# Bangalore University

## Jnana Bharathi Campus, Bengaluru-560 056

# 3rd and 4th Semester Syllabus
# For UG Program in
# Biotechnology framed under NEP- 2020

**Department of Microbiology**
**Bangalore University**
**Bengaluru-560 056**

# PREAMBLE

The role of education is paramount in nation building. One of the major objectives of UGC is maintenance of standards of higher education. Over the past decades the higher education system of our country has undergone substantial structural and functional changes resulting in both quantitative and qualitative development of the beneficiaries. Such changes have gained momentum with the introduction of Choice Based Credit System (CBCS) which further expects Learning Outcome-Based curriculum to maximize the benefits of the newly designed curriculum. The Learning Outcome- Based Curriculum in Biotechnology will help the teachers of the discipline to visualize the curriculum more specifically in terms of the learning outcomes expected from the students at the end of the instructional process. The commission strives to promote the link of students with the society/industry such that majority of the students engage in socially productive activities during their period of study in the institutions and at least half of the graduate students will secure access to employment/self-employment or engage themselves in pursuit of higher education. The model curriculum envisages to cater to the developmental trends in higher education, incorporating multi- disciplinary skills, professional and soft skills such as teamwork, communication skills, leadership skills, time management skills and inculcate human values, professional ethics, and the spirit of Innovation / entrepreneurship and critical thinking among students and promote avenues for display of these talents, linking general studies with professional courses. Besides imparting disciplinary knowledge to the learners, curriculum should aim to equip the students with competencies like problem solving, analytical reasoning and moral and ethical awareness. Introduction of internship and appropriate fieldwork/case studies are embedded in the curriculum for providing wider exposure to the students and enhancing their employability.

Learning outcomes specify what exactly the graduates are expected to know after completing a program of study. The expected learning outcomes are used as reference points to help formulate graduate attributes, qualification descriptors, program learning outcomes and course learning outcomes. Keeping the above objectives of higher education in mind the Learning Outcome-Based Curriculum Framework (LOCF) for the discipline of Biotechnology has been prepared and presented here.

# Contents

# BANGALORE UNIVERSITY

Department of Microbiology

Jnana Bharathi Campus, Bengaluru -560 056. Phone.No.080-22961461

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**Dr. J. Savitha**
Professor and Chairman

Date: 20.08.2022

**Proceedings of the Board of studies (BOS)(UG)**

A BOS meeting was held on 20th August, 2022 regarding finalization of Under graduate (UG) 3rd and 4th Semester Microbiology and Biotechnology syllabus of Bangalore University as per the NEP regulation.

The Chairperson welcomed all the members of the BOS (UG) and then the members were invited to discuss the syllabus of the 3rd and 4th semester Microbiology received from the Karnataka Higher Education council.

The members have gone through the syllabus critically and approved the syllabus with minor correction. The suggestions made by the all members were incorporated. The meeting ended with vote of thanks by the Chairperson.

Chairman (BOS)

CHAIRMAN
Department of Microbiology
& Biotechnology
Bangalore University, JB Campus,
Bangalore - 560 056.

| Sl No | Name | Signature |
|---|---|---|
| 1 | Dr. Kavya shree R | ABSENT |
| 2 | Smt. Nalina N | – |
| 3 | Dr. Sudiptha Kumar Mohanty | |
| 4 | Dr. Mohana D.C | |
| 5 | Dr. Geethanjali P.A | |
| 6 | Dr. Raja Naika H | ABSENT |
| 7 | Prof. C Srinivas | |
| 8 | Prof. J Savitha | |

# Curriculum as per KSHEC

| Program Name | **B.Sc. Discipline** | Total Credits for the Program | **Credits** |
|---|---|---|---|
| Core | **Biotechnology** | Starting year of implementation | **2021-22** |

**Program Outcomes**: At the end of the program the student should be able to:

(Refer to literature on outcome-based education (OBE) for details on Program Outcomes)

PO1. Understanding concepts of Biotechnology and demonstrate interdisciplinary skills acquired in cell biology, genetics, biochemistry, microbiology, and molecular biology

PO2. Demonstrating the Laboratory skills in cell biology, basic and applied microbiology with an emphasis on technological aspects

PO3. Competent to apply the knowledge and skills gained in the fields of Plant biotechnology, animal biotechnology and microbial technology in pharma, food, agriculture, beverages, herbal and nutraceutical industries.

PO4. Critically analyse the environmental issues and apply the biotechnology knowledge gained for conserving the environment and resolving the problems.

PO5. Demonstrate comprehensive innovations and skills in the fields of biomolecules, cell and organelles, molecular biology, bioprocess engineering and genetic engineering of plants, microbes, and animals with respect to applications for human welfare.

PO6. Apply knowledge and skills of immunology, bioinformatics, computational modelling of proteins, drug design and simulations to test the models and aid in drug discovery.

PO7. Critically analyse, interpret data, and apply tools of bioinformatics and multi omics in various sectors of biotechnology including health and Food.

PO8. Demonstrate communication skills, scientific writing, data collection and interpretation abilities in all the fields of biotechnology.

PO9. Learning and practicing professional skills in handling microbes, animals and plants and demonstrate the ability to identify ethical issues related to recombinant DNA technology, genetic engineering, animals handling, intellectual property rights, biosafety, and biohazards.

PO10. Exploring the biotechnological practices and demonstrating innovative thinking in addressing the current day and future challenges with respect to food, health, and environment.

PO11. Thorough knowledge and application of good laboratory and good manufacturing practices in biotech industries.

PO12. Understanding and application of molecular biology techniques and principles in forensic and clinical biotechnology.

PO13. Demonstrate entrepreneurship abilities, innovative thinking, planning, and setting up small-scale enterprises or CROs.

## Assessment:

Weightage for assessments (in percentage)

| Type of Course | Formative Assessment / IA | Summative Assessment |
|---|---|---|
| **Theory** | 40 | 60 |
| **Practical** | 25 | 25 |
| **Projects** | - | - |
| **Experiential Learning (Internships etc.)** | - | - |

## Contents of Courses for B.Sc. Biotechnology as Major Model II A

| Semester | Course code | Course Category | Theory / Practical | Credits | Paper Title | Marks | |
|---|---|---|---|---|---|---|---|
| | | | | | | SA | FA |
| 3. | **BTC: 103** | DSC- 7 | Theory | 4 | Biomolecules | 60 | 40 |
| | **BTC: 103** | | Practical | 2 | Biomolecules | 25 | 25 |
| | **BTC: 303** | OE- 3 | Theory | 3 | Nutrition and Health | 60 | 40 |
| 4. | **BTC: 104** | DSC- 8 | Theory | 4 | Molecular Biology | 60 | 40 |
| | **BTC: 104** | | Practical | 2 | Molecular Biology | 25 | 25 |
| | **BTC: 304** | OE- 4 | Theory | 3 | Intellectual Property Rights | 60 | 40 |
| | **Exit Option with Diploma in Biotechnology (100 Credits)** | | | | | | |

| Program Name | **BSc Biotechnology** | | Semester | **Third** |
|---|---|---|---|---|
| Course Title | **Biomolecules** | | | |
| Course No. | **BTC: 103** | **DSC -3T** | No. of Theory Credits | **4** |
| Contact hours | **56 hrs.** | | Duration of ESA/Exam | **3 hrs.** |
| Formative Assessment Marks | **40** | | Summative Assessment Marks | **60** |

**Course Pre-requisite (s):**

**Course Outcomes (COs)**: At the end of the course the student should be able to:

1. Acquire knowledge about types of biomolecules, structure, and their functions
2. Will be able to demonstrate the skills to perform bioanalytical techniques
3. Apply comprehensive innovations and skills of biomolecules to biotechnology field

| **Content** | **56 Hrs** |
|---|---|
| **Unit–I** | **14 Hrs.** |
| **a. Carbohydrates**<br>Introduction, sources, classification of carbohydrates. Structure, properties and function of carbohydrates. Monosaccharides – Isomerism and ring structure, Sugar derivatives<br>Oligosaccharides – Sucrose and Fructose<br>Polysaccharides – Classification as homo and heteropolysaccharides, Homopolysaccharides - storage polysaccharides (starch and glycogen- structure, reaction, properties), structural polysaccharides (cellulose and chitin-structure, properties), Heteropolysaccharides - glycoproteins and proteoglycans.<br>**b. Amino Acids, Peptides and Proteins**<br>Introduction, classification and structure of amino acids. Concept of – Zwitterion, isoelectric point, pK values. Essential and nonessential amino acids. Peptide and peptide bond, classification of proteins based on structure and function, Structural organization of proteins [primary,secondary, tertiary and quaternary]. Fibrous and globular proteins, Denaturation and renaturation of proteins secondary ($\alpha$, $\beta$), tertiary. | |
| **Unit -II** | **14 Hrs** |
| **a. Lipids**<br>Classification and function of lipids, properties (saponification value, acid value, iodine number, rancidity), Hydrogenation of fats and oils, saturated and unsaturated fatty acids. General structure and biological functions of - phospholipids, sphingolipids, glycolipids, lipoproteins, prostaglandins and cholesterol. | |
| **b. Enzymes**<br>Introduction, nomenclature and classification, enzyme kinetics, factors influencing enzyme activity, metalloenzymes, activation energy and transition state, enzyme activity, specific activity. Coenzymes and their functions (one reaction involving FMN, FAD, NAD). Enzyme inhibition- Irreversible and reversible (competitive, non-competitive and uncompetitive inhibition with an example each) Zymogens (trypsinogen, chymotrypsinogen and pepsinogen),<br>Isozymes (LDH). | |

| Unit -III | 14 Hrs |
|---|---|
| **a. Vitamins**<br>Water and fat soluble vitamins, dietary source and biological role of vitamins Deficiency manifestation of vitamin A, B, C, D, E and K<br>**b. Nucleic acids**<br>Structures of purines and pyrimidines, nucleosides, nucleotides in DNA<br>**c. Hormones**<br>Classification of hormones based on chemical nature and mechanism of action. Chemical structure and functions of the following hormones: Glucagon, Cortisone, Epinephrine, Testosterone and Estradiol. | |
| **Unit -IV** | **14 Hrs** |
| **Bioanalytical tools:**<br>**a. Chromatography:** Principle, procedure and applications of - paper chromatography and thin layer chromatography. | |
| **b. Electrophoresis:** Principle, procedure and applications of electrophoresis (Gel electrophoresis -PAGE, SDS- PAGE & agarose gel electrophoresis).<br><br>**c. Spectroscopy:** UV-Vis spectrophotometry; mass and atomic absorption spectroscopy. | |

**Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)**

| Course Outcomes (COs) / Program Outcomes (POs) | Program Outcomes (POs) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Acquire knowledge about types of biomolecules, structure, and their functions | ✓ | | | | ✓ | | | | | | | ✓ |
| Will be able to demonstrate the skills to perform bioanalytical techniques | | | ✓ | | | | | | | | ✓ | ✓ |
| Apply comprehensive innovations and skills of biomolecules to biotechnology field | ✓ | | | | ✓ | | | | | | | ✓ |
| | | | | | | | | | | | | |

**Pedagogy:** Lectures, Seminars, Industry Visits, Debates, Quiz and Assignments

| **Summative Assessment = 60 Marks** | |
|---|---|
| **Formative Assessment Occasion / type** | **Weightage in Marks** |
| Attendance | 10 |
| Seminar and Assignment | 10 |
| Debates and Quiz | 10 |
| Test | 10 |
| **Total** | **60 marks + 40 marks = 100 marks** |

| Course Title | **Biomolecules (Practical)** | | Practical Credits | **2** |
|---|---|---|---|---|
| Course No. | **BTC:103** | **DSC-3P** | Contact hours | 4hrs/week |
| **Content** | | | | |
| 1. Calculations of Molarity, Molality, Normality, percent by mass % (w/w), Percent by volume (% v/v), parts per million (ppm), parts per billion (ppb)<br>2. Preparation of standard solutions.<br>3. Preparation of buffers – Acetate, phosphate, Tris<br>4. Estimation of reducing sugar by DNS method<br>5. Determination of α-amylase activity by DNS method<br>6. Estimation of proteins by Lowry's/Biuret/ Bradford's method<br>7. Estimation of amino acid by Ninhydrin method<br>8. Extraction of protein from soaked/sprouted green gram by salting out method<br>9. Separation of plant pigments by paper chromatography<br>10. Separation of amino acids by thin layer chromatography<br>11. Demonstration of active protein by Native PAGE<br>12. Determination of Saponification and iodine number of lipids | | | | |

## Practical assessment

| **Assessment** | | | |
|---|---|---|---|
| **Formative assessment** | | **Summative Assessment** | **Total Marks** |
| **Assessment Occasion / type** | **Weightage in Marks** | **Practical Exam** | |
| Record | 5 | 25 | **50** |
| Test | 10 | | |
| Attendance | 5 | | |
| Performance | 5 | | |
| **Total** | **25** | **25** | |

## References


1 David Plummer; 2001. 3rd Edition. An Introduction to Practical Biochemistry, Tata McGraw Hill Edu.Pvt.Ltd. New Delhi, India

2 Sadashivam,S.Manickam, A.1995. Biochemical Methods,1st Edition, New Age International Publishers, India

3 Sawhney, S. K. & Randhir Singh. Introductory Practical biochemistry, (ed) Narosa Publishing. House, New Delhi, ISBN 81-7319-302-9

4 Beedu Sasidhar Rao & Vijay Despande. Experimental Biochemistry: A Student Companion, (ed) I.K.International Pvt. LTD, New Delhi. ISBN 81-88237-41-8

5 Thimmaiah, S. K. (ed), Kalyani Publishers, Standard Methods of Biochemical Analysis, Ludhiana ISBN 81-7663-067

| | | | | |
|---|---|---|---|---|
| Program Name | **BSc Biotechnology** | | Semester | **Third** |
| Course Title | **Nutrition and Health** | | | |
| Course Code | **BTC:303** | **OE-3** | No. of Theory Credits | **3** |
| Contact hours | **Lecture** | **42 hrs.** | Duration of ESA/Exam | **2 Hours** |
| | **Practical** | **-** | | |
| Formative Assessment Marks | 40 | | Summative Assessment Marks | 60 |

| | |
|---|---|
| **Course Pre-requisite(s):** | |
| **Course Outcomes (COs)**: At the end of the course the student should be able to:<br>1. Study the concepts of food, nutrition, diet and health<br>2. To apply the best practices of food intake and dietary requirements<br>3. Acquire knowledge on various sources of nutrients and good cooking practices | |
| **Content** | **42 Hrs** |
| **Unit–I** | **14 Hrs** |
| **Introduction**<br>Concepts of nutrition and health. Definition of Food, Diet and nutrition, Food groups. Food pyramids. Functions of food. Balanced diet. Meal planning. Eat right concept. Functional foods, Probiotics, Prebiotics, and antioxidants. | |
| **Unit -II** | **14 Hrs** |
| **Nutrients**<br>Macro and Micronutrients - Sources, functions and deficiency. Carbohydrates, Proteins, Fats – Sources and calories. Minerals –Calcium, Iron, Iodine.<br>Vitamins – Fat soluble vitamins –A, D, E & K. Water soluble vitamins – Vitamin C, Thiamine, Riboflavin, Niacin. Water–Functions and water balance. Fibre –Functions and sources. Recommended Dietary Allowance, Body Mass Index and Basal Metabolic Rate. | |
| **Unit -III -** | **14 Hrs** |
| **Nutrition and Health**<br>Methods of cooking affecting nutritional value. Advantages and disadvantages. Boiling, steaming, pressure cooking. Oil/Fat – Shallow frying, deep frying. Baking. Nutrition and lifestyle. Nutritional requirement, dietary guidelines: Adulthood, Pregnancy, Lactation, Infancy-Complementary feeding, Pre-school, Adolescence, geriatric. Nutrition related metabolic disorders- diabetes and cardiovascular disease. | |

**Pedagogy:** Lectures, Seminars, Industry Visits, Debates, Quiz and Assignments

| **Summative Assessment = 60 Marks** | |
|---|---|
| **Formative Assessment Occasion / type** | **Weightage in Marks** |
| Attendance | 10 |
| Seminar and Assignment | 10 |
| Debates and Quiz | 10 |
| Test | 10 |
| **Total** | **60 marks + 40 marks = 100 marks** |

## References


1 Sri Lakshmi B, (2007), Dietetics. New Age International publishers. New Delhi

2 Sri Lakshmi B, (2002), Nutrition Science. New Age International publishers. New Delhi

3 Swaminathan M. (2002), Advanced text book on food and Nutrition. Volume I. Bappco

4 Gopalan.C., Rama Sastry B.V., and S.C.Balasubramanian (2009), Nutritive value of Indian Foods. NIN.ICMR. Hyderabad.

5 Mudambi S R and Rajagopal M V, (2008), Fundamentals of Foods, Nutrition & diet therapy by New Age International Publishers, New Delhi

| | | | | |
|---|---|---|---|---|
| Program Name | **BSc Biotechnology** | | Semester | **Fourth** |
| Course Title | **Molecular Biology** | | | |
| Course No. | **BTC: 104** | **DSC-4T** | No. of Theory Credits | **4** |
| Contact hours | **56 hrs.** | | Duration of ESA/Exam | **3 Hours** |
| Formative Assessment Marks | 40 | | Summative Assessment Marks | 60 |

**Course Pre-requisite (s):**

**Course Outcomes (COs)**: At the end of the course the student should be able to:

1. Study the advancements in molecular biology with latest trends.
2. Will acquire the knowledge of structure, functional relationship of proteins and nucleic acids.
3. Aware about the basic cellular processes such as transcription, translation, DNA replication and repair mechanisms.

| Content | 56 Hrs |
|---|---|
| **Unit–I** | **14 Hrs** |
| **Molecular basis of life - Nucleic Acids**<br>An introduction to DNA and RNA, experimental proof of DNA as genetic material, Structure and functions of DNA and RNA, Watson and Crick model of DNA and forms of DNA (A and Z). Ribozymes. | |
| **Unit -II** | **14 Hrs** |
| **DNA Replication and Repair**<br>Replication of DNA in prokaryotes and eukaryote. Enzymes and proteins involved in replication, Theta model, linear and rolling circle model. DNA Polymerases.<br>**Replication complex:** Pre-priming proteins, primosome, replisome, unique aspects of eukaryotic chromosome replication, fidelity of replication, DNA damage and repair mechanism**:** photo reactivation, excision repair, mismatch repair and SOS repair. | |
| **Unit -III** | **14 Hrs** |
| **Transcription and RNA processing**<br>Central dogma, types of RNA, Transcription in prokaryotes, RNA polymerase, role of sigma factor, promoter, Initiation, elongation and termination of RNA chains.<br>Transcription in eukaryotes: Eukaryotic RNA polymerases, transcription factors, promoters, enhancers, mechanism of transcription initiation, promoter clearance and elongation RNA splicing and processing: processing of pre-mRNA: 5' cap formation, polyadenylation, splicing, rRNA and tRNA splicing. | |
| **Unit –IV** | **14 Hrs** |
| **Regulation of gene expression and translation**<br>Genetic code and its characteristics, Wobble hypothesis. Translation in prokaryotes and eukaryotes, ribosome, enzymes and factors involved in translation. Mechanism of translation-activation of amino acid, aminoacyl tRNA synthesis, Mechanism- initiation, elongation and termination of polypeptide chain. Fidelity of translation, Inhibitors of translation. Protein folding and modifications, Post translational modifications of proteins.<br>Operon concept Lac and Trp. | |

**Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)**

| Course Outcomes (COs) / Program Outcomes (POs) | Program Outcomes (POs) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Study the advancements in molecular biology with latest trends | ✓ | | | | ✓ | | | | | | | ✓ |
| Will acquire the knowledge of structure, functional relationship of proteins and nucleic acids | | | | | ✓ | ✓ | | | | | | ✓ |
| Awareness on the basic cellular processes such as transcription, translation, DNA replication and repair mechanisms | ✓ | | | | ✓ | | | | ✓ | | | ✓ |

**Pedagogy:** Lectures, Seminars, Industry Visits, Debates, Quiz and Assignments

| **Summative Assessment = 60 Marks** | |
|---|---|
| **Formative Assessment Occasion / type** | **Weightage in Marks** |
| Attendance | 10 |
| Seminar and Assignment | 10 |
| Debates and Quiz | 10 |
| Test | 10 |
| **Total** | **60 marks + 40 marks = 100 marks** |

| Course Title | **Molecular Biology (Practical)** | | Practical Credits | **2** |
|---|---|---|---|---|
| Course No. | **BTC:104** | **DSC-4P** | Contact hours | 4hrs/week |

**Content**

1. Isolation of DNA from yeast/plant/animal sources
2. Estimation of DNA by DPA method
3. Analysis of DNA by Agarose gel electrophoresis
4. Estimation of RNA by Orcinol method
5. Extraction of protein from microbial/plant and partial purification by Ammonium sulphate precipitation.
6. Extraction and partial purification of protein from animal source by organic solvents.
7. Protein separation by SDS-Polyacrylamide Gel Electrophoresis (PAGE)
8. Study of Conjugation, Transformation and Transduction,
9. DNA replication model
10. Types of RNA (Model)
11. Preparation of forms of DNA model
12. Demonstration of Replica plating technique

## Practical assessment

| **Assessment** | | | |
|---|---|---|---|
| **Formative assessment** | | **Summative Assessment** | **Total Marks** |
| **Assessment Occasion / type** | **Weightage in Marks** | **Practical Exam** | |
| Record | 5 | 25 | **50** |
| Test | 10 | | |
| Attendance | 5 | | |
| Performance | 5 | | |
| **Total** | **25** | **25** | |

**References**


| | |
|---|---|
| 1 | Glick, B.R and Pasternak, J.J 1998. Molecular biotechnology, Principles and application of recombinant DNA, Washington D.C. ASM press |
| 2 | Howe. C. 1995. Gene cloning and manipulation, Cambridge University Press, USA |
| 3 | Lewin, B. Gene VI New York, Oxford University Press |
| 4 | Rigby, P.W.J. 1987 Genetic Engineering Academic Press Inc. Florida, USA |
| 5 | Sambrook et al 2000. Molecular cloning Volumes I, II & III, Cold spring Harbor Laboratory Press New York, USA |
| 6 | Walker, J. M. and Ging old, E.B. 1983. Molecular Biology & Biotechnology (Indian Edition) Royal Society of Chemistry U.K |
| 7 | Karp. G 2002. Cell & Molecular Biology, 3rd Edition, John Wiley & Sons, Inc. |

| | | | | |
|---|---|---|---|---|
| Program Name | **BSc Biotechnology** | | Semester | **Fourth** |
| Course Title | **Intellectual Property Rights** | | | |
| Course Code | **BTC:304** | **OE-4** | No. of Theory Credits | **3** |
| Contact hours | **Lecture** | **42 hrs.** | Duration of ESA/Exam | **2 Hours** |
| | **Practical** | **-** | | |
| Formative Assessment Marks | 40 | | Summative Assessment Marks | 60 |

| | |
|---|---|
| **Course Pre-requisite(s): Semester I and II of composite Home Science.** | |
| **Course Outcomes (COs)**: At the end of the course the student should be able to:<br>1. Knowledge about need and scope of Intellectual property rights<br>2. Acquire knowledge about filing patents, process, and infringement<br>3. Knowledge about trademarks, industrial designs, and copyright | |
| **Content** | **42 Hrs** |
| **Unit–I** | **14 Hrs** |
| **Introduction to Intellectual property rights (IPR):**<br>Genesis and scope. Types of Intellectual property rights - Patent, Trademarks, Copyright, Design, Trade secret, Geographical indicators, Plant variety protection. National and International agencies – WIPO, World Trade Organization (WTO), Trade-Related Aspects of Intellectual Property Rights (TRIPS), General Agreement on Tariffs and Trade (GATT). | |
| **Unit -II** | **14 Hrs** |
| **Patenting, process, and infringement**<br>Basics of patents - Types of patents; Patentable and Non-Patentable inventions, Process and Product patent. Indian Patent Act 1970; Recent amendments; Patent Cooperation Treaty (PCT) and implications. Process of patenting. Types of patent applications: Provisional and complete specifications; Concept of "prior art", patent databases (USPTO, EPO, India). Financial assistance, schemes, and grants for patenting. Patent infringement- Case studies on patents (Basmati rice, Turmeric, Neem) | |
| **Unit -III -** | **14 Hrs** |
| **Trademarks, Copy right, industrial Designs** | |
| Trademarks- types, Purpose and function of trademarks, trademark registration, Protection of trademark. Copy right- Fundamentals of copyright law, Originality of material, rights of reproduction, industrial Designs: Protection, Kind of protection provided by industrial design. | |

## Pedagogy

| **Summative assessment = 40 marks theory paper, End semester Exam duration of exam 2 hours** | |
|---|---|
| **Formative Assessment Occasion / type** | **Weightage in Marks** |
| Assignment | 10 |

| | |
|---|---|
| Seminar | 10 |
| Case studies | 10 |
| Test | 10 |
| **Total** | **40 marks** |

## References


1 Manish Arora. 2007. Universal's Guide to Patents Law (English) 4th Edition) -Publisher: Universal Law Publishing House
2 Kalyan C. Kankanala. 2012. Fundamentals of Intellectual Property. Asia Law House
3 Ganguli, P. 2001. Intellectual Property Rights: Unleashing the knowledge economy. New Delhi: Tata McGraw-Hill Pub
4 World trade organization - http://www.wto.org
5 World Intellectual Property organization – www.wipo.int Office of the controller general of Patents, Design & Trademarks - www.ipindia.nic.in