO 4	Formulate and conduct simple experiments in ATC, PTC labs
CO 5	Apply different preservation techniques in ATC and PTC
CO 6	Formulate and illustrate the essential methodologies in ATC and PTC

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lecture s
RPSBTK301	I	Plant tissue culture Introduction to primary and secondary metabolism, important pathways leading to biosynthesis of secondary metabolites in plants, Metabolic products produced from invitro culturing of plant	

		cells ,selection of plant cells/ tissues for production of a specific products, culture system in secondary plant product .Biotransformation of precursors by cell culturing, metabolic engineering for production of secondary metabolites, Hairy root culture, elicitation	
	II	Plant tissue culture–II 15 Cryopreservation -Principle and types. Germplasm conservation, Transgenic plants- Edible vaccine, Golden rice	15
	III	Animal tissue culture–I Biology of cultured cells, Culture vessels, Culture Media, Microbial contamination, cross contamination. Cryopreservation, Primary culture: Types, isolation of tissues, culturing of different cells. Cell lines: Development, Subculture and propagation	15
	IV	Animal tissue culture–II Immortalization of cell line, cell line designation, selection of cell lines, routine maintenance, Cytotoxicity, Transformation, Culture of tumor cells, Scaffolds for Tissue Engineering: Classification of scaffold materials - examples, criteria for ideal scaffold, control of architecture, Scaffold design and fabrication techniques. Bioartificial organs: Artificial tissue and artificial skeleton. Three dimensional cell culture and tissue growth, 3D printing of tissue, cells and organs. Bioartificial heart, Bioartificial kidney. Tissue regeneration: Tissue regeneration driven by growth hormones, Stem Cells as source in regeneration of tissues, Therapeutic applications: Tissue therapy, Drug-vaccine-viral delivery in RM Bioethical Issues.	15

References:

1. Plant Cells in liquid culture (1991) Author : Payne Shuler, Hanser Publishers
2. Biochemistry and molecular biology of plants by Buchanan, Gruissem, Jones; 1st Ed ; I.K International publishers
3. Textbook of Plant Pharmaceuticals by Chandrakant Kokate; 1 st edition; Elsevier
4. Plant Biotechnology by K.G. Ramawat , 1 st Ed. S.Chand and Company
5. Culture of Animal Cells: A Manual of Basic Techniques by Ian Freshney

Course Code: RPSBTKP301

Course Title: Practicals based on RPSBTK301

DETAILED SYLLABUS

Course Code	Course/ Unit Title	Credit s
RPSBTKP301	1. Media preparation (MS, B5 and coconutwater) 2. Seed sterilization: Physical & Chemical methods. Check the efficiency of seed sterilization using both The methods. 3. Explant preparation ,inoculation & initiation of Tissue culture. 4. Callus induction and characterisation 5. Subculture of callus and plantlet establishment 6. Synthetic seed 7. Somatic embryogenesis 8. Establishment of suspension cultures. (Periodic subculture of callus can be done on solid media/ semisolid media / liquid media) 9. Dissection of chick embryo 10. Monolayer formation (fibroblast) and passaging. 11. To assay the radical scavenging activity of tissue hydrolysate- DPPH method 12. Techniques for cell preservation 13. Karyotyping with Giemsa staining 14. Observation of Normal and transformed cell line 15. Toxicology MTT Assay	2

Course Code: RPSBTK302
 Course Title: Medical Microbiology

Academic year 2022-23

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
CO 1	Explain the basics of medical microbiology
CO 2	Comment and appreciate the significance of this field
CO 3	Develop an understanding of various disease related issues of medical microbiology
CO 4	Analyse and interpret the molecular techniques involved in medical microbiology
CO 5	Formulate and develop molecular diagnostic techniques for various infections
CO 6	Determine the role of biofilms in the field of medicine

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lecture s
RPSBTK302	I	Cytogenetics Chromosomal disorders, Karyotyping, G-banding, Chromosome analysis, variations, Chromosome painting, Molecular Cytogenetics, FISH,CGH	
	II	Medical microbiology Infections of Respiratory tract- Pneumonia, GI tract infection- , Shigella, Vibrio,Salmonella, Nosocomial- S.pyogenes, Klebsiella. Viral infections-	15

		HIV, Hepatitis (ELISA). Fungal- Candidiasis. Parasitic: Malaria, Leishmania and Dengue, Ebola, SARS, Nipah, CoronaVirus	
	III	Molecular diagnostics 15 Introduction to molecular diagnostics, pros and cons, importance, molecular techniques, amplification based techniques (probe, signal and target amplification). Molecular diagnostics for Pneumonia, Tuberculosis, Pseudomonas, HIV, Hepatitis. Candidiasis	15
	IV	Biofilms Biofilms in medicine: Outline specifications: Stages in biofilm formation, Quorum sensing, biofilm in medical devices- implants & treatments, biofilms in pathogenesis, biofilm forming organisms- <i>E.coli</i> , <i>Pseudomonas spp</i> , <i>S.aureus</i>	15

References:

1. Industrial Microbiology an Introduction Michael, Neil, John & Gary
2. Diagnostic Microbiology 5th edition Elmer Koneman, Stephen Allen Lippincott
3. Molecular Microbiology: Diagnostic Persing, Tenover, ASM press Washington
4. Principles & Practice (2004) Versalone DC
5. Pharmaceutical microbiology 7th ed., (2004) Hugo Russell's Edited by Stephen P. Denyer, Hodges and Sean P. Gorman

Course Code: RPSBTKP302

Course Title: Practicals based on RPSBTK302

DETAILED SYLLABUS

Course Code	Course/ Unit Title	Credits
RPSBTKP302	1. Medical diagnostic – Identification of organisms from specimens (Salmonella, Shigella , Klebsiella pneumoniae ,). 2. Staining of Biofilms 3. ELISA for Hepatitis, 4. PCR based diagnosis for Malaria	2

Course Code: RPSBTK303

Course Title: GMO and Environment

Academic year 2022–23

COURSE OUTCOMES: On course completion, the student should be able to:

COURSE OUTCOME	DESCRIPTION
CO 1	Explain the importance GMOs and GM crops
CO 2	Elaborate on the development of GMOs to date
CO 3	Describe the use of genetic modification in agriculture
CO 4	Discuss the potential risks & benefits of human activities on the environment
CO 5	Discuss the potential risks & benefits associated with GMO crop consumption
CO 6	Articulate the concept of bioremediation of waste from different industries

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lecture s
RPSBTK303	I	Introduction to GMOs Genetically modified microorganisms, examples and methods, Humulin, ice minus bacteria, GM bacteria in bioremediation, use of PCR as a GMO identification tool, risks and controversies related to use genetically modified microorganisms. Proteins based assay methods, Toxicological evaluation	
	II	GMO crops	15

		GE crops' Arabidopsis as a model plant for studies in genetic engineering; Protocols on food and feed safety assessments, acute oral safety study in rats and mice, sub chronic feeding study in rodents, protein thermal stability, pepsin digestibility, livestock feeding	
	III	Solid waste management Solid waste treatment, pollution indicators & biosensors, biodegradation of xenobiotics, pesticides, phytoremediation	15
	IV	Biodegradation Biodegradation of waste from food, textile, petrochemicals, paper industries, biological detoxification, Removal of oil spillage & grease deposits, Valorization, Radioactive waste, pollution measurement by MHRD guidelines.	15

References:

1. Environmental Biotechnology (2nd Edition, 2005) Alan Scragg Oxford University Press
2. Environmental Biotechnology- Basic Concepts and Applications (2006)Indu Shekhar Thakur I. K. International Pvt.Ltd.
3. Environmental Biotechnology M. H. Fulekar Oxford & IBH Publishing

Course Code: RPSBTKP303

Course Title: Practicals based on RPSBTK303

DETAILED SYLLABUS

Course Code	Course/ Unit Title	Credits
RPSBTKP303	<ol style="list-style-type: none">1. Bioremediation- isolation of metal tolerant organisms & study their growth characteristics and pattern.2. GMO validation – kit based/demo3. Isolation of pesticides degraders4. Pollution indicators- Detection and Identification.	2

Course Code: RPSBTK304

Course Title: DEVELOPMENTAL BIOLOGY

Academic year 2022-23

COURSE OUTCOMES: On course completion, the student should be able to:

COURSE OUTCOME	DESCRIPTION
CO 1	Apply the key principles of developmental biology toward evaluating and analyzing primary literature in the field.
CO 2	Explain significant concepts including mechanisms by which differential gene activity controls development, mechanisms that determine cell fate and mechanisms that ensure consistency and reliability of development.
CO 3	Summarize the post fertilization events.
CO 4	Explain the molecular mechanisms of sex hormone.
CO 5	Discuss the immunology of pregnancy.
CO 6	Appraise and criticize the ethical issues in embryo research.

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lecture S
RPSBTK304	I	Human Embryonic development 15 Human Embryonic development: Events during fertilization, in-vitro fertilization, Zona pellucida, glycoprotein, Oolemma protein and their role in fertilization, sperm, antigens and their functional	

		significance. Molecular and biochemical events during sperm function	
	II	Post fertilization events 15 Post fertilization events: early embryonic development, establishing multi cellularity, formation of blastula, embryonic germ layer, tracking of migrating cells.	15
	III	Sex hormones and Implantation 15 Molecular mechanism of sex hormone action and regulation of gene expression. Implantation and endometrium antigens involved in implantation Immunology of pregnancy. Superovulation, embryo culture and embryo transfer technology	15
	IV	Infertility and reproductive vaccines 15 Infertility and reproductive vaccines. Frontiers in contraceptive research. Cryopreservation of sex gametes and embryos. Ethical issues related to embryo research	15

References:

1. Langman's Medical Embryology (9th Edition 2004) T. W.Sadler. Lippincott Williams &Wilkins
2. Essential Developmental Biology (2nd Edition 2006) J. M. W. Slack Blackwell Publishing
3. Developmental Biology (8th Edition 2006) Scott F. Gilbert Sinauer Associates, Inc

Course Code: RPSBTKP304

Course Title: Practicals based on RPSBTK304

DETAILED SYLLABUS

Course Code	Course/ Unit Title	Credits
RPSBTKP304	1. Candling, Observing Chick embryo- stages of development, prepared slides/ Preserved specimen 2. Developmental biology- Visit to laboratory/video lectures for latest development in the field. To be documented	2

Modality of Assessment

Semester III

Theory Examination Pattern

A. Internal assessment -40%-40 Marks

Sr.No	Evaluation Type	Marks
1	One Assignment /case study/project based/Written assignment/Presentations	20
2	One class test (Multiple choice questions)	20

B. External Examination- 60%-60 Marks

Semester End Theory Examination:

1. Duration: These examination shall be of 2.5 hrs

2. Theory question paper pattern

- There shall be 4 questions each of 15 Marks. On each unit there will be one question
- All questions shall be compulsory with internal choice within the questions

Paper Pattern:

Questions Pattern	Marks	Question based on
Q.1 A) Any 1 out of 2	8	Unit I
Q.1 B) compulsory	7	
Q.2 A) Any 1 out of 2	7	Unit II
Q.2 B) compulsory	8	
Q.3 A) Any 1 out of 2	8	Unit III
Q.3 B) compulsory	7	
Q.4 A) Any 1 out of 2	7	Unit IV
Q.4 B) compulsory	8	
TOTAL	60M	

Practical Examination Pattern:

- A. External Examination- 50 Marks
Semester End Practical Examination

Particulars	Paper
Laboratory Work	40
Journal	05
Viva	05
Total	50

Overall Examination and Marks Distribution Pattern
Semester III

Course	RPSBTK301/302/303/304			Grand Total
	Internal	External	Total	
Theory	40	60	100	400
Practicals	-	50	50	200

SEMESTER IV

Course Code: RPSBTK401

Course Title: Nanotechnology

Academic year 2022-23

COURSE OUTCOMES: On course completion, the student should be able to:

COURSE OUTCOME	DESCRIPTION
CO 1	Discuss the basics of nanotechnology, tools used for characterizing nanomaterials and specific applications of nanotechnology
CO 2	Examine the nanorobotics devices of nature
CO 3	Analyse and interpret the latest developments in nanotechnology in the field of medical sciences
CO 4	Explain drug delivery system using nanotechnology.
CO 5	Apply nanomaterials in food, cosmetics, agriculture, environment Management.
CO 6	Assess and appreciate the thrust in this science and feel encouraged to take it ahead in research

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lecture s
RPSBTK401	I	Introduction, synthesis of nanomaterials Introduction, synthesis of nanomaterials, biological methods, use of microbial systems & plant extracts, use of proteins & templates like DNA. Characterization of nanomaterials, analysis techniques, properties of nanomechanical, optical, magnetic properties, electrical conductivity, thermal conductivity.	

	II	CNTs and nanomotors Carbon nanotubes, Nanorobotics devices of nature: ATP synthase, the kinen, myosin, dynein, flagella modulated motion	15
	III	Nanomedicine 15 Nanomedicine: biopharmaceutics, implantable materials, implantable chemicals, surgical aids, diagnostic tools, nanosensors, nanoscanning, nano enabled drug delivery system, nanorobotics in medicine.	15
	IV	Applications of nanotechnology Application of nanomaterials in food, cosmetics, agriculture, environment management	15

References:

1. TheNanoscope encyclopedia of nanoscience and nanochehnology, VolI,V and VI (2005) Dr.Parag Diwan and Ashish Bharadwaj Pentagon Press NewDelhi
2. Nano forms of carbon and its applications (2007) Prof. Maheshwar Sharon and Dr.Madhuri Sharon Manad Nanotech Pvt.Ltd.
3. Biotech nanotechnology lessons from Nature (2004) David Goodsell Wiley-Liss A John Wiley and sons
4. Nanotechnology- Basic science and emerging technologies (2005) Willson Kannangava, Smith, Simmons, Raguse Oversease Press
5. Texbook of Biotechnology (2005) R. C. Dubey S. Chand and Co.
6. Nanotechnology- Principles and practices S. K. Kulkarni Capital Publishing Co.

Course Code: RPSBTK402
Course Title: IPR & PROTECTION OF INVENTIONS

Academic year 2022–23

COURSE OUTCOMES: On course completion, the student should be able to:

COURSE OUTCOME	DESCRIPTION
CO 1	Elaborate on the rules and regulations for patenting
CO 2	Distinguish between copyright, Trademark, GI and Industrial designs
CO 3	Interpret different case laws in biotechnology
CO 4	Discuss the roles and responsibilities of the patent officer and the institution
CO 5	Examine various patent applications
CO 6	Summarize the various case studies associated

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lecture s
RPSBTK402	I	Introduction to Intellectual Property Introduction to IPR; Globalization & development of GATT, WTO, TRIPS agreement; Important provisions under TRIPS (Article/s 3, 4, 31/31f) agreement; Important provisions under Geographical indications act, PVPFRA; Traditional knowledge and Bio-piracy; Differences among copyright, Trademark, GI and Industrial designs; Classification of trademark;	15

		conventional v/s non-conventional	
	II	<p>Concept of 'prior art'</p> <p>Indian patents act 1970 and rights of patentee (section 48), Principles of patent protection (sec 83); Patenting biotech inventions: objectives, concept of novelty, concept of inventive step, non-patentable objects (sec 3/4), Budapest treaty and protection of microorganisms, moral issues in patenting biotech</p>	15
	III	<p>Patent filing and Infringement. 15</p> <p>Patent application- forms and guidelines, fee structure, time frames; Types of patent applications:</p> <p>ordinary patent application (provisional and complete specifications, timeline); PCT (timeline) and conventional patent applications; Patent-of-addition v/s divisional patent, publication of patents-gazette of India, status in Europe and US .Parts of a patent ;How to write a claim ,types of claims (independent v/s dependent claims, Markush claims, Omnibus claims, biotechnology claims, etc.), Patenting by research students, lecturers and scientists- University/organizational rules</p> <p>in India and abroad, credit/royalty sharing by workers and financial incentives. Patent infringement meaning, scope, litigation, case studies and examples. Important case studies: Glivec case (section 3d), Natco v/s Bayer</p> <p>case of compulsory licensing</p>	15
	IV	<p>Important aspects of IP protection 15</p> <p>IP transfer, patent filing, types of patent, types of claim, claim drafting, patent search. Exhaustion doctrine and article 6 of TRIPS agreement in conjunction with sec 48 of Indian patents act 1970; case studies; fair dealing and de minimis principle. IP enforcement (proactive vs reactive measures):-civil, criminal and custom remedies. Article 34 of TRIPS agreement. Legislative structure and IP protection in India, role of IPAB. Copyright protection: Rights of copyright owner (sec 14, economic rights; sec 57, moral rights), Contract of service v/s Contract for service (sec 17) and idea-expression dichotomy under Indian copyright act 1957; spring-board doctrine, doctrine of first-sale and Creative</p>	15

	commons (CC). Levels of trademark protection (based on trade name). Passing off v/s trademarks infringement	
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References:

1. https://www.wipo.it/wipo_magazine/en/2011/03/article_0002.html
2. https://www.wipo.int/edocs/mdocs/africa/en/wipo_tiscs_znz_16/wipo_tiscs_znz_16_t_6.pdf
3. <https://www.lexisnexisip.com/knowledge-center/totalpatent-one-and-the-usptosseven-step-patent-search-strategy/>
4. <https://www.khuranaandkhurana.com/wp-content/uploads/2017/01/ANATOMYOF-PATENT-SPECIFICATION.pdf>
5. https://www.wipo.int/edocs/mdocs/aspac/en/wipo_ip_phl_16/wipo_ip_phl_16_t5.pdf
6. <http://www.mondaq.com/india/x/667450/Patent/Patent+Claims+And+Their+Type>

Ramnarain Ruia Autonomous College

Course Code: RPSBTK403
 Course Title: Clinical Studies

Academic year 2022-23

COURSE OUTCOMES: On course completion, the student should be able to:

COURSE OUTCOME	DESCRIPTION
CO 1	Discuss the ethical issues in human subjects research
CO 2	Imagine and understand the different phases of clinical trials
CO 3	Analyse the roles and responsibilities of the investigator and the institution
CO 4	Examine various regulatory issues related to clinical studies
CO 5	Recall the companies and organizations associated in this field
CO 6	Develop interest on medical writing and design a clinical study report

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lectures
RPSBTK403	I	Drug discovery and Preclinical toxicology Pre-Clinical toxicology: General Principles, Systemic toxicology, (Single dose and repeat dose toxicity studies), Carcinogenicity, Mutagenicity, Teratogenicity, Reproductive toxicity, Local toxicity, Genotoxicity, animal toxicity requirements	15
	II	Introduction to Clinical trials Introduction to clinical trials, Historical guidelines in clinical research (Nuremberg code, Declaration of Helsinki and Belmonte report), ICH-GCP guidelines (E6-R1), Phases of clinical trials	15

	III	Clinical study design Clinical study methodology and regulations: Principles, types (single blinding, double blinding, open access, randomized trials and their examples), Design of protocol, CRF, e-CRF, IB, ICF and preparation of trial reports, Regulations involved (ICMR guidelines) and ethics.	15
	IV	Medical Writing Medical Writing: Literature search and medical articles, contract writing, publication, abstracts, bibliography, clinical study reports, principles and softwares in CDM (Clinical Data Management)	15

References:

1. EC R1 guidelines
2. ICMR ethical guidelines
3. D & C Rules – Schedule Y
4. Law Of Intellectual Property Rights Shiv Sahai Singh Deep & Deep Publications (p) Ltd
5. WTO And Intellectual Property Rights By Talwar Sabanna (2007) Serials Publications
6. IPR: Unleashing the Knowledge Economy (2003) Prabuddha Ganguli Tata Mc grow Hill publication

Course Code: RPSBTK404

Course Title: Biostatistics

Academic year 2022–23

COURSE OUTCOMES: On course completion, the student should be able to:

COURSE OUTCOME	DESCRIPTION
CO 1	Calculate standard normal scores and resulting probabilities
CO 2	Interpret and explain a p-value
CO 3	Perform a two-sample t-test and interpret the results; calculate a 95% confidence interval for the difference in population means
CO 4	Discuss and interpret results from Analysis of Variance (ANOVA), a technique used to compare means amongst more than two independent populations
CO 5	Analyse and interpret relative risks and odds ratios when comparing two populations
CO 6	Evaluate correlation and regression

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lecture s
RPSBTK404	I	Introduction to Statistics Statistical population, sample from population, Random sample. Central Tendency: Mean, Median and Mode, Standard Deviation Confidence intervals	
	II	Gaussian distribution and normality Gaussian Distribution and testing for normality, Nonparametric tests (Sign test, Wilcoxon test, Mann- Whitney Test, Krushkal- Whllis test,), transforming data to create Gaussian Distribution	15

	III	Hypothesis testing Test of Significance. Hypothesis testing:- Theory o errors - Type I and Type II errors, Null hypothesis, P values-one v/s two tail P values, t test(paired & unpaired), z-test, Chi square test, contingency table	15
	IV	ANOVA Comparing three or more groups- Introduction to ANOVA, One way ANOVA, repeated measures ANOVA, Friedman Test. Correlation and Regression: Linear and multiple Correlation and Regression	15

References:

1. Introduction to Biostatistics (Second Edition-2005) N. Gurumani M J P Publishers
2. Basic Biostatistics (2008) B. Burt Gerstman Jones and Bartlet Publishers
3. Biostatistics: A foundation For Analysis In Health Sciences (7th Edition 1999) Wayne W. Daniel John Wiley & Sons Inc.
4. Fundamentals of Biostatistics (2006) Veer Bala Rastogi Ane Books India
5. Biostatistics- The Bare Essentials (Second Edition 2000) Nosman Streiner B.C. Decker Inc.

Modality of Assessment

Semester IV

Theory Examination Pattern

A. Internal assessment -40%-40 Marks

Sr.No	Evaluation Type	Marks
1	One Assignment /case study/project based/Written assignment/Presentations	20 20
2	One class test (Multiple choice questions)	

B. External Examination- 60%-60 Marks

Semester End Theory Examination:

1. Duration: These examination shall be of 2.5 hrs
2. Theory question paper pattern

- There shall be 4 questions each of 15 Marks. On each unit there will be one question
- All questions shall be compulsory with internal choice within the questions

Paper Pattern:

Questions Pattern	Marks	Question based on	
Q.1 A)	Any 1 out of 2	8	Unit I
Q.1 B)	compulsory	7	Unit II
Q.2 A)	Any 1 out of 2	7	
Q.2 B)	compulsory	8	
Q.3 A)	Any 1 out of 2	8	Unit III
Q.3 B)	compulsory	7	Unit IV
Q.4 A)	Any 1 out of 2	7	
Q.4 B)	compulsory	8	
	TOTAL	60M	

Practical Examination Pattern:
 students will have to undergo mandatory hands on project for 200M in an established laboratory /college laboratory for 4-6 months

A. Semester End Examination: (200 marks)

Particulars	
Internal departmental teachers	50
Internal examiner	50
External examiner	50
TOTAL	200

**Overall Examination and Marks Distribution Pattern
 Semester IV**

Course	RPSBTK401/402/403/404			Grand Total
	Internal	External	Total	
Theory	40	60	100	400
Practicals	-	50	50	200
