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NPTEL : Proteomics: Principles and Techniques (Biotechnology)

Co-ordinators : Prof. Sanjeeva Srivastava

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Co-ordinators : Prof. Sanjeeva Srivastava

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NPTEL : Animal Physiology (Biotechnology)

Co-ordinators : Prof. Mainak Das

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NPTEL : Bio electricity (Biotechnology)

Co-ordinators : Prof. Mainak Das

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Lecture 13 - From Carbon dioxide to two Molecules of 3 - Phospho Glycerate by RUBISCO

Lecture 14 - RUBISCO enzyme

Lecture 15 - Photo respiration and Calvin Cycle

Lecture 16 - Efficiency Calculation of Photosynthesis Process

Lecture 17 - C3 and C4 Plant Structure and Photosynthesis Process

Lecture 18 - Biomass production System and their Categorization

Lecture 19 - Important Parameters for Selecting Biomass Crops

Lecture 20 - Factors Determining the Conversion Process - I

Lecture 21 - Factors Determining the Conversion Process - II

Lecture 22 - Factors Determining the Conversion Process - III

Lecture 23 - Conversion Technology

Lecture 24 - Conversion Process- (Combustion Process)

Lecture 25 - Pyrolysis Process

Lecture 26 - Classification of Pyrolysis

Lecture 27 - Bio Oil - (Solution for Thermal Instability and Corrosivity)

Lecture 28 - Spark Ignition Engine

Lecture 29 - Compression Ignition Engine

Lecture 30 - Carbonization - Graphene like material

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[Lecture 40 - Biological Root of Gasification and Summary of Course](#)

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Lecture 2 - Organization of living system

Lecture 3 - Homeostasis and system integration

Lecture 4 - Positive feedback loop in homeostasis

Lecture 5 - Chemical basis of organization of the body

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Lecture 7 - Integumentary system - II

Lecture 8 - Integumentary System - III

Lecture 9 - Bone and Cartilage - I

Lecture 10 - Bone and Cartilage - II

Lecture 11 - Introduction of muscle

Lecture 12 - Skeletal muscle formation

Lecture 13 - Anatomy of skeletal muscle

Lecture 14 - Contraction in muscle

Lecture 15 - Function of actin and myosin

Lecture 16 - Length tension relationship of skeletal muscle

Lecture 17 - Excitation contraction coupling with nervous system

Lecture 18 - Stretch reflex phenomena

Lecture 19 - Nervous system anatomy and signaling

Lecture 20 - Structure and circuit of neurons

Lecture 21 - Origin of biological cell

Lecture 22 - Excitability in cell

Lecture 23 - Ion transportation in the cell

Lecture 24 - Signal propagation in neurons

Lecture 25 - Neurotransmitter and action potential

Lecture 26 - Spatial temporal summation of signal in mesh neurons

Lecture 27 - Anatomy of Hippo-campus

Lecture 28 - Epilepsy and memory

Lecture 29 - Long term potentiation

Lecture 30 - Long term depression

Lecture 31 - Alzheimers disease

Lecture 32 - Parkinsons disease

Lecture 33 - Amyotrophic lateral sclerosis

Lecture 34 - Spinal cord injury

Lecture 35 - Glial cells

Lecture 36 - Stretch reflex arc circuit - I

Lecture 37 - Stretch reflex arc circuit - II

Lecture 38 - Neuro muscular junction

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Lecture 40 - Olfaction system

Lecture 41 - Anatomy of eye

Lecture 42 - Eye lens and cataract

Lecture 43 - Structure of Retina

Lecture 44 - Image formation and processing in eyes

Lecture 45 - Mechanism of photo processing by rods

Lecture 46 - Structure and Function of Heart - I

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Lecture 48 - Conduction circuit of heart

Lecture 49 - Contractile system and Conducting system

Lecture 50 - EKG and Comparison of action potential between pace make cell and work cell

Lecture 51 - Respiratory Physiology

Lecture 52 - Anatomy and physiology of Blood vessels - I

Lecture 53 - Anatomy and Physiology of Blood vessels - II

Lecture 54 - Anatomy and physiology of blood vessels - III

Lecture 55 - Anatomy and physiology of blood vessels - IV

Lecture 56 - Endocrine system - I

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Lecture 58 - Blood

Lecture 59 - Kidney and immune system

Lecture 60 - Reproductive system

- Lecture 1 - Introduction of Cell Culture Technology
- Lecture 2 - Philosophy and complexity in cell culture
- Lecture 3 - To grow the cell outside the body
- Lecture 4 - Cell cycle concept
- Lecture 5 - Dividing cells
- Lecture 6 - Biology of cell culture
- Lecture 7 - Layout(s) and design(s) of cell culture facility
- Lecture 8 - Precautions during designing the lab layout - I
- Lecture 9 - Precautions during designing the lab layout - II
- Lecture 10 - Precautions during designing the lab layout - III
- Lecture 11 - State of the art facility in cell culture lab - I
- Lecture 12 - State of the art facility in cell culture lab - II
- Lecture 13 - Specialized facility in cell culture lab
- Lecture 14 - Interaction of cell and glass/polycarbonate surface - I
- Lecture 15 - Interaction of cell and glass/polycarbonate surface - II
- Lecture 16 - Poly D lysine deposition
- Lecture 17 - Surface chemical analysis
- Lecture 18 - Cell growth process
- Lecture 19 - Cell surface interface
- Lecture 20 - Cell culture substrate patterning
- Lecture 21 - Introduction of define system
- Lecture 22 - Mechanical dissociation of hippocampal tissue
- Lecture 23 - Rules for mechanical dissociation of tissue
- Lecture 24 - Drum molecule testing
- Lecture 25 - Adult hippocampal neuron dissociation
- Lecture 26 - Cell separation and In vitro myelination cell culture mode - I
- Lecture 27 - Cell separation and In vitro myelination cell culture mode - II
- Lecture 28 - Cell separation and In vitro myelination cell culture mode - III
- Lecture 29 - Cell Separation and In vitro myelination cell culture mode - IV
- Lecture 30 - Cell separation and in vitro myelination cell culture mode - V
- Lecture 31 - Fluorescent assisted cell sorting

[Lecture 32 - Condition for regenerated cells](#)

[Lecture 33 - Introduction of skeletal muscle cell culture](#)

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[Lecture 38 - Advance cell culture modules - III](#)

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Lecture 2 - Recap of formulae: area and volume

Lecture 3 - Recap of trigonometry

Lecture 4 - Measurement of central tendency and dispersion

Lecture 5 - Graphical presentation of data

Lecture 6 - Shape of a tree: Form and Taper

Lecture 7 - Metzgers theory

Lecture 8 - Form factor and form quotients

Lecture 9 - Taper equations

Lecture 10 - Making the cuts

Lecture 11 - Cross-section of a tree

Lecture 12 - Where to measure the diameter

Lecture 13 - Callipers - Usages and Issues

Lecture 14 - Tape: Usage and issue

Lecture 15 - Measurement of bark and growth rings

Lecture 16 - Tree height: Direct and indirect measurements

Lecture 17 - Method of similar triangles: Shadow and sticks

Lecture 18 - Distance measurements: foot, tape and rangefinder

Lecture 19 - Angular measurement

Lecture 20 - LIDAR

Lecture 21 - Canopy attributes - Part I

Lecture 22 - Canopy attributes - Part II

Lecture 23 - Canopy attributes - Part III

Lecture 24 - Canopy cover and closure

Lecture 25 - Photogrammetry

Lecture 26 - Basal area of a tree and stand

Lecture 27 - Stand basal area, crop diameter and crop age

Lecture 28 - Point sampling - I

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Lecture 30 - Number density and sample calculations

Lecture 31 - Volume: Direct calculations through sections

[Lecture 32 - The Quarter - girth formula](#)

[Lecture 33 - Volume computations in the field](#)

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[Lecture 35 - Forest Sampling](#)

[Lecture 36 - Density and mass measurement](#)

[Lecture 37 - Normalized difference vegetation Index \(NDVI\)](#)

[Lecture 38 - Site quality](#)

[Lecture 39 - Recap - I](#)

[Lecture 40 - Recap - II](#)

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- Lecture 2 - Where do research ideas come from?
- Lecture 3 - Inductive vs Deductive Reasoning
- Lecture 4 - Scientific Hypothesis
- Lecture 5 - Scientific Hypothesis (Continued...)
- Lecture 6 - Testing the Hypothesis
- Lecture 7 - Introduction to Scientific Writing
- Lecture 8 - Writing an Abstract
- Lecture 9 - Title for a Research Paper
- Lecture 10 - Title and Keywords
- Lecture 11 - Mileposts for the Article Writing
- Lecture 12 - Writing the Methods Section
- Lecture 13 - Writing the Results Section
- Lecture 14 - Writing Results Section (Continued...)
- Lecture 15 - How to Prepare Figures
- Lecture 16 - How to Prepare Schematics
- Lecture 17 - How to write Introduction and Discussion Sections
- Lecture 18 - Finalizing the Manuscript and Ethics in Research
- Lecture 19 - Writing a Research Proposal and Preparing for a Presentation
- Lecture 20 - Tutorial Session : Oral communication

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Lecture 2 - Basic Concepts - II

Lecture 3 - Key Terms

Lecture 4 - Galvanic Cells - I

Lecture 5 - Galvanic Cells - II

Lecture 6 - Salt Bridge

Lecture 7 - Standard Potentials - I

Lecture 8 - Standard Potentials - II

Lecture 9 - Standard Potentials - III

Lecture 10 - Nernst Equation

Lecture 11 - Relationship between Standard electrode potential (E°) and Equilibrium constant (K)

Lecture 12 - Cell as chemical probe and Biochemist's formal potential

Lecture 13 - Concept of Concentration Cell - I

Lecture 14 - Concept of Concentration Cell - II

Lecture 15 - Bio-electrochemistry of excitable cells (nerve cells)

Lecture 16 - Types of electrodes

Lecture 17 - Critical care profile and metal electrode

Lecture 18 - pH measurement: Ion selective electrode

Lecture 19 - Redox indicators amperometry: glucose, oxygen sensors

Lecture 20 - Redox proteins, Metalloproteins and Cyclic Voltammetry

Lecture 1 - Bioenergetics of Life Processes: An Overview

Lecture 2 - Bioenergetics: Origin of life

Lecture 3 - Iron-Sulfur world

Lecture 4 - Evolution of complex cellular membranes

Lecture 5 - Charge transfer across membrane: Key terms

Lecture 6 - Biological order and energy - I

Lecture 7 - Biological order and energy - II

Lecture 8 - Biological order and energy - III

Lecture 9 - Summary of thermodynamical parameters - I

Lecture 10 - Summary of thermodynamical parameters - II

Lecture 11 - Photosynthesis - I

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Lecture 13 - Photosynthesis - III

Lecture 14 - Photosynthesis - IV

Lecture 15 - Photosynthesis - V

Lecture 16 - Photosynthesis - VI

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Lecture 18 - Photosynthesis - VIII

Lecture 19 - ATP Synthesis

Lecture 20 - Mitochondria and Chemiosmotic hypothesis

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Lecture 2 - A closer look at Biodiversity

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Lecture 6 - Basics of Sampling

Lecture 7 - Distance Sampling - I

Lecture 8 - Distance Sampling - II

Lecture 9 - Radio-telemetry

Lecture 10 - Behavioural monitoring

Lecture 11 - What is a habitat

Lecture 12 - Habitat degradation, loss, fragmentation and displacement

Lecture 13 - Reserve selection and design

Lecture 14 - Habitat management and improvement

Lecture 15 - Some terminologies

Lecture 16 - Some common wildlife diseases

Lecture 17 - Principles of disease management

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Lecture 19 - Mechanical capture

Lecture 20 - Chemical capture

Lecture 21 - Capture myopathy

Lecture 22 - Care of immobilised animal

Lecture 23 - Legal aspects of capture and restraint

Lecture 24 - Other topics in capture and restraint

Lecture 25 - Preliminaries and introduction to genetics

Lecture 26 - Population genetics

Lecture 27 - Chromosomal and genetic disorders, inbreeding

Lecture 28 - Population viability analysis

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[Lecture 38 - Revision - I](#)

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Lecture 2 - What is Nanotechnology

Lecture 3 - An outline

Lecture 4 - Agriculture: Natural versus Modern

Lecture 5 - Modern Agriculture: controlled or out of control

Lecture 6 - A Restart:Utilising Our Discoveries

Lecture 7 - Classifying nanomaterials Based on Shape and Geometry

Lecture 8 - Classifying Nanomaterials Based on Chemical Nature

Lecture 9 - Physical Approaches to Nanomaterial Synthesis

Lecture 10 - Biological and Chemical Approaches to Nanomaterial Synthesis

Lecture 11 - Detailed Physical Techniques - I

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Lecture 13 - Detailed Chemical Techniques

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Lecture 15 - Basic Characterisation Techniques of Nanomaterials

Lecture 16 - Characterisation techniques for physical and chemical surface properties of a material

Lecture 17 - Nanomaterials in Agriculture

Lecture 18 - Iron pyrite and seed pre-treatment

Lecture 19 - nano-Pyrite and its lab trial with chickpea

Lecture 20 - nano-Pyrite field trial with spinach and its mechanistic details

Lecture 21 - Mechanistic details of the action of Pyrite nano-particle

Lecture 22 - Application of Pyrite nano-particle in different crops

Lecture 23 - Application of different nano-particles in Agriculture - I

Lecture 24 - Benefits of nanoparticles in Agriculture

Lecture 25 - Nanotechnology in animal production

Lecture 26 - Antioxidant nanomaterial in animal production - I

Lecture 27 - Antioxidant nanomaterial in animal production - II

Lecture 28 - Antioxidant nanomaterial in animal production - III

Lecture 29 - Antioxidant nanomaterial in skeletal muscle development - I

Lecture 30 - Antioxidant nanomaterial in skeletal muscle development - II

Lecture 31 - Skeletal muscle development and nanomaterial intervention

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[Lecture 33 - Summarising role of nanomaterials in animal production](#)

[Lecture 34 - Nanomaterials in food processing and preservation - I](#)

[Lecture 35 - Nanomaterials in food processing and preservation - II](#)

[Lecture 36 - Multifunctionality of nanomaterial: water purification, waste disposal, and energy](#)

[Lecture 37 - Futuristic multifunctional, sustainable and green nanomaterial](#)

[Lecture 38 - Case study of Titanium dioxide - I](#)

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[Lecture 40 - The future: evolving nano world](#)

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- Lecture 2 - A historical overview of Ecology
- Lecture 3 - Ecology and Evolution
- Lecture 4 - The levels of organisation
- Lecture 5 - Species abundance and composition: Biodiversity
- Lecture 6 - Biodiversity - II
- Lecture 7 - Positive Interactions
- Lecture 8 - Negative Interactions
- Lecture 9 - Study of Behaviour and Behavioral Ecology
- Lecture 10 - Food chains, Food webs and trophic levels
- Lecture 11 - Primary Production
- Lecture 12 - Nutrient Cycles
- Lecture 13 - Population parameters and demographic techniques
- Lecture 14 - Population growth and regulation
- Lecture 15 - Population studies and applications
- Lecture 16 - Community nature and parameters
- Lecture 17 - Community changes and ecological succession
- Lecture 18 - Community organisation
- Lecture 19 - Biogeography: Analysis of geographic distributions
- Lecture 20 - Why are things where they are?
- Lecture 21 - Some push and pull factors in greater detail
- Lecture 22 - Threats to species
- Lecture 23 - In-situ conservation
- Lecture 24 - Ex-situ conservation
- Lecture 25 - Introduction and impacts
- Lecture 26 - Human population growth and food requirements
- Lecture 27 - Sustainable development
- Lecture 28 - Oil spills
- Lecture 29 - Plastic and biodiversity
- Lecture 30 - Impacts of climate change
- Lecture 31 - Optimum yield problem

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Lecture 2 - Classification of forests

Lecture 3 - Value of forests

Lecture 4 - What is Silviculture ?

Lecture 5 - Plant Growth Factors

Lecture 6 - Ecological Succession

Lecture 7 - Soil and Soil Profile

Lecture 8 - Major Soil Types

Lecture 9 - Nutrient Cycles

Lecture 10 - Tree Form

Lecture 11 - Measurement of Tree attributes - I

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Lecture 13 - Classical Tools

Lecture 14 - Photogrammetry

Lecture 15 - LiDAR

Lecture 16 - Kinds of Threats

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Lecture 19 - Regeneration

Lecture 20 - Silvicultural Systems

Lecture 21 - Clear Felling System

Lecture 22 - Shelterwood System - I

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Lecture 24 - Selection System and Irregular Shelterwood System

Lecture 25 - Logging and Processing

Lecture 26 - Growing Stock and Increment

Lecture 27 - Yield and Sustained Yield

Lecture 28 - Seed Collection and Treatment

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Lecture 2 - Making Decisions - II and Interactions - I

Lecture 3 - Intecractions-II and Working of the Economy

Lecture 4 - Conservation in the Anthropocene

Lecture 5 - Human population growth and food requirements

Lecture 6 - Unsustainable development

Lecture 7 - Climate change

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Lecture 10 - Push and pull factors: Localisation of species

Lecture 11 - Threats to species

Lecture 12 - Developmental Hazards and Ecotoxicology

Lecture 13 - Need to understand controls

Lecture 14 - Thinking as an Economist

Lecture 15 - Interdependence and gains from trade

Lecture 16 - Demand and supply

Lecture 17 - Elasticity

Lecture 18 - Government policy

Lecture 19 - Surplus and market efficiency

Lecture 20 - Market Efficiency and Cost of Taxation

Lecture 21 - International Trade

Lecture 22 - Externalities

Lecture 23 - Public goods and common resources

Lecture 24 - The design of the tax system

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- Lecture 2 - Geography and conservation
- Lecture 3 - Biogeography
- Lecture 4 - Origin and evolution of the earth
- Lecture 5 - Structure of the earth
- Lecture 6 - Features of the earth
- Lecture 7 - Rocks and minerals
- Lecture 8 - Geomorphology and processes
- Lecture 9 - Evolution of landforms
- Lecture 10 - Structure and composition
- Lecture 11 - Atmospheric circulation and weather
- Lecture 12 - Climate and climate change
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- Lecture 14 - Oceans and water movement
- Lecture 15 - Hydrological cycle
- Lecture 16 - Structure and physiography of India
- Lecture 17 - Climate and habitats of India
- Lecture 18 - Drainage systems
- Lecture 19 - Soil
- Lecture 20 - Life on Earth
- Lecture 21 - Biodiversity
- Lecture 22 - Threats to species
- Lecture 23 - Ex-situ and in-situ conservation
- Lecture 24 - Benefits from conservation
- Lecture 25 - Population and population growth - I
- Lecture 26 - Population and population growth - II
- Lecture 27 - Human development and sustainable development
- Lecture 28 - Resources and Conservation
- Lecture 29 - Water Resources
- Lecture 30 - Mineral and Energy Resources
- Lecture 31 - Economic Geography and Conservation

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Lecture 2 - Allelopathic Interferences and Case Study

Lecture 3 - U.N.W.H.I.M.A.A.I

Lecture 4 - Livestock Biosecurity and its Preventive Measures

Lecture 5 - Bioterrorist Agents and Modes of Attack

Lecture 6 - History of Bioterrorism : Black Death

Lecture 7 - Bioweapons Used in Warfare and Biological Weapon and Toxin Convention (BWC)

Lecture 8 - Ebola and Marburg Virology in context to Biosensor Development

Lecture 9 - Bacillus Anthrax Bacteriology in context to Biosensor Development

Lecture 10 - Anthrax Types and Preventive Measures

Lecture 11 - Unraveling the Ingenious Bacillus Anthracis Attack and Case Study for Anthrax Sensor

Lecture 12 - Components for Designing Biosensors

Lecture 13 - Principle of Quartz Crystal Microbalance (QCM)

Lecture 14 - Sauerbrey Equation and QCM-D

Lecture 15 - Principle, Setup and Applications of E-QCM-D

Lecture 16 - Use of AFM Tool for Sensing - Part 1

Lecture 17 - AFM for Bio-sensing - Part 2

Lecture 18 - AFM and Recap Raman and IR Spectroscopy

Lecture 19 - Applications of Raman

Lecture 20 - AFM Cum Electrochemistry Workstation

Lecture 21 - Monoclonal Antibody

Lecture 22 - Monoclonal Antibody Production

Lecture 23 - MAB Production Via Hybridomas

Lecture 24 - Recognition Elements scFvs

Lecture 25 - SPR : Surface Plasmon Resonance

Lecture 26 - Design and Fabrication of Lateral-Flow Immunoassays

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Lecture 11 - Enzymatic reaction Kinetics

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Lecture 14 - Immobilization techniques

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Lecture 16 - Life cycle of the microbial cell, Microbial growth kinetics, product formation and substrate degradation

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Lecture 20 - Flow diagrams and pumps and valves used in fermentation industries

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- Lecture 36 - Lactic acid production
- Lecture 37 - Lactic acid production (Continued...)
- Lecture 38 - Glutamic acid production
- Lecture 39 - Penicillin production
- Lecture 40 - Penicillin production (Continued...)
- Lecture 41 - Cephalosporin production
- Lecture 42 - Streptomycin production
- Lecture 43 - Baker's yeast fermentation
- Lecture 44 - Baker's yeast fermentation (Continued...)
- Lecture 45 - Fodder yeast production
- Lecture 46 - Spirulina production
- Lecture 47 - Alpha amylase production
- Lecture 48 - High fructose corn syrup production
- Lecture 49 - Metal leaching
- Lecture 50 - Cheese production
- Lecture 51 - Cheese production (Continued...)
- Lecture 52 - Biodiesel production
- Lecture 53 - Butanol production
- Lecture 54 - Biofertilizer
- Lecture 55 - Aerobic effluent treatment process
- Lecture 56 - Aerobic effluent treatment process (Continued...)
- Lecture 57 - Anaerobic effluent treatment process: Biomethanation process
- Lecture 58 - Anaerobic effluent treatment process: Biomethanation process (Continued...)
- Lecture 59 - 10 m³ Pilot Plant operation for Biohydrogen production
- Lecture 60 - Summary and conclusion

Lecture 1 - Introduction

Lecture 2 - Microbiology - I

Lecture 3 - Microbiology - II

Lecture 4 - Fundamentals of Biochemistry

Lecture 5 - Bioproducts and their market values

Lecture 6 - Stoichiometry of Biochemical Processes - I

Lecture 7 - Stoichiometry of Biochemical Processes - II

Lecture 8 - Stoichiometry of Biochemical Processes - III

Lecture 9 - Reaction Thermodynamics - I

Lecture 10 - Reaction Thermodynamics - II

Lecture 11 - Kinetics of homogeneous chemical reactions - I

Lecture 12 - Kinetics of homogeneous chemical reactions - II

Lecture 13 - Kinetics of homogeneous chemical reactions - III

Lecture 14 - Kinetics of homogeneous chemical reactions - IV

Lecture 15 - Kinetics of homogeneous chemical reactions - V

Lecture 16 - Different types of reactors

Lecture 17 - Reactor analysis - I

Lecture 18 - Reactor analysis - II

Lecture 19 - Reactor analysis - III

Lecture 20 - Reactor analysis - IV

Lecture 21 - Kinetics of enzyme catalyzed reactions using free enzymes - I

Lecture 22 - Kinetics of enzyme catalyzed reactions using free enzymes - II

Lecture 23 - Kinetics of enzyme catalyzed reactions using free enzymes - III

Lecture 24 - Kinetics of enzyme catalyzed reactions using free enzymes - IV

Lecture 25 - Kinetics of enzyme catalyzed reactions using free enzymes - V

Lecture 26 - Kinetics of enzyme catalyzed reactions using free enzymes - VI

Lecture 27 - Immobilization of Enzymes - I

Lecture 28 - Immobilization of Enzymes - II

Lecture 29 - Kinetics of enzyme catalyzed reactions using immobilized enzymes - I

Lecture 30 - Kinetics of enzyme catalyzed reactions using immobilized enzymes - II

Lecture 31 - Kinetics of substrate utilization, product formation and biomass production of microbial cells - I

- Lecture 32 - Kinetics of substrate utilization, product formation and biomass production of microbial cells - II
- Lecture 33 - Kinetics of substrate utilization, product formation and biomass production of microbial cells - III
- Lecture 34 - Kinetics of substrate utilization, product formation and biomass production of microbial cells - IV
- Lecture 35 - Kinetics of substrate utilization, product formation and biomass production of microbial cells - V
- Lecture 36 - Kinetics of substrate utilization, product formation and biomass production of microbial cells - VI
- Lecture 37 - Kinetics of substrate utilization, product formation and biomass production of microbial cells - VII
- Lecture 38 - Kinetics of substrate utilization, product formation and biomass production of microbial cells - VIII
- Lecture 39 - Kinetics of substrate utilization, product formation and biomass production of microbial cells - IX
- Lecture 40 - Kinetics of substrate utilization, product formation and biomass production of microbial cells - X
- Lecture 41 - Kinetics of substrate utilization, product formation and biomass production of microbial cells - XI
- Lecture 42 - Design and analysis of activated sludge process - I
- Lecture 43 - Design and analysis of activated sludge process - II
- Lecture 44 - Design and analysis of anaerobic digestion process
- Lecture 45 - Scale up of Bioreactor - I
- Lecture 46 - Scale up of Bioreactor - II
- Lecture 47 - Transport Phenomenon in Bioprocess - I
- Lecture 48 - Transport Phenomenon in Bioprocess - II
- Lecture 49 - Transport Phenomenon in Bioprocess - III
- Lecture 50 - Transport Phenomenon in Bioprocess - IV
- Lecture 51 - Air sterilization - I
- Lecture 52 - Air sterilization - II
- Lecture 53 - Medium sterilization - I
- Lecture 54 - Medium sterilization - II
- Lecture 55 - Operation of industrial fermenter and material analysis
- Lecture 56 - Process control of the biochemical processes
- Lecture 57 - Downstream processing - I
- Lecture 58 - Downstream processing - II
- Lecture 59 - Economic analysis of the biochemical processes
- Lecture 60 - Summary and Conclusion

Lecture 1 - Introduction to Biomechanics

Lecture 2 - Introduction to Biomechanics (Continued...)

Lecture 3 - Engineers' guide to the cell

Lecture 4 - Fluidics in living systems and mechanobiology

Lecture 5 - Pressure Driven Flows

Lecture 6 - Surface tension driven flows

Lecture 7 - Modulating surface tension

Lecture 8 - Lab on a CD

Lecture 9 - Introduction to Electrokinetics - Part I

Lecture 10 - Introduction to Electrokinetics - Part II

Lecture 11 - Microfluidic cell culture - Part I

Lecture 12 - Microfluidic cell culture - Part II

Lecture 13 - On-chip cellular assay techniques - Part I

Lecture 14 - On-chip cellular assay techniques - Part II

Lecture 15 - Microfluidics for understanding biology

Lecture 16 - Organ-on-a-chip

Lecture 17 - Lab-on-a-chip for genetic analysis

Lecture 18 - Microfluidic technology for monoclonal antibody production

Lecture 19 - Microfluidics for Healthcare

Lecture 20 - Microfluidics for Healthcare

NPTEL : NOC:Immunology (Biotechnology)

Co-ordinators : Prof. Agneyo Ganguly, Prof. S. K Ghosh

Lecture 1 - Basic Concepts in Immunology

Lecture 2 - Basic Concepts in Immunology (Continued...)

Lecture 3 - Basic Concepts in Immunology (Continued...)

Lecture 4 - Basic Concepts in Immunology (Continued...)

Lecture 5 - Basic Concepts in Immunology (Continued...)

Lecture 6 - Innate Immunity

Lecture 7 - Inflammatory Response

Lecture 8 - Adaptive Immunity

Lecture 9 - Adaptive Immunity (Humoral)

Lecture 10 - Effector Mechanisms

Lecture 11 - Structure of antibody

Lecture 12 - Structure of antibody and T-Cell Receptors

Lecture 13 - Generation of diversity (GOD) of lymphocyte antigen receptors (Continued...)

Lecture 14 - Generation of diversity (GOD) of lymphocyte antigen receptors (Continued...)

Lecture 15 - Generation of diversity (GOD) of lymphocyte antigen receptors (Continued...)

Lecture 16 - Generation of diversity (GOD) of lymphocyte antigen receptors (Continued...)

Lecture 17 - Structural variation in immunoglobulin constant regions and isotype switching

Lecture 18 - Structural variation in immunoglobulin constant regions and isotype switching (Continued...)

Lecture 19 - Antigen recognition by T cell : major histocompatibility complex

Lecture 20 - Antigen recognition by T cell : major histocompatibility complex (Continued...)

Lecture 21 - Antigen Recognition by T cell : Major Histocompatibility Complex (Continued...)

Lecture 22 - Antigen Recognition by T cell : Major Histocompatibility Complex (Continued...)

Lecture 23 - The Generation of \hat{I}^{\pm} : \hat{I}^2 T - Cell receptor ligands

Lecture 24 - The Generation of \hat{I}^{\pm} : \hat{I}^2 T - Cell receptor ligands (Continued...)

Lecture 25 - Summary of Immune system

Lecture 26 - Tools and Techniques

Lecture 27 - Tools and Techniques (Continued...)

Lecture 28 - Tools and Techniques (Continued...)

Lecture 29 - Tools and Techniques (Continued...)

Lecture 30 - Flow Cytometry

Lecture 31 - Development of T Lymphocytes

- [Lecture 32 - Development of T Lymphocytes \(Continued...\)](#)
- [Lecture 33 - Development of T Lymphocytes \(Continued...\)](#)
- [Lecture 34 - T Cell Mediated Immunity](#)
- [Lecture 35 - T Cell Mediated Immunity \(Continued...\)](#)
- [Lecture 36 - B-Cell Maturation - I](#)
- [Lecture 37 - B-Cell Maturation - II](#)
- [Lecture 38 - B-Cell Activation](#)
- [Lecture 39 - B-Cell Activation and Differentiation](#)
- [Lecture 40 - Effector T - Cells](#)
- [Lecture 41 - Complement System Overview](#)
- [Lecture 42 - Complement System Overview \(Continued...\)](#)
- [Lecture 43 - Complement Biological Consequences](#)
- [Lecture 44 - Complement Biological Consequences \(Continued...\)](#)
- [Lecture 45 - Cytokines : Introduction](#)
- [Lecture 46 - Cytokines : Introduction \(Continued...\)](#)
- [Lecture 47 - Cytokines in Innate and Adaptive Immunity](#)
- [Lecture 48 - Interferons](#)
- [Lecture 49 - Hypersensitivity](#)
- [Lecture 50 - Hypersensitivity \(Continued...\)](#)
- [Lecture 51 - Autoimmunity](#)
- [Lecture 52 - Autoimmunity \(Continued...\)](#)
- [Lecture 53 - Autoimmunity \(Continued...\)](#)
- [Lecture 54 - Transplantation or Graft vs. Host Reaction](#)
- [Lecture 55 - Transplantation or Graft vs. Host Reaction \(Continued...\)](#)
- [Lecture 56 - Active and Passive Immunity and Vaccination](#)
- [Lecture 57 - Active and Passive Immunity and Vaccination \(Continued...\)](#)
- [Lecture 58 - Active and Passive Immunity and Vaccination \(Continued...\)](#)
- [Lecture 59 - Monoclonal Antibody](#)
- [Lecture 60 - Monoclonal Antibody \(Continued...\)](#)

- Lecture 1 - Introduction to Metabolic Engineering
- Lecture 2 - Essence of Metabolic Engineering - Part A
- Lecture 3 - Essence of Metabolic Engineering - Part B
- Lecture 4 - Essence of Metabolic Engineering - Part C
- Lecture 5 - Essence of Metabolic Engineering - Part D
- Lecture 6 - Review of Cellular Metabolism - Part A
- Lecture 7 - Review of Cellular Metabolism - Part B
- Lecture 8 - Review of Cellular Metabolism - Part C
- Lecture 9 - Review of Cellular Metabolism - Part D
- Lecture 10 - Review of Cellular Metabolism - Part E
- Lecture 11 - Review of Cellular Metabolism - Part F
- Lecture 12 - Introduction to Metabolic Networks
- Lecture 13 - Introduction to Systems Biology
- Lecture 14 - Regulatory Networks
- Lecture 15 - Reconstruction of Metabolic Networks
- Lecture 16 - The Stoichiometric Matrix: Representing Reconstructed Network Mathematically
- Lecture 17 - Flux Balance Analysis (FBA)
- Lecture 18 - Flux Variability Analysis (FVA) and Flux Coupling (FC)
- Lecture 19 - Dynamic Flux Balance Analysis (DFBA) and Gene Deletion Algorithms
- Lecture 20 - Optimization in MATLAB
- Lecture 21 - Robustness Analysis and Phenotypic Phase Planes
- Lecture 22 - Flux Sampling, Optknock and Optstrain
- Lecture 23 - Extreme Pathways and Elementary modes
- Lecture 24 - ^{13}C Metabolic Flux Analysis (^{13}C MFA)
- Lecture 25 - ^{13}C Metabolic Flux Analysis (^{13}C MFA)
- Lecture 26 - Advancement in ^{13}C Metabolic Flux Analysis
- Lecture 27 - E.coli core metabolic Network Optimization in MATLAB
- Lecture 28 - Application of Metabolic Flux Analysis
- Lecture 29 - CRISPR-Cas system and its application in metabolic engineering - Part I
- Lecture 30 - CRISPR-Cas system and its application in metabolic engineering - Part II
- Lecture 31 - CRISPR-Cas system and its application in metabolic engineering - Part III

[Lecture 32 - CRISPR-Cas system and its application in metabolic engineering - Part IV](#)

[Lecture 33 - Examples of pathway manipulations by metabolic engineering - Biofuels](#)

[Lecture 34 - Metabolic engineering for biofuel production - Part A](#)

[Lecture 35 - Metabolic engineering for biofuel production - Part B](#)

[Lecture 36 - Metabolic engineering for biofuel production - Part C](#)

[Lecture 37 - Applications of metabolic engineering in amino acids production](#)

Lecture 1 - Acids, Bases and Salts - Part I

Lecture 2 - Acids, Bases and Salts - Part II

Lecture 3 - Acids, Bases and Salts - Part III

Lecture 4 - Acids, Bases and Salts - Part IV

Lecture 5 - Acids, Bases and Salts - Part V

Lecture 6 - Chemical Equilibrium - I

Lecture 7 - Chemical Equilibrium - II

Lecture 8 - Chemical Equilibrium - III

Lecture 9 - Chemical Equilibrium - IV

Lecture 10 - Chemical Equilibrium - V

Lecture 11 - Chemical Kinetics - I

Lecture 12 - Chemical Kinetics - II

Lecture 13 - Chemical Kinetics - III

Lecture 14 - Chemical Kinetics - IV

Lecture 15 - Chemical Kinetics - V

Lecture 16 - Chemical Kinetics - Reaction Mechanism - Part A

Lecture 17 - Chemical Kinetics - Reaction Mechanism - Part B

Lecture 18 - Chemical Kinetics - Catalysis - Part A

Lecture 19 - Chemical Kinetics - Catalysis - Part B

Lecture 20 - Chemical Kinetics - Catalysis - Part C

Lecture 21 - Nitrogen chemistry - Part A

Lecture 22 - Nitrogen chemistry - Part B

Lecture 23 - Chlorine chemistry and disinfection - Part A

Lecture 24 - Chlorine chemistry and disinfection - Part B

Lecture 25 - Chlorine chemistry and disinfection - Part C

Lecture 26 - Radioactivity - Part A

Lecture 27 - Radioactivity - Part B

Lecture 28 - Radioactivity - Part C

Lecture 29 - Radioactivity - Part D

Lecture 30 - Radioactivity - Part E

Lecture 31 - Introduction - I

[Lecture 32 - Introduction - II](#)

[Lecture 33 - Overview of microbial life - I](#)

[Lecture 34 - Overview of microbial life - II](#)

[Lecture 35 - Overview of microbial life - III](#)

[Lecture 36 - Cell chemistry - I](#)

[Lecture 37 - Cell chemistry - II](#)

[Lecture 38 - Cell Biology - I](#)

[Lecture 39 - Cell Biology - II](#)

[Lecture 40 - Cell Biology - III](#)

[Lecture 41 - Cell Biology - IV](#)

[Lecture 42 - Microscopy - I](#)

[Lecture 43 - Microscopy - II](#)

[Lecture 44 - Microbial Metabolism - I](#)

[Lecture 45 - Microbial Metabolism - II](#)

[Lecture 46 - Microbial Metabolism - III](#)

[Lecture 47 - Xenobiotics - I](#)

[Lecture 48 - Xenobiotics - II](#)

[Lecture 49 - Microbial Growth - I](#)

[Lecture 50 - Microbial Growth - II](#)

[Lecture 51 - Microbial Growth - III](#)

[Lecture 52 - Microbial Growth and Control - I](#)

[Lecture 53 - Microbial Growth and Control - II](#)

[Lecture 54 - Pathogens and diseases - I](#)

[Lecture 55 - Pathogens and diseases - II](#)

[Lecture 56 - Metabolic Diversity - I](#)

[Lecture 57 - Metabolic Diversity - II](#)

[Lecture 58 - Metabolic Diversity - III](#)

[Lecture 59 - Metabolic Diversity - IV](#)

[Lecture 60 - Metabolic Diversity - V](#)

[Lecture 61 - Metabolic Diversity - VI](#)

[Lecture 62 - Biogeochemical cycles - I](#)

[Lecture 63 - Biogeochemical cycles - II](#)

NPTEL : NOC:Environmental Biotechnology (Biotechnology)

Co-ordinators : Prof. Pinaki Sar

Lecture 1 - Introduction of Environmental Biotechnology, Scope and applications of the subject

Lecture 2 - Introduction of Environmental Biotechnology, Scope and applications of the subject

Lecture 3 - Ecosystem : Basic concepts of structure and function

Lecture 4 - Ecosystem : Basic concepts of structure and function (Continued...)

Lecture 5 - Microbial Ecology

Lecture 6 - Microbial Ecology (Continued...)

Lecture 7 - Microbial Ecosystems and Biogeochemical Cycling

Lecture 8 - Biogeochemical Cycles

Lecture 9 - Microbial ecology and environmental biotechnology - Part A

Lecture 10 - Microbial ecology and environmental biotechnology - Part B

Lecture 11 - Microbial ecology and environmental biotechnology - Part B (Continued...)

Lecture 12 - Microbial ecology and environmental biotechnology - Part B (Continued...)

Lecture 13 - Microbial ecology and environmental biotechnology - Part C

Lecture 14 - Microbial ecology and environmental biotechnology - Part C (Continued...)

Lecture 15 - Microbial ecology and environmental biotechnology - Part C (Continued...)

Lecture 16 - Microbial Ecology and Environmental Biotechnology - Part C (Continued...)

Lecture 17 - Microbiology of Environmental Engineering System

Lecture 18 - Microbiology of Environmental Engineering System

Lecture 19 - Microbiology of Environmental Engineering System

Lecture 20 - Microbiology of Environmental Engineering System (Continued...)

Lecture 21 - Physiological Ecology and Resource Exploitation by Microorganisms

Lecture 22 - Physiological ecology and Resource Exploitation by Microorganisms (Continued...)

Lecture 23 - Physiological ecology and Resource Exploitation by Microorganisms (Continued...)

Lecture 24 - Physiological ecology and Resource Exploitation by Microorganisms (Continued...)

Lecture 25 - Methods in Microbial Ecology with Relevance to Environmental Biotechnology

Lecture 26 - Methods in Microbial Ecology with Relevance to Environmental Biotechnology (Continued...)

Lecture 27 - Methods in Microbial Ecology with Relevance to Environmental Biotechnology (Continued...)

Lecture 28 - Methods in Microbial Ecology with Relevance to Environmental Biotechnology (Continued...)

Lecture 29 - Methods in Microbial Ecology with Relevance to Environmental Biotechnology (Continued...)

Lecture 30 - Methods in Microbial Ecology with Relevance to Environmental Biotechnology (Continued...)

Lecture 31 - Methods in Microbial Ecology with Relevance to Environmental Biotechnology (Continued...)

[Lecture 32 - Methods in Microbial Ecology with Relevance to Environmental Biotechnology \(Continued...\)](#)

[Lecture 33 - Methods in Microbial Ecology with Relevance to Environmental Biotechnology \(Continued...\)](#)

[Lecture 34 - Methods in Microbial Ecology with Relevance to Environmental Biotechnology \(Continued...\)](#)

[Lecture 35 - Bioremediation](#)

[Lecture 36 - Bioremediation \(Continued...\)](#)

[Lecture 37 - Bioremediation \(Continued...\)](#)

[Lecture 38 - Bioremediation \(Continued...\)](#)

[Lecture 39 - Biodegradation](#)

[Lecture 40 - Biodegradation](#)

[Lecture 41 - Biodegradation \(Continued...\)](#)

[Lecture 42 - Microbial Interactions with Heavy Metals and Metalloids](#)

[Lecture 43 - Microbial Interactions with Heavy Metals and Metalloids - Bioremediation](#)

[Lecture 44 - Biohydrometallurgy](#)

[Lecture 45 - Enhanced biological phosphorus removal process \(EBPR\)](#)

[Lecture 46 - Biological nitrogen removal](#)

[Lecture 47 - Microbially Enhanced Oil Recovery \(MEOR\)](#)

[Lecture 48 - Emerging Pollutants](#)

[Lecture 49 - Carbon capture, Carbon Sequestration and Utilization](#)

[Lecture 50 - Bioenergy and Environmental Biotechnology](#)

[Lecture 51 - Bioremediation case studies](#)

[Lecture 52 - Bioremediation case studies \(Continued...\)](#)

Lecture 1 - Amino Acids - I

Lecture 2 - Amino Acids - II

Lecture 3 - Amino Acids - III

Lecture 4 - The Peptide Bond

Lecture 5 - Discussion Class

Lecture 6 - Primary Structure

Lecture 7 - Secondary Structure

Lecture 8 - Tertiary and Quaternary Structure

Lecture 9 - Protein Interactions

Lecture 10 - Discussion Class

Lecture 11 - Protein folding and structure

Lecture 12 - Thermodynamics of Protein Folding

Lecture 13 - Protein Structure Methods

Lecture 14 - Protein Denaturation

Lecture 15 - Discussion Class

Lecture 16 - Protein Isolation Methods

Lecture 17 - Protein Purification

Lecture 18 - Biophysical Methods - I

Lecture 19 - Biophysical Methods - II

Lecture 20 - Biophysical Methods - III

Lecture 21 - Types of Protein ligand interactions

Lecture 22 - Kinetics and Thermodynamics of protein-ligand binding

Lecture 23 - Experimental methods in protein ligand interactions

Lecture 24 - Protein ligand docking

Lecture 25 - Discussion class

Lecture 26 - Enzymes I - Classification

Lecture 27 - Enzymes - II

Lecture 28 - Enzyme Mechanisms - I

Lecture 29 - Enzyme Mechanisms - II

Lecture 30 - Enzyme mechanisms - III

Lecture 31 - Enzyme Kinetics - I

Lecture 32 - Enzyme Kinetics - II
Lecture 33 - Enzyme Inhibition - I
Lecture 34 - Enzyme Inhibition - II
Lecture 35 - Discussion class
Lecture 36 - Motor Proteins - I
Lecture 37 - Motor Proteins - II
Lecture 38 - Metalloproteins - I
Lecture 39 - Metalloproteins - II
Lecture 40 - Myoglobin and Hemoglobin
Lecture 41 - Membrane Proteins - I
Lecture 42 - Membrane proteins - II
Lecture 43 - Membrane Transport - I
Lecture 44 - Membrane Transport - II
Lecture 45 - Electron Transport Chain
Lecture 46 - Protein Carbohydrate Interactions - I
Lecture 47 - Protein Carbohydrate Interactions - II
Lecture 48 - Protein Nucleic Acid Interactions - I
Lecture 49 - Protein Nucleic Acid Interactions - II
Lecture 50 - Protein Nucleic Acid Interactions - III
Lecture 51 - Protein Protein Interactions - I
Lecture 52 - Protein Protein Interactions - II
Lecture 53 - Protein Peptide Interactions
Lecture 54 - Chaperone proteins
Lecture 55 - Protein Nanoparticle Interactions
Lecture 56 - Oxidative stress in Proteins
Lecture 57 - Enzyme action and Proteolytic cleavage
Lecture 58 - Intrinsically disordered proteins
Lecture 59 - Viral proteins
Lecture 60 - Overview of Course

Lecture 1 - Introduction - 1

Lecture 2 - Introduction - 2

Lecture 3 - Signals and Systems Overview

Lecture 4 - Important Signals

Lecture 5 - System

Lecture 6 - LSI Systems

Lecture 7 - Image Quality

Lecture 8 - Local Contrast

Lecture 9 - Blurring and Noise

Lecture 10 - Physics of Radiography

Lecture 11 - Types of Ionizing Radiations

Lecture 12 - EM Radiation

Lecture 13 - Attenuation Models

Lecture 14 - Radiation Dosimetry

Lecture 15 - PR_Instrument

Lecture 16 - PR_Instru_CA

Lecture 17 - PR_Image_formation

Lecture 18 - Imaging Equation_updated

Lecture 19 - Film screen_Optical Density

Lecture 20 - PR_Image Quality

Lecture 21 - CT_Intsru

Lecture 22 - CT_Instru_finish

Lecture 23 - CT Back projection

Lecture 24 - CT_BP_finish

Lecture 25 - Fan beam_IQ

Lecture 26 - CT_IQ_Artifact

Lecture 27 - Nuclear Med_Phys

Lecture 28 - Nuclear_Med_Radiotracers

Lecture 29 - Planar_Scintigraphy_Instru

Lecture 30 - Planar_Scintigraphy_Im and IQ

Lecture 31 - Spect_Pet

[Lecture 32 - Ultrasound_Intro_Phys](#)

[Lecture 33 - Ultrasound Phys_Interactions](#)

[Lecture 34 - US doppler and Instrumentation](#)

[Lecture 35 - US_Beampattern](#)

[Lecture 36 - Approximations](#)

[Lecture 37 - US_Imaging Equation_modes](#)

[Lecture 38 - Parameters of interest](#)

[Lecture 39 - Beam Steering : Phased Array](#)

[Lecture 40 - MRI_Intro_S1-S9](#)

[Lecture 41 - MRI_Phys_S10-S16](#)

[Lecture 42 - MRI_Phys_S17-S20](#)

[Lecture 43 - MRI_Phys_S21-S28](#)

[Lecture 44 - MRI_Phys_S29-S39](#)

[Lecture 45 - MRI_Phys_S40-S44](#)

[Lecture 46 - MRI_Phys_S45_S52](#)

[Lecture 47 - MRI_Instru_S1_S16](#)

[Lecture 48 - MRI_Instru_s17_s26](#)

[Lecture 49 - MRI_slice sel_S27_S41](#)

[Lecture 50 - MRI_Freq_Encode_S42_S60](#)

[Lecture 51 - MRI_DAQ_S61_S69](#)

[Lecture 52 - MRI_RECON_S70_S82](#)

[Lecture 53 - MRI_IQ_S83_S96](#)

Lecture 1 - Introduction

Lecture 2 - Next Generation Sequencing Technologies - 454 Sequencing

Lecture 3 - Illumina Sequencing By Synthesis (SBS)

Lecture 4 - Single Molecule Real Time (SMRT) Sequencing

Lecture 5 - Ion Torrent and Nanopore Sequencing

Lecture 6 - Sequencing Coverage, Quality Score and Experiment Design

Lecture 7 - Data Formats

Lecture 8 - Data Formats (Continued...)

Lecture 9 - Data Quality

Lecture 10 - Data QC and Trimming

Lecture 11 - Hands-on: Setting up the system

Lecture 12 - Basic Shell Commands

Lecture 13 - Data Download and Exploration

Lecture 14 - Hands-on 1 - Data exploration and QC

Lecture 15 - Hands-on 1 - Data QC and Trimming

Lecture 16 - Read Mapping

Lecture 17 - Mapping Algorithms

Lecture 18 - Suffix tree-based mapping algorithm

Lecture 19 - Burrows-Wheeler Transform (BWT)

Lecture 20 - Read Mapping with BWT

Lecture 21 - Bowtie2 tool

Lecture 22 - Mapping reads with Bowtie2

Lecture 23 - Bowtie2 output

Lecture 24 - SAM and BAM format

Lecture 25 - SAM format: Alignment section

Lecture 26 - Variant Calling

Lecture 27 - Calling SNP/SNVs and Indels

Lecture 28 - Hands-on analysis : Variant Calling

Lecture 29 - VCF Files

Lecture 30 - Variant Annotation

Lecture 31 - Analysis of CNVs and SVs

- Lecture 32 - Introduction to RNA sequencing
- Lecture 33 - RNA-seq data processing pipeline
- Lecture 34 - Transcriptome Assembly and Quantification
- Lecture 35 - Transcript Abundance Quantification
- Lecture 36 - Biases in RNA-seq experiments
- Lecture 37 - Data Normalization Methods
- Lecture 38 - Data Normalization Methods (Continued...)
- Lecture 39 - Differential Gene Expression (DGE) Analysis
- Lecture 40 - DGE analysis results and visualizations
- Lecture 41 - Multiple hypothesis testing correction
- Lecture 42 - FDR correction and interpretation of DGE analysis results
- Lecture 43 - Functional Enrichment Analysis
- Lecture 44 - RNA-seq data analysis - Hands-on 2
- Lecture 45 - Hands-on 2: Setting up the system
- Lecture 46 - Hands-on 2: Preliminary Data Analysis
- Lecture 47 - Sample Specific Bias Correction
- Lecture 48 - Differential Gene Expression Analysis I
- Lecture 49 - DGE Analysis with spike-ins
- Lecture 50 - DGE Analysis Results and Functional Enrichment Analysis
- Lecture 51 - Genome Assembly
- Lecture 52 - Shortest Common Superstring (SCS) assembly
- Lecture 53 - Overlap-Layout-Consensus (OLC) approach
- Lecture 54 - de Bruijn Graph (DBG) based assembly
- Lecture 55 - Assembly and Quality Control
- Lecture 56 - Applications of NGS in Epigenomics
- Lecture 57 - Detecting DNA Methylations
- Lecture 58 - Genome-wide Transcription Factor(TF) Binding Sites
- Lecture 59 - Chromatin Accessibility
- Lecture 60 - Genome Organization in 3D

Lecture 1 - Neuron Structure

Lecture 2 - Networks of Neurons and Synapses

Lecture 3 - Basic Structures in the Brain

Lecture 4 - Systems of neural processing

Lecture 5 - Methods of Recording Neural Activity

Lecture 6 - Membrane Potential and All or None Spike

Lecture 7 - Patch Clamp Measurements

Lecture 8 - Ion channels

Lecture 9 - Current injection: Synapses

Lecture 10 - Single Neuron Activity

Lecture 11 - Point and compartmental models of neurons

Lecture 12 - Hodgkin Huxley Equations - I

Lecture 13 - Hodgkin Huxley Equations - II

Lecture 14 - Reducing the HHE and Morris-Lecar Equations (MLE)

Lecture 15 - Properties of MLE

Lecture 16 - Phase Plane Analysis - I

Lecture 17 - Phase Plane Analysis - II

Lecture 18 - Phase Plane Analysis - III

Lecture 19 - Analysing HHE with Phase Plane Analysis - I

Lecture 20 - Analysing HHE with Phase Plane Analysis - II

Lecture 21 - Random variables and random process

Lecture 22 - Spike train statistics and response measure

Lecture 23 - Receptive fields and models of receptive fields

Lecture 24 - Stimulus to Response mapping (Coding) - I

Lecture 25 - Stimulus to Response mapping (Coding) - II

Lecture 26 - Stimulus to Response Mapping (Coding) - III

Lecture 27 - Response to Stimulus Mapping (Decoding)

Lecture 28 - Basics of Information Theory - I

Lecture 29 - Basics of Information Theory - II

Lecture 30 - Maximally Informative Dimensions

Lecture 31 - Intro to Discrimination based methods

- Lecture 32 - Kullback Leibler Distance
- Lecture 33 - Measuring Spike Train Distances - I
- Lecture 34 - Measuring Spike Train Distances - II
- Lecture 35 - Signal and Noise Correlations
- Lecture 36 - Statistical Methods in Discrimination
- Lecture 37 - Single Cell Decoding - I: Two Alternative Forced Choice task in Monkeys
- Lecture 38 - Single Cell Decoding - II: Using ROC Curves for discrimination
- Lecture 39 - Single Cell Encoding - I: Operant Conditioning Task in Ferrets
- Lecture 40 - Single Cell Encoding - II: Learning in avoidance and approach methods in Ferrets
- Lecture 41 - Plasticity - Synaptic Transmission and Synaptic Strength
- Lecture 42 - Ways of modification of Synaptic Strength
- Lecture 43 - Type of Plasticity
- Lecture 44 - Short Term Plasticity - I
- Lecture 45 - Short Term Plasticity - II
- Lecture 46 - Long Term Plasticity
- Lecture 47 - Spike Time Dependent Plasticity
- Lecture 48 - Hebbian Plasticity
- Lecture 49 - BCM Rule
- Lecture 50 - Synaptic Normalization
- Lecture 51 - Adaptation
- Lecture 52 - Models of Short Term Plasticity
- Lecture 53 - Attention - I
- Lecture 54 - Attention - II
- Lecture 55 - Developmental Cicuits
- Lecture 56 - Optimal Coding in Visual System
- Lecture 57 - Optimal Coding in Auditory System
- Lecture 58 - Optimal Coding of Deviant Stimuli in Development
- Lecture 59 - Spike Timing Dependent Plasticity - a theoretical Perspective
- Lecture 60 - Important Problems in Neuroscience

Lecture 1 - Ionic basis of membrane potential

Lecture 2 - Physiology of voltage gated channels

Lecture 3 - Physiology of voltage gated channels

Lecture 4 - Cardiac muscle physiology

Lecture 5 - Action potential of cardiac muscle - 1

Lecture 6 - Action potential of cardiac muscle - 2

Lecture 7 - Conducting system of heart

Lecture 8 - ECG-Physiological basis

Lecture 9 - ECG-Normal, Technical aspects

Lecture 10 - ECG Interpretation

Lecture 11 - Abnormal ECG - 1

Lecture 12 - Abnormal ECG - 2

Lecture 13 - ECG and Myocardial Infarction

Lecture 14 - Heart rate and Blood pressure - Baroreflex pathway

Lecture 15 - ECG and Hypertension

Lecture 16 - Autonomic regulation of heart

Lecture 17 - Heart rate variability (HRV)

Lecture 18 - Heart rate variability-interpretation and clinical uses, Blood pressure variability

Lecture 19 - Autonomic Function Tests - 1

Lecture 20 - Autonomic Function Tests - 2

Lecture 1 - Pharmacognosy and Medicinal Plants

Lecture 2 - Plant Specialized Metabolites: Waste Products or Ecochemicals?

Lecture 3 - Evolution of Specialized Metabolism from Primary Metabolism

Lecture 4 - Production of specialized metabolites through cell and organ culture

Lecture 5 - Eliciting specialized metabolism in culture

Lecture 6 - Analysis of Specialized Metabolites - Tools and Techniques

Lecture 7 - Metabolic phytochemistry-based approaches for studying plant specialized metabolism

Lecture 8 - Metabolic engineering strategies in plants

Lecture 9 - Plant genetic transformation (through natural genetic engineer)

Lecture 10 - Design of vectors for Agrobacterium-mediated gene transfer; Transformed and co-

Lecture 11 - Introduction to alkaloids

Lecture 12 - Biosynthesis of tropane alkaloids

Lecture 13 - Engineering tropane alkaloid pathways in plants - I

Lecture 14 - Engineering tropane alkaloid pathways in plants - II : Engineering tropane alkaloid pathway

Lecture 15 - Isoquinoline alkaloids - Biosynthesis and tissue localization

Lecture 16 - Isoquinoline alkaloids - Late steps of biosynthetic pathway and tissue localization

Lecture 17 - Benzyloisoquinoline alkaloids - Induced top1 mutant and natural T mutantEngineering

Lecture 18 - Benzyloisoquinoline alkaloids - Metabolic pathway engineering

Lecture 19 - RNAi-mediated replacement of morphine with nonnarcotic alkaloid reticuline in opium

Lecture 20 - Isoquinoline alkaloids - biosynthesis and tissue localization

Lecture 21 - Indole alkaloids - Early steps of biosynthesis

Lecture 22 - Indole alkaloids - Metabolic engineering of early steps of indole alkaloid pathway

Lecture 23 - Indole alkaloids - Environmental factors regulating indole alkaloid biosynthesis

Lecture 24 - Indole alkaloids - Role of elicitors in modulating alkaloids accumulation

Lecture 25 - Indole alkaloids - Late steps of indole alkaloid biosynthesis

Lecture 26 - Indole alkaloids - Regulatory roles of transcription factors in light-induced

Lecture 27 - Engineering indole alkaloid pathways in Catharanthus roseus hairy root cultures

Lecture 28 - Missing enzymes of vindoline biosynthetic pathway

Lecture 29 - Monoterpene indole alkaloid pathway cell and tissue localization

Lecture 30 - Model for biosynthesis and secretion of monoterpene indole alkaloids involving

Lecture 31 - Metabolic reprogramming of periwinkle plant culture

- Lecture 32 - Engineered yeast brews precursors of anticancer drug vinblastine
- Lecture 33 - Recent discovery of strychnine biosynthetic pathway
- Lecture 34 - Indole alkaloid biosynthesis - a final overview
- Lecture 35 - Recent discovery of colchicine biosynthetic pathway
- Lecture 36 - Biosynthesis of terpenoids - an outline
- Lecture 37 - Diversity of monoterpenoids
- Lecture 38 - Biosynthesis of monoterpenoids
- Lecture 39 - Diversity of sesquiterpenes, diterpenes, triterpenes and polyterpenes
- Lecture 40 - Oleoresins and polyterpenes - an outline
- Lecture 41 - Monoterpenoids as components of floral scent volatiles: Metabolic engineering of
- Lecture 42 - Biosynthesis of carotenoids and carotenoid cleavage products
- Lecture 43 - Metabolic engineering of carotenoid pathway
- Lecture 44 - Metabolic engineering of carotenoid pathway: Golden Rice Story
- Lecture 45 - Menthol story: Biosynthesis and pathway manipulation - I
- Lecture 46 - Menthol story: Biosynthesis and pathway manipulation - II
- Lecture 47 - Artemisinin, hyperforin and taxol - three promising candidates for biotechnological
- Lecture 48 - Phenolics: Origin via shikimate pathway
- Lecture 49 - Phenolics: Phenylpropanoids, benzenoids, coumarins, tannins
- Lecture 50 - Phenolics: Monolignols, lignins and lignans
- Lecture 51 - Phenolics: Metabolic engineering of monolignol pathways
- Lecture 52 - Phenolics: Biosynthesis of lignans and podophyllotoxin; Caffeic acid esters
- Lecture 53 - Phenolics: Flavonoids, Flavones, Isoflavonoids, Proanthocyanidins
- Lecture 54 - Phenolics: Biosynthesis of anthocyanins; Metabolic pathway engineering for enhance
- Lecture 55 - Phenolics: Metabolic engineering of anthocyanin pathways in flowers
- Lecture 56 - Phenolics: Alcohol acetyl transferses and volatile phenolics
- Lecture 57 - Phenolics: Biosynthesis of volatile benzenoids
- Lecture 58 - Phenolics: Biosynthesis of vanillin in plants
- Lecture 59 - Phenolics: Metabolic engineering for vanillin
- Lecture 60 - Phenolics: Biosynthesis of shikonin
- Lecture 61 - Phenolics: Metabolic engineering of shikonin pathway
- Lecture 62 - Molecular Pharming: Transplastomic plants
- Lecture 63 - Molecular Pharming: production of human somatotropin in tobacco

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Lecture 2 - Mass balance, Heat Balance, flow sheet

Lecture 3 - Costing

Lecture 4 - Costing (continued), Physical and chemical principles in Down stream

Lecture 5 - Problems in Mass balance, flow sheet

Lecture 6 - Cell Breakage

Lecture 7 - Cell breakage (Continued...)

Lecture 8 - Solid Liquid Separation

Lecture 9 - Solid Liquid Separation (Continued...)

Lecture 10 - Solid Liquid separation-problems

Lecture 11 - Pre-treatment and Filters

Lecture 12 - Adsorption

Lecture 13 - Adsorption

Lecture 14 - Adsorption

Lecture 15 - Adsorption

Lecture 16 - Liquid-Liquid Extraction

Lecture 17 - Liquid-Liquid Extraction

Lecture 18 - Liquid-Liquid Extraction

Lecture 19 - Liquid liquid extraction

Lecture 20 - Reversed micellar and aqueous two phase extraction

Lecture 21 - Membranes

Lecture 22 - Membranes

Lecture 23 - Membranes

Lecture 24 - Membranes

Lecture 25 - Precipitation

Lecture 26 - Chromatography

Lecture 27 - Chromatography

Lecture 28 - Chromatography

Lecture 29 - Chromatography

Lecture 30 - Chromatography

Lecture 31 - Chromatography

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[Lecture 33 - Crystallisation](#)

[Lecture 34 - Drying](#)

[Lecture 35 - Drying and distillation](#)

[Lecture 36 - Future trends](#)

Lecture 1 - Introduction and Review

Lecture 2 - Need for Analysis Additional Thermodynamic Functions State and Path Variables

Lecture 3 - Equations for a Closed system Chemical Potential Concept Gibbs-Duhem Equation

Lecture 4 - Maxwell's relations

Lecture 5 - Inter-Relationships between Thermodynamic Variables

Lecture 6 - Some Useful Mathematical Manipulations

Lecture 7 - Thermodynamic Relations for a Closed System with 1 mole of a pure Substances

Lecture 8 - Maximum Work, Lost Work Review of Closed Systems

Lecture 9 - Open Systems

Lecture 10 - Equations of State - Virial Equations

Lecture 11 - Equations of State - Cubic Equations

Lecture 12 - Volume Estimation

Lecture 13 - Volume Estimation (Continued...) Generalized correlations

Lecture 14 - Generalized correlations (Continued...) Residual Properties

Lecture 15 - Residual Properties (Continued...)

Lecture 16 - Generalized Correlations and Residual Properties

Lecture 17 - Fugacity Coefficient Estimation

Lecture 18 - Review of Module 3

Lecture 19 - Learning Aspects Chemical Potential Formulations

Lecture 20 - Lewis and Randall rule partial Molar Properties

Lecture 21 - Partial Molar Property Estimation from Mixing Experiments

Lecture 22 - Partial Molar Property Estimation (Continued...) Excess Property

Lecture 23 - Activity Coefficient from Excess Property

Lecture 24 - Activity Coefficient from Excess Property (Continued...)

Lecture 25 - Activity Coefficient from Excess Property (Continued...) Models for Activity Coefficient in Binary Systems

Lecture 26 - Models for Activity Coefficient in Binary Systems (Continued...)

Lecture 27 - Review of Module 4

Lecture 28 - Criteria for Phase Equilibrium Phase Rule for Non-reacting Biosystems

Lecture 29 - Clausius - Clayperon Equation

Lecture 30 - Clausius - Clayperon Equation (Continued...) vapour-Liquid Equilibrium

Lecture 31 - Vapour-Liquid Equilibrium (Continued...) Estimation of Fugacity coefficient from Equilibrium P-V-T Data

[Lecture 32 - Liquid/Liquid and Solid/Liquid Equilibria](#)

[Lecture 33 - Review of Module 5](#)

[Lecture 34 - Criteria for Bio-reaction Equilibria](#)

[Lecture 35 - Phase rule for Reacting Biosystems Equilibrium constants](#)

[Lecture 36 - Effect of Temperature and Pressure on the Equilibrium constants](#)

[Lecture 37 - Reaction in Liquid or Solid Phases](#)

[Lecture 38 - Free energy Changes for some Bioreactions](#)

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[Lecture 40 - Course Review](#)

Lecture 1 - Introduction

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Lecture 3 - Costing

Lecture 4 - Cell Breakage

Lecture 5 - Solid Liquid Separation

Lecture 6 - Pre-treatment and Filters/centrifuge

Lecture 7 - Liquid-Liquid Extraction

Lecture 8 - Liquid-Liquid extraction (Continued...)

Lecture 9 - Adsorption

Lecture 10 - Reversed micellar and aqueous two phase extraction

Lecture 11 - Membranes

Lecture 12 - Membranes (Continued...)

Lecture 13 - Product stabilization, Drying, Lyophilisation

Lecture 14 - Precipitation and crystallization

Lecture 15 - Electrophoresis / SDS PAGE

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Lecture 17 - Chromatography (Continued...1)

Lecture 18 - Chromatography (Continued...2)

Lecture 19 - Chromatography (Continued...3)

Lecture 20 - Future trends, Other downstream operations/Summary of the course

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Lecture 2 - Experimental Design Strategy

Lecture 3 - Data types : Binomial distribution

Lecture 4 - Poisson Distribution

Lecture 5 - Normal Distribution

Lecture 6 - Standardized Normal Distribution / t-distribution

Lecture 7 - t-distribution/confidence interval

Lecture 8 - Statistical tests

Lecture 9 - t-Test

Lecture 10 - t-Tests

Lecture 11 - t-test

Lecture 12 - F-tests

Lecture 13 - F-tests

Lecture 14 - ANOVA

Lecture 15 - ANOVA

Lecture 16 - Anova

Lecture 17 - Anova

Lecture 18 - Anova

Lecture 19 - Anova

Lecture 20 - Anova

Lecture 21 - Normality test / Odds ratio

Lecture 22 - Chi square distribution

Lecture 23 - Chi square distribution / test

Lecture 24 - Chi square test

Lecture 25 - Chi square test and Weibull Distribution

Lecture 26 - Weibull Distribution

Lecture 27 - Weibull distribution.

Lecture 28 - Non-parametric test

Lecture 29 - Non parametric test/homogeneity of variance / beta distribution

Lecture 30 - Exponential / hypergeometric distributions

Lecture 31 - Hypergeometric / Log normal distribution

[Lecture 32 - Design of experiments \(DOE\) - Introduction](#)

[Lecture 33 - Factorial Design](#)

[Lecture 34 - Full factorial design](#)

[Lecture 35 - Fractional factorial design](#)

[Lecture 36 - Other designs](#)

[Lecture 37 - Second order designs](#)

[Lecture 38 - Second order design](#)

[Lecture 39 - Regression analysis](#)

[Lecture 40 - Control charts](#)

Lecture 1 - Introduction

Lecture 2 - Sterilization

Lecture 3 - Solution to PP 1.1

Lecture 4 - Some important concepts

Lecture 5 - Enzyme bioreactors, enzyme kinetics

Lecture 6 - Solution to PP 2.1

Lecture 7 - Inhibited enzyme kinetics

Lecture 8 - Solution to PP 2.2

Lecture 9 - Measurement principles and methods

Lecture 10 - Batch growth kinetics

Lecture 11 - Solution to PP 3.1

Lecture 12 - Bioreactor analysis: chemostat and fed-batch

Lecture 13 - Solution to PP 3.2

Lecture 14 - Bioreactor environment parameters

Lecture 15 - Bioreactor env. par. (DO)

Lecture 16 - Solution to PP 4.1

Lecture 17 - Shear stress, scale-up, scale-down

Lecture 18 - Cell view: stoichiometry; degree of reductance

Lecture 19 - Solution to PP 5.1

Lecture 20 - Culture status, metabolic flux analysis

Lecture 21 - Course summary

Lecture 1 - Introduction to Biomaterials

Lecture 2 - Background history

Lecture 3 - History

Lecture 4 - Properties - Mechanical and Physico-chemical

Lecture 5 - Properties - Mechanical and Physico-chemical

Lecture 6 - Mechanical properties

Lecture 7 - Mechanical Properties (Continued...)

Lecture 8 - Resorbability, biodegradation

Lecture 9 - Resorbability, biodegradation (Continued...)

Lecture 10 - Biofilm

Lecture 11 - Biofilm (Continued...)

Lecture 12 - Biofilm (Continued...)

Lecture 13 - Biofilm (Continued...)

Lecture 14 - Material characterization - Analytical instruments

Lecture 15 - Analytical instruments

Lecture 16 - Analytical instruments (Continued...)

Lecture 17 - Analytical instruments (Continued...)

Lecture 18 - Biological responses, compatibility, cytotoxicity

Lecture 19 - Biological Responses

Lecture 20 - Cell-biomaterial interaction

Lecture 21 - Animal trials (in vivo)

Lecture 22 - Animal trials

Lecture 23 - Metals-types, classifications, applications

Lecture 24 - Metals - properties

Lecture 25 - Metals - properties (Continued...)

Lecture 26 - Metals - properties (Continued...)

Lecture 27 - Metals

Lecture 28 - Polymers-types, classifications, applications

Lecture 29 - Polymers

Lecture 30 - Polymers (Continued...)

Lecture 31 - Polymer blends

[Lecture 32 - Natural biopolymers](#)

[Lecture 33 - Natural biopolymers - \(Continued...\)](#)

[Lecture 34 - Biopolymers- proteins / hydrogels](#)

[Lecture 35 - Hydrogels](#)

[Lecture 36 - Experiments](#)

[Lecture 37 - surface modification-Demonstration](#)

[Lecture 38 - Ceramics](#)

[Lecture 39 - Cardiovascular and ocular biomaterials](#)

[Lecture 40 - Sterilisation/Device failure](#)

Lecture 1 - Concepts and importance of Bioinformatics

Lecture 2 - Complexities in biological systems

Lecture 3 - DNA sequence analysis

Lecture 4 - Sequence based parameters

Lecture 5 - Database

Lecture 6 - Database categories

Lecture 7 - Protein structure and function - I

Lecture 8 - Protein structure and function - II

Lecture 9 - Protein sequence databases - I

Lecture 10 - Protein sequence databases - II

Lecture 11 - Pairwise alignment - I

Lecture 12 - Pairwise alignment - II

Lecture 13 - Uniprot Demo

Lecture 14 - Sequence alignment - I

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Lecture 16 - Sequence alignment: Online resources - I

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Lecture 18 - Conservation score - I

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Lecture 20 - Blast Demo

Lecture 21 - Phylogenetic trees - I

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Lecture 23 - Protein sequence analysis - I

Lecture 24 - Protein sequence analysis - II

Lecture 25 - Hydrophobicity profiles

Lecture 26 - Patterns and PSSM profiles

Lecture 27 - Construction of Non-redundant datasets - I

Lecture 28 - Non-redundant datasets - II

Lecture 29 - Protein secondary structure

Lecture 30 - Secondary structure prediction - I

Lecture 31 - Secondary structure prediction - II

Lecture 32 - Secondary structure prediction - III

Lecture 33 - Protein tertiary structure - I

Lecture 34 - Protein tertiary structure - II

Lecture 35 - Protein structure analysis - I

Lecture 36 - Protein structure analysis - II

Lecture 37 - Protein structure analysis - III

Lecture 38 - Demo: PDB or Pymol or PDBParam

Lecture 39 - Protein structure analysis - IV

Lecture 40 - Protein structure prediction - I

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Lecture 42 - Protein stability - I

Lecture 43 - Protein stability - II

Lecture 44 - Demo: Homology Modelling

Lecture 45 - Stabilizing residues

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Lecture 47 - Stability of proteins upon mutations - I

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Lecture 49 - Demo: ProTherm

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Lecture 51 - Protein folding rate - II

Lecture 52 - Protein interactions - I

Lecture 53 - Protein interactions - II

Lecture 54 - Computer aided drug design - I

Lecture 55 - Computer aided drug design - II

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Lecture 57 - Virtual screening - II

Lecture 58 - QSAR - I

Lecture 59 - QSAR - II

Lecture 60 - Demo: Autodock

Lecture 61 - awk programming - I

Lecture 62 - awk programming - II

Lecture 63 - Development of algorithms - I

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[Lecture 65 - Applications of bioinformatics - I](#)

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[Lecture 67 - Overview - I](#)

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NPTEL : NOC:Demystifying the Brain (Biotechnology)

Co-ordinators : Dr. V Srinivasa Chakravarthy

Lecture 1 - The Whole and Its Parts: A History of Ideas about Brain

Lecture 2 - Understanding Brain's Shape - Segment 1 - Brain size and intelligence

Lecture 3 - Understanding Brain's Shape - Segment 2 - Save Wire Principle

Lecture 4 - Understanding Brain's Shape - Segment 3 - Brain Evolution

Lecture 5 - Neurons and Neural Signaling: Outline

Lecture 6 - Neural Signalling : Molecular and Cellular Basis

Lecture 7 - Networks that Learn - Segment 1

Lecture 8 - Multilayer Perceptrons Applications in Psychology and Neuroscience

Lecture 9 - Organization of the Central Nervous System-Segment 1 - Cortex

Lecture 10 - Organization of the Central Nervous System-Segment 2 - Subcortical Structures

Lecture 11 - Maps in the Brain - Segment 1

Lecture 12 - Maps in the Brain - Segment 2

Lecture 13 - Emotions in the Brain - Segment 1

Lecture 14 - Emotions in the Brain - Segment 2

Lecture 15 - Memories and Holograms - Segment 1

Lecture 16 - Memories and Holograms - Segment 2

Lecture 17 - Consciousness - Segment 1

Lecture 18 - Consciousness - Segment 2

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Lecture 2 - Introduction to Modelling

Lecture 3 - Introduction to Modelling

Lecture 4 - Fundamentals of Mathematical Modelling

Lecture 5 - Fundamentals of Mathematical Modelling

Lecture 6 - Fundamentals of Mathematical Modelling

Lecture 7 - Some Example Models

Lecture 8 - Representation of Biological Networks

Lecture 9 - Lab: MATLAB Basics

Lecture 10 - Lab: MATLAB Basics

Lecture 11 - Lab: MATLAB Basics

Lecture 12 - Lab: MATLAB Basics

Lecture 13 - Introduction to Networks

Lecture 14 - Introduction to Networks

Lecture 15 - Introduction to Network Biology

Lecture 16 - Introduction to Network Biology

Lecture 17 - Introduction to Network Biology

Lecture 18 - Network Biology

Lecture 19 - Network Models

Lecture 20 - Network Models

Lecture 21 - Biological Networks

Lecture 22 - Network Perturbations

Lecture 23 - Community Detection

Lecture 24 - Network Motifs

Lecture 25 - Lab: Cytoscape

Lecture 26 - Lab: Cytoscape

Lecture 27 - Lab: Network Biology

Lecture 28 - Network Biology: Recap

Lecture 29 - Lab: Network Models and Perturbations

Lecture 30 - Lab: Network Models and Perturbations

Lecture 31 - Reconstruction of Gene Regulatory Networks

- Lecture 32 - Reconstruction of Protein Networks
- Lecture 33 - Reconstruction of Signalling Networks
- Lecture 34 - Reconstruction of Signalling Networks
- Lecture 35 - Introduction to Dynamic Modelling
- Lecture 36 - Introduction to Dynamic Modelling
- Lecture 37 - Introduction to Dynamic Modelling
- Lecture 38 - Lab: Solving ODEs in MATLAB
- Lecture 39 - Lab: Example Biological Model
- Lecture 40 - Parameter Estimation
- Lecture 41 - Parameter Estimation
- Lecture 42 - Parameter Estimation
- Lecture 43 - Methods for Parameter Estimation
- Lecture 44 - Direct Search Methods
- Lecture 45 - Genetic Algorithms
- Lecture 46 - Genetic Algorithms
- Lecture 47 - Other Evolutionary Algorithms
- Lecture 48 - PyGMO
- Lecture 49 - Dynamic Modelling Recap
- Lecture 50 - Lab: Parameter Estimation
- Lecture 51 - Guest Lecture: Modelling in Drug Development
- Lecture 52 - Guest Lecture: Modelling in Drug Development
- Lecture 53 - Guest Lecture: Quantitative Systems Pharmacology
- Lecture 54 - Guest Lecture: Quantitative Systems Pharmacology
- Lecture 55 - Guest Lecture: Quantitative Systems Pharmacology
- Lecture 56 - Constraint-based Modelling of Metabolic Networks
- Lecture 57 - Flux Balance Analysis
- Lecture 58 - Flux Balance Analysis
- Lecture 59 - Flux Balance Analysis
- Lecture 60 - Other Constraint-Based Approaches
- Lecture 61 - Other Constraint-Based Approaches
- Lecture 62 - Lab: FBA using MATLAB
- Lecture 63 - Perturbations to Metabolic Networks: Deletions
- Lecture 64 - Lab: COBRA Toolbox

Lecture 65 - Understanding FBA

Lecture 66 - Understanding FBA

Lecture 67 - Perturbations to Metabolic Networks: Over-expression

Lecture 68 - Perturbations to Metabolic Networks: Synthetic Lethals

Lecture 69 - Perturbations to Metabolic Networks: Synthetic Lethals

Lecture 70 - Constraint-based Modelling of Metabolic Networks

Lecture 71 - Lab: Gene Deletions

Lecture 72 - Integrating Regulatory Information into Constraint-Based Models

Lecture 73 - Elementary Modes

Lecture 74 - Elementary Modes

Lecture 75 - Constraint-based Modelling of Metabolic Networks: Applications

Lecture 76 - Constraint-based Modelling of Metabolic Networks: Applications

Lecture 77 - Constraint-based Modelling of Metabolic Networks: Applications

Lecture 78 - Lab: Gene Deletions

Lecture 79 - Constraint-based Modelling of Metabolic Networks: Recap

Lecture 80 - Constraint-based Modelling of Metabolic Networks: Recap

Lecture 81 - Constraint-based Modelling of Metabolic Networks: Recap

Lecture 82 - ^{13}C -Metabolic Flux Analysis using Mass Spectrometry

Lecture 83 - ^{13}C -Metabolic Flux Analysis using Mass Spectrometry

Lecture 84 - ^{13}C -Metabolic Flux Analysis using Mass Spectrometry

Lecture 85 - Lab: ^{13}C -Metabolic Flux Analysis using Mass Spectrometry

Lecture 86 - Modelling Gene Regulatory Networks

Lecture 87 - Modelling Gene Regulatory Networks

Lecture 88 - Modelling Gene Regulatory Networks

Lecture 89 - Lab: Modelling Gene Regulatory Networks

Lecture 90 - Lab: Modelling Gene Regulatory Networks

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Lecture 92 - Computational Modelling of Host-Pathogen Interactions

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Lecture 94 - Robustness in Biological Systems: Mechanisms

Lecture 95 - Robustness in Biological Systems: Organising Principles

Lecture 96 - Robustness in Biological Systems: Trade-offs

Lecture 97 - Robustness and Evolvability

[Lecture 98 - robustness and Evolvability](#)

[Lecture 99 - Introduction to Synthetic Biology](#)

[Lecture 100 - Advanced Topics](#)

[Lecture 101 - Advanced Topics](#)

[Lecture 102 - Advanced Topics](#)

[Lecture 103 - Course Recap](#)

Lecture 1 - Fundamentals of Engineering Calculations

Lecture 2 - Process Parameters and Variables

Lecture 3 - Fundamentals of Material Balances

Lecture 4 - Material Balance Calculations for Single Units Without Reactions - Part 1

Lecture 5 - Material Balance Calculations for Single Units Without Reactions - Part 2

Lecture 6 - Material Balance Calculations for Single Units Without Reactions - Part 3

Lecture 7 - Material Balance Calculations for Single Units Without Reactions - Part 4

Lecture 8 - Material Balance Calculations for Multiple Units Without Reactions - Part 1

Lecture 9 - Material Balance Calculations for Multiple Units Without Reactions - Part 2

Lecture 10 - Fundamentals of Reactive Processes

Lecture 11 - Material Balance Calculations For Single Units With A Single Reaction

Lecture 12 - Material Balance Calculations for Single Units with A Single Reaction (Continued...)

Lecture 13 - Material Balance Calculations for Single Units with Multiple Reactions - Part 1

Lecture 14 - Material Balance Calculations for Single Units with Multiple Reactions - Part 2

Lecture 15 - Material Balance Calculations for Single Units with Multiple Reactions - Part 3

Lecture 16 - Material Balance Calculations for Multiple Units with Reactions - Part 1

Lecture 17 - Material Balance Calculations for Multiple Units with Reactions - Part 2

Lecture 18 - Material Balances on Reactive Processes - Tutorials

Lecture 19 - Combustion Reactions: An Introduction

Lecture 20 - Material Balances for Combustion Reactions

Lecture 21 - Biochemical Reactions: Enzyme Kinetics

Lecture 22 - Biochemical Reactions: Cell Growth

Lecture 23 - Recycle Without Reactions

Lecture 24 - Recycle with Reactions

Lecture 25 - Recycle: Tutorials

Lecture 26 - Bypass

Lecture 27 - Purge

Lecture 28 - Material Balance: A Review - Part 1

Lecture 29 - Material Balance: A Review - Part 2

Lecture 30 - Material Balance: A Review - Part 3

Lecture 31 - The Unreasonable Effectiveness of Material Balance

- Lecture 32 - Constraint-based modelling
- Lecture 33 - Flux balance analysis - Part 1
- Lecture 34 - Flux balance analysis - Part 2
- Lecture 35 - Energy Balance Terminologies and Concepts
- Lecture 36 - Introduction to Energy Balances - Part 1
- Lecture 37 - Introduction to Energy Balances - Part 2
- Lecture 38 - Introduction to Energy Balances: Tutorials
- Lecture 39 - Mechanical Energy Balances
- Lecture 40 - Mechanical Energy Balances: Tutorials
- Lecture 41 - Energy Balance Objectives and Procedures
- Lecture 42 - Introduction to Nonreactive Processes Without Phase Change
- Lecture 43 - Energy Balances on Single-Phase Nonreactive Processes
- Lecture 44 - Energy Balances on Single-Phase Nonreactive Processes: Tutorials
- Lecture 45 - Fundamentals of Nonreactive Phase Change Processes
- Lecture 46 - Estimating Latent Heats
- Lecture 47 - Energy Balances on Nonreactive Processes With Phase Change
- Lecture 48 - Energy Balances on Nonreactive Processes With Phase Change: Tutorials - 1
- Lecture 49 - Energy Balances on Nonreactive Processes With Phase Change: Tutorials - 2
- Lecture 50 - Psychrometric Charts
- Lecture 51 - Energy Balances Using Psychrometric Charts
- Lecture 52 - Mixing and Solution
- Lecture 53 - Mixing and Solution: Tutorials - 1
- Lecture 54 - Mixing and Solution: Tutorials - 2
- Lecture 55 - Fundamentals for Energy Balances on Reactive Processes - Part 1
- Lecture 56 - Fundamentals for Energy Balances on Reactive Processes - Part 1 and Part 2
- Lecture 57 - Fundamentals for Energy Balances on Reactive Processes - Tutorials
- Lecture 58 - Energy Balances on Reactive Processes - Part 1
- Lecture 59 - Energy Balances on Reactive Processes - Part 2
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- Lecture 61 - Energy Balances on Reactive Processes - Part 4
- Lecture 62 - Energy Balances on Reactive Processes - Part 5
- Lecture 63 - Energy Balances on Reactive Processes - Part 6
- Lecture 64 - Energy Balances: A Review - Part 1

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[Lecture 69 - Unsteady State Energy Balances](#)

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Lecture 2 - Drug Discovery - Issues

Lecture 3 - Target and Lead Identification

Lecture 4 - Drug And Data bases

Lecture 5 - Drug Properties

Lecture 6 - Drug - Properties / SMILES

Lecture 7 - Drug Solubility

Lecture 8 - Drug Solubility / permeability

Lecture 9 - ADME

Lecture 10 - Drug - ADME

Lecture 11 - Drug - ADME

Lecture 12 - Drug - BBB

Lecture 13 - Pgp efflux/Drug Likeness

Lecture 14 - Drug Likeness

Lecture 15 - Molecular Modelling

Lecture 16 - Molecular Mechanics / Force Field

Lecture 17 - Molecular Mechanics / Force Field

Lecture 18 - Molecular Mechanics / Force Field

Lecture 19 - Molecular Mechanics / Force Field

Lecture 20 - ODES and Numerical methods

Lecture 21 - ODES and Numerical methods

Lecture 22 - Conformational Search / MD

Lecture 23 - Quantum Mechanics

Lecture 24 - Quantum Mechanics

Lecture 25 - Quantitative Struture Activity Relationship (QSAR)

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- Lecture 51 - Endomembrane System of Cells: Discussion Session 2
- Lecture 52 - Endomembrane System of Cells - Part 3
- Lecture 53 - Endomembrane System of Cells: Discussion Session 3
- Lecture 54 - Endomembrane System of Cells - Part 4
- Lecture 55 - Endomembrane System of Cells: Discussion Session 4
- Lecture 56 - Cell Division
- Lecture 57 - Cell Division: Discussion session
- Lecture 58 - Discussion Session on Organization and Function of a Cell

Lecture 1 - Introduction to RNA Biology and RNA World - The Beginning

Lecture 2 - Introduction to RNA Biology and RNA World - Evidences

Lecture 3 - Introduction to RNA Biology and RNA World - Origin of Monomers

Lecture 4 - Introduction to RNA Biology and RNA World - Shift to DNA

Lecture 5 - Introduction to RNA Biology and RNA World - RNA Self Replication

Lecture 6 - Introduction to RNA Biology and RNA World - Origin of RNA Enzymes

Lecture 7 - RNA as Enzymes: The Ribozymes

Lecture 8 - RNA as Enzymes: Structure and Functions

Lecture 9 - RNA as Enzymes: The Present and Future

Lecture 10 - RNA Transcription: The Central Dogma

Lecture 11 - RNA Transcription: Initial Steps

Lecture 12 - RNA Transcription: Different Stages

Lecture 13 - RNA Transcription: Termination and RNA Modification

Lecture 14 - RNA Transcription: Different Polymerases

Lecture 15 - RNA Processing and Life Cycle: RNA Maturation and RNPs

Lecture 16 - RNA Processing and Life Cycle: RNA Splicing

Lecture 17 - RNA Processing and Life Cycle: Post Transcriptional Processing

Lecture 18 - Alternative RNA Processing and Editing: Alternative Splicing

Lecture 19 - Alternative RNA Processing and Editing: Implications of Introns

Lecture 20 - Alternative RNA Processing and Editing: Splicing and Pathology

Lecture 21 - Alternative RNA Processing and Editing: RNA Editing in Detail

Lecture 22 - Alternative RNA Processing and Editing: Relevance of RNA Editing

Lecture 23 - Alternative RNA Processing and Editing: Relevance in Immunology

Lecture 24 - RNA Splicing, Export and Stability: Relevance of Introns

Lecture 25 - RNA Splicing, Export and Stability: Introns in RNA Splicing

Lecture 26 - RNA Splicing, Export and Stability: Different Spliceosomes

Lecture 27 - RNA Splicing, Export and Stability: SMN Complex

Lecture 28 - snRNA, rRNA, miRNA, siRNA Processing, Export and Function: Introns and Link to Splicing

Lecture 29 - snRNA, rRNA, miRNA, siRNA Processing, Export and Function: RNA Helicases

Lecture 30 - snRNA, rRNA, miRNA, siRNA Processing, Export and Function: Nucleo Cytoplasmic Transport

Lecture 31 - snRNA, rRNA, miRNA, siRNA Processing, Export and Function: Nucleoporins and miRNAs

Lecture 32 - snRNA, rRNA, miRNA, siRNA Processing, Export and Function: RNA Export Mechanisms

Lecture 33 - snRNA, rRNA, miRNA, siRNA Processing, Export and Function: RNA Quality Control

Lecture 34 - Mechanisms of RNA Decay and Non Coding RNAs: Decay Pathways

Lecture 35 - Mechanisms of RNA Decay and Non Coding RNAs: The Exosomes

Lecture 36 - Mechanisms of RNA Decay and Non Coding RNAs: mRNA Surveillance

Lecture 37 - Mechanisms of RNA Decay and Non Coding RNAs: Mechanisms of RNA Decay

Lecture 38 - Mechanisms of RNA Decay and Non Coding RNAs: Autoregulation of RNAs

Lecture 39 - Mechanisms of RNA Decay and Non Coding RNAs: Introduction to Non-Coding RNAs

Lecture 40 - Dosage Compensation and X-Inactivation: SRP and Different Modes of Compensation

Lecture 41 - Dosage Compensation and X-Inactivation: Dosage Compensation of X

Lecture 42 - Dosage Compensation and X-Inactivation: Omprinted vs Random X Inactivation

Lecture 43 - Dosage Compensation and X-Inactivation: Molecular Basis of X-Inactivation

Lecture 44 - Dosage Compensation and X-Inactivation: ES Cells and X-Inactivation

Lecture 45 - Dosage Compensation, Xist and ncRNA in Imprinting: The Roles of YY1

Lecture 46 - Dosage Compensation, Xist and ncRNA in Imprinting: shRNAs and Gene Expression

Lecture 47 - Dosage Compensation, Xist and ncRNA in Imprinting: Mechanism of RNAi in Action

Lecture 48 - Dosage Compensation, Xist and ncRNA in Imprinting: Genomic Imprinting in Action

Lecture 49 - Dosage Compensation, Xist and ncRNA in Imprinting: Different ncRNAs and their Roles

Lecture 50 - Dosage Compensation, Xist and ncRNA in Imprinting: lncRNA-Induced Cancer

Lecture 51 - Dosage Compensation, Xist and ncRNA in Imprinting: Xist and Cancer

Lecture 52 - Telomere, Telomerase and Impact on Genomes: The Importance of Telomeres

Lecture 53 - Telomere, Telomerase and Impact on Genomes: Telomerase and Aging

Lecture 54 - Telomere, Telomerase and Impact on Genomes: Telomere Length as Marker of Aging

Lecture 55 - Telomere, Telomerase and Impact on Genomes: Telomeres and Cancer

Lecture 56 - Telomere, Telomerase and Impact on Genomes: Cell Cycle Arrest

Lecture 57 - Telomere, Telomerase and Impact on Genomes: Maintenance and Manipulation of Telomeres

Lecture 58 - Epitranscriptome and Protein Synthesis: Important RNA Modifications

Lecture 59 - Epitranscriptome and Protein Synthesis: Readers, Writes and Erasers

Lecture 60 - Epitranscriptome and Protein Synthesis: Biological Implications of RNA Modifications

Lecture 61 - Epitranscriptome and Protein Synthesis: Roles of RNAs in Translation

Lecture 62 - Epitranscriptome and Protein Synthesis: Mechanism of Translation

Lecture 1 - Introduction to forces - Resolving forces, principle of transmissibility

Lecture 2 - Statics FBD and EOE

Lecture 3 - Example problems on FBD and EOE

Lecture 4 - Joints in human body

Lecture 5 - Machines and mechanical advantage

Lecture 6 - Levers and types of levers

Lecture 7 - Insertion point and torque

Lecture 8 - Practice problem - 1

Lecture 9 - Practice problem - 2

Lecture 10 - Key terminologies

Lecture 11 - Anatomical planes and axis

Lecture 12 - Sagittal plane movements

Lecture 13 - Coronal plane movements

Lecture 14 - Transverse plane movements

Lecture 15 - Muscles - Muscle fascicles

Lecture 16 - Muscle fibers- Pennation angle

Lecture 17 - More on pennation angle

Lecture 18 - Excitation contraction coupling

Lecture 19 - Sliding filament theory

Lecture 20 - Force length relationship

Lecture 21 - Shoulder joints and muscles

Lecture 22 - Shoulder problem - 1

Lecture 23 - Shoulder problem - 2

Lecture 24 - Elbow theory

Lecture 25 - Elbow problem - 1

Lecture 26 - Elbow problem - 2

Lecture 27 - Elbow problem - 3

Lecture 28 - Wrist theory

Lecture 29 - Finger theory

Lecture 30 - Finger muscles

Lecture 31 - Spine anatomy and movements

Lecture 32 - Spine muscles

Lecture 33 - Spine problem

Lecture 34 - Hip anatomy and movements

Lecture 35 - Hip muscles

Lecture 36 - Hip problem

Lecture 37 - Knee anatomy and movements

Lecture 38 - Knee muscles

Lecture 39 - Knee problem

Lecture 40 - Ankle anatomy and movements

Lecture 41 - Ankle muscles

Lecture 42 - Ankle problem

Lecture 43 - Grasping- reaching- chains

Lecture 44 - D.O.F mobility, open/closed chain

Lecture 45 - Forward kinematics and workspace

Lecture 46 - 2R inverse kinematics

Lecture 47 - 3R kinematics forward and inverse

Lecture 48 - D-H parameters

Lecture 49 - Velocity and jacobian

Lecture 50 - 3R velocity

Lecture 51 - Tissues and types of tissues

Lecture 52 - Bone microstructure and cells

Lecture 53 - Properties of bones

Lecture 54 - Wolffs Law and Hookean behavior

Lecture 55 - Elastic properties and stress strain relations

Lecture 56 - Stress strain curve and mechanical properties of biological materials

Lecture 57 - Bending of Bones

Lecture 58 - Viscoelastic modelling

Lecture 59 - Maxwell Model

Lecture 60 - Voight Model

Lecture 61 - Kelvin model

Lecture 62 - Viscoelasticity in bones

Lecture 63 - Tissues and its constituents

Lecture 64 - Cartilages, ligaments and tendons

Lecture 65 - Stress strain relations in tendons

Lecture 66 - Tendon forces and factors affecting tendon property

Lecture 67 - Gliding resistance, tendon wrapping and friction forces

Lecture 68 - Enslaving - Intertendinous force transfer and motor units

Lecture 69 - Introduction to enslavement

Lecture 70 - Enslaving effects in finger force production - 1

Lecture 71 - Enslaving effects in finger force production - 2

Lecture 72 - Wrist posture and finger interdependence - 1

Lecture 73 - Wrist posture and finger interdependence - 2

Lecture 74 - Wrist posture and finger interdependence - 3

Lecture 75 - Measurement of orientation in 3D space - Devices

Lecture 76 - Rotation matrices in 2D and 3D

Lecture 77 - Animating using rotation matrices- Matlab Examples

Lecture 78 - Composite rotation matrix and relative orientations

Lecture 79 - Complex numbers and quaternions

Lecture 80 - Singularity, Gimbal Lock, Advantages and disadvantages of parameterization methods

Lecture 81 - Single finger kinematics measurement using IMU's

Lecture 82 - IMU based Full hand kinematics measurement system (HKMS)

Lecture 83 - Demonstration of the Hand Kinematics Measurement System (HKMS)

Lecture 84 - Introduction to Gait and running

NPTEL : Introduction to Synthetic Biology (Biotechnology)

Co-ordinators : Prof. Karthik Raman

- Lecture 1 - Introduction to Synthetic Biology - Day 1 Part 1
- Lecture 2 - Introduction to Synthetic Biology - Day 1 Part 2
- Lecture 3 - Introduction to Synthetic Biology - Day 1 Part 3
- Lecture 4 - Introduction to Synthetic Biology - Day 1 Part 4
- Lecture 5 - Introduction to Synthetic Biology - Day 2 Part 1
- Lecture 6 - Introduction to Synthetic Biology - Day 2 Part 2
- Lecture 7 - Introduction to Synthetic Biology - Day 2 Part 3
- Lecture 8 - Introduction to Synthetic Biology - Day 2 Part 4
- Lecture 9 - Introduction to Synthetic Biology - Day 3 Part 1
- Lecture 10 - Introduction to Synthetic Biology - Day 3 Part 2
- Lecture 11 - Introduction to Synthetic Biology - Day 3 Part 3
- Lecture 12 - Introduction to Synthetic Biology - Day 3 Part 4
- Lecture 13 - Introduction to Synthetic Biology - Day 4 Part 1
- Lecture 14 - Introduction to Synthetic Biology - Day 4 Part 2
- Lecture 15 - Introduction to Synthetic Biology - Day 4 Part 3
- Lecture 16 - Introduction to Synthetic Biology - Day 5 Part 1
- Lecture 17 - Introduction to Synthetic Biology - Day 5 Part 2
- Lecture 18 - Introduction to Synthetic Biology - Day 5 Part 3
- Lecture 19 - Introduction to Synthetic Biology - Day 5 Part 4
- Lecture 20 - Introduction to Synthetic Biology - Day 6 Part 1
- Lecture 21 - Introduction to Synthetic Biology - Day 6 Part 2
- Lecture 22 - Introduction to Synthetic Biology - Day 6 Part 3
- Lecture 23 - Introduction to Synthetic Biology - Day 7 Part 1
- Lecture 24 - Introduction to Synthetic Biology - Day 7 Part 2
- Lecture 25 - Introduction to Synthetic Biology - Day 7 Part 3
- Lecture 26 - Introduction to Synthetic Biology - Day 8 Part 1
- Lecture 27 - Introduction to Synthetic Biology - Day 8 Part 2
- Lecture 28 - Introduction to Synthetic Biology - Day 9 Part 1
- Lecture 29 - Introduction to Synthetic Biology - Day 9 Part 2
- Lecture 30 - Introduction to Synthetic Biology - Day 9 Part 3
- Lecture 31 - Introduction to Synthetic Biology - Day 10 Part 1

[Lecture 32 - Introduction to Synthetic Biology - Day 10 Part 2](#)

[Lecture 33 - Introduction to Synthetic Biology - Day 10 Part 3](#)

Lecture 1 - Introduction to Different OMICS Approaches and their Applications

Lecture 2 - Genetic Information in Prokaryotic

Lecture 3 - Databases and Web Resources to Store and Access the Biological Data

Lecture 4 - First and Second Generation Sequencing Technologies

Lecture 5 - Long Read Sequencing and Linked Read Sequencing - Part 1

Lecture 6 - Long Read Sequencing and Linked Read Sequencing - Part 2

Lecture 7 - Sequence Formats and Databases for Genomic Analysis

Lecture 8 - Introduction to Linux

Lecture 9 - File Handling and Remote Connectivity in Linux

Lecture 10 - Running Linux Commands and Installation of Genomic Packages

Lecture 11 - Introduction to R and Applications in Genomic Analysis

Lecture 12 - Publicly Available Tools and Need for Workstations for Genomic Analysis

Lecture 13 - Overview of Genomic and Transcriptomic Analysis

Lecture 14 - Genomic and Transcriptomic Analysis of an Organism with Case Studies

Lecture 15 - How to Collect and Confirm Sample of the Species to be Sequenced and Transcriptome Sequencing Approaches

Lecture 16 - Estimating the Amount of Sequencing Coverage for a Genome and Hybrid Sequencing Approaches

Lecture 17 - Types of Reads, Quality Filtering, Estimating the Genome Complexity and Heterozygosity

Lecture 18 - Genome Assembly and its Completion Status, Assembly Algorithms

Lecture 19 - Commonly Used Assembly Tools

Lecture 20 - Linked-Read Sequencing and Processing

Lecture 21 - Long Reads Analysis and Assembly Workflow

Lecture 22 - De novo Assembly Using Genomic and Transcriptomic Reads

Lecture 23 - Merging Assemblies to Create Hybrid Assembly and Determining the Quality of Assembly

Lecture 24 - Chromosomal Level Assembly and Case Studies

Lecture 25 - Identification and Annotation of Repeats in Genomes

Lecture 26 - De novo Transcriptome Assembly and Making the Coding Gene Set

Lecture 27 - Prediction of tRNA, rRNA and miRNA in a Genome

Lecture 28 - Functional Annotation and Identification of Metabolic Pathways in a Genome

Lecture 29 - Comprehensive Functional Annotation of Predicted Genes in a Genome

Lecture 30 - Functional Annotation of Predicted Genes by Alternate Methods

Lecture 31 - Methods and Steps to Perform the Evolutionary Analysis of a Genome

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

[Lecture 32 - Methods for Taxonomic Classification and Phylogeny Econstruction and Analysis](#)

[Lecture 33 - Epigenetics, ChIp-seq, Transcriptome and Microarrays for Regulation of Expression](#)

[Lecture 34 - Single Cell Genomics, 10X Chromium Linked-reads and Illumina Sequencing, Single Cell Gene Expression](#)

[Lecture 35 - Application of Multiomics Approaches in Human Health and Diseases Such as Cancer, Diabetes, etc.](#)

[Lecture 36 - Prokaryotic Genome Sequencing and Assembly Approaches](#)

[Lecture 37 - Gene Prediction Approaches and Common Methods for Bacterial Gene Prediction](#)

[Lecture 38 - Common Methods for Annotation of a Bacterial Genome, t-RNA, rRNA, Operon Prediction and Annotation](#)

[Lecture 39 - Phylogenetic Analysis of Bacterial Genomes](#)

[Lecture 40 - Metabolic and Comparative Analysis](#)

[Lecture 41 - Microbiome and Metagenome, Human, Organismal and Environmental Microbiomes](#)

[Lecture 42 - Sequencing and Assembly of Metagenomes, Gene Prediction, Annotation, MAGs - Part 1](#)

[Lecture 43 - Sequencing and Assembly of Metagenomes, Gene Prediction, Annotation, MAGs - Part 2](#)

[Lecture 44 - Taxonomic Analysis Using Amplicon Sequence Variants, Statistical Analysis](#)

Lecture 1 - Introduction to Homeostasis

Lecture 2 - Mechanisms of Homeostasis - Part 1

Lecture 3 - Mechanisms of Homeostasis - Part 2

Lecture 4 - Physiology of muscle - Part 1

Lecture 5 - Physiology of muscle - Part 2

Lecture 6 - Molecular Mechanism of muscle contractility - Part 1

Lecture 7 - Molecular Mechanism of muscle contractility - Part 2

Lecture 8 - How does the heart muscle work? - Part 1

Lecture 9 - How does the heart muscle work? - Part 2

Lecture 10 - Cardiac system : From stimuli to rhythmic muscle contraction - Part 1

Lecture 11 - Cardiac system : From stimuli to rhythmic muscle contraction - Part 2

Lecture 12 - Cardiac system : From stimuli to rhythmic muscle contraction - Part 3

Lecture 13 - Cardiac system : From stimuli to rhythmic muscle contraction - Part 4

Lecture 14 - Rhythmicity of heart beat - Part 1

Lecture 15 - Rhythmicity of heart beat - Part 2

Lecture 16 - Hemodynamics

Lecture 17 - Hemodynamics and Regulation - Part 1

Lecture 18 - Hemodynamics and Regulation - Part 2

Lecture 19 - Hemodynamics and Regulation - Part 3

Lecture 20 - Hemodynamics and Regulation - Part 4

Lecture 21 - Hemodynamics and Regulation - Part 5

Lecture 22 - Hemodynamics and Regulation - Part 6

Lecture 23 - Lymphatic system

Lecture 24 - Excretory system : Kidney - Part 1

Lecture 25 - Excretory system : Kidney - Part 2

Lecture 26 - Excretory system : Kidney - Part 3

Lecture 27 - Kidney and RBC production

Lecture 28 - Excretory system : Nephron - Part 1

Lecture 29 - Excretory system : Nephron - Part 2

Lecture 30 - Excretory system : Nephron - Part 2.1

Lecture 31 - Excretory system : Nephron - Part 3

- Lecture 32 - Excretory system : Regulation of Osmolarity and counter-current mechanism - Part 1
- Lecture 33 - Excretory system : Regulation of Osmolarity and counter-current mechanism - Part 2
- Lecture 34 - Excretory system : Regulation of Osmolarity and counter-current mechanism - Part 3
- Lecture 35 - Physiology and Introduction of Respiration - Part 1
- Lecture 36 - Physiology and Introduction of Respiration - Part 2
- Lecture 37 - Respiration - Part 1
- Lecture 38 - Respiration - Part 2
- Lecture 39 - Respiration - Part 3
- Lecture 40 - Respiration - Part 4
- Lecture 41 - Physiology of smooth muscles and digestive system - Part 1
- Lecture 42 - Physiology of smooth muscles and digestive system - Part 2
- Lecture 43 - Physiology of smooth muscles and digestive system - Part 3
- Lecture 44 - Physiology of smooth muscles and digestive system - Part 4
- Lecture 45 - Secretory functions of alimentary tract - Part 1
- Lecture 46 - Secretory functions of alimentary tract - Part 2
- Lecture 47 - Secretory functions of alimentary tract and Pancreas - Part 1
- Lecture 48 - Secretory functions of alimentary tract and Pancreas - Part 2
- Lecture 49 - Secretory functions of Pancreas and liver
- Lecture 50 - Secretory functions of Liver and Gallbladder
- Lecture 51 - Introduction to Endocrine system
- Lecture 52 - Pituitary gland and growth hormone secretion - Part 1
- Lecture 53 - Pituitary gland and growth hormone secretion - Part 2
- Lecture 54 - Thyroid gland - Part 1
- Lecture 55 - Thyroid gland - Part 2
- Lecture 56 - Hormones of adrenal cortex - Part 1
- Lecture 57 - Hormones of adrenal cortex - Part 2
- Lecture 58 - Physiology of Glucocorticoids - Part 1
- Lecture 59 - Physiology of Glucocorticoids - Part 2
- Lecture 60 - Course Summary

Lecture 1 - What is Biology ?

Lecture 2 - Pillars of Biology

Lecture 3 - Biology and the City

Lecture 4 - The Process of Science

Lecture 5 - A Tale of Forgotten Scientists - Part I

Lecture 6 - A Tale of Forgotten Scientists - Part II

Lecture 7 - Numbers and Scales in Biology - Part I

Lecture 8 - Numbers and Scales in Biology - Part II

Lecture 9 - Experimentation vs Theory_Discussion

Lecture 10 - How to Find Reliable Information ?

Lecture 11 - How to Read a Scientific Article ?

Lecture 12 - Biomolecules - Part I

Lecture 13 - Biomolecules - Part II

Lecture 14 - Central Dogma

Lecture 15 - Gene Regulation

Lecture 16 - Non-Coding RNA

Lecture 17 - Introduction to Cells

Lecture 18 - Our Favourite Cells - Part I

Lecture 19 - Our Favourite Cells - Part II

Lecture 20 - Cell Cycle

Lecture 21 - Cell Cycle Control

Lecture 22 - Cancer Biology (Guest Lecture) - Dr. Ramray Bhat (IISc)

Lecture 23 - Discussion on Cancer Biology - Dr. Ramray Bhat (IISc) and Dr. Divya Uma (Azim Premji University)

Lecture 24 - Genetics - I

Lecture 25 - Genetics - II

Lecture 26 - Genetics - III

Lecture 27 - Gene Mutations and Genetic Disorders (Guest Lecture) Dr. Antara Das, Azim Premji University

Lecture 28 - Studying Human Genetic Disorders using Transgenic Animals - Research talk (Guest Lecture)

Lecture 29 - Bead Microscopy (Guest Lecture) Dr. Procheta Mallik (ISPF and ThinkTac)

Lecture 30 - Molecular Biology Techniques

Lecture 31 - Bacterial DNA Isolation and PCR - Hands-on (Guest Lecture) Dr. Beena DB (Azim Premji University)

Lecture 32 - BT Cotton - Part 1 (Case study)

Lecture 33 - Molecular Biology Techniques - BT Cotton - Part 2 (Case study)

Lecture 34 - Introduction to Evolution

Lecture 35 - Evidences of Evolution

Lecture 36 - Mechanism of Evolution

Lecture 37 - Misconceptions about Evolution - Discussion

Lecture 38 - Human Evolution

Lecture 39 - Species, Speciation and Biodiversity - I

Lecture 40 - Species, Speciation and Biodiversity - II

Lecture 41 - Measuring Biodiversity (Tutorial)

Lecture 42 - Speciation

Lecture 43 - Speciation (Case studies)

Lecture 44 - Introduction to Ecological Interactions - Part 1

Lecture 45 - Ecological Interactions - Part 2

Lecture 46 - Ecological Interactions - Part 3

Lecture 47 - Mutualism - Figs (Case Study)

Lecture 48 - Seed Dispersal (Case study)

Lecture 49 - Introduction to Public Health (Guest Lecture) Dr. Abha Rao (Public Health Foundation of India)

Lecture 50 - Public Health in India (Guest Lecture) Dr. Abha Rao (Public Health Foundation of India)

Lecture 51 - Discussion on Public Health - Dr. Abha Rao (PHFI) and Mr. Pratush Brahma (University of Florida)

Lecture 52 - Public Health - Rotavirus (Case study)

Lecture 53 - Public Health - Malaria (Case study) - Part 1

Lecture 54 - Public Health - Malaria (Case study) - Part 2

Lecture 55 - Biology and Climate Change - Part 1

Lecture 56 - Biology and Climate Change - Part 2

Lecture 57 - Biology and Climate Change - Part 3

Lecture 58 - Biodiversity Conservation (Guest Lecture) Dr. Krishnapriya Tamma (Azim Premji University)

Lecture 59 - Discussion on Biology and Society

Lecture 60 - Discussion on Art and Science

Lecture 61 - Biology and Society - Case study on Stray Dogs

Lecture 62 - Nature Relatedness

Lecture 63 - Course Wrap-Up

Lecture 1 - History of Neuroscience : Introduction - Part 1

Lecture 2 - History of Neuroscience : Introduction - Part 2

Lecture 3 - Factors that produce discoveries

Lecture 4 - Importance of the 1950s in Neuroscience

Lecture 5 - Advances in Molecular Biology (Genes to DNA)

Lecture 6 - Discovery of the structure of the DNA

Lecture 7 - How DNA works

Lecture 8 - Molecular biology of the human brain

Lecture 9 - Signaling molecule: The First growth Factor

Lecture 10 - Nerve Growth Factor

Lecture 11 - Organizing the Connections

Lecture 12 - Axonal Transport

Lecture 13 - Signaling molecules: The First Neurotransmitter in the brain

Lecture 14 - The concept of Lock and Key

Lecture 15 - The Soup vs Sparks Debate

Lecture 16 - Intracellular Electrode, Neurotransmitter in the Brain, Dales Law

Lecture 17 - Early evidence of Acetylcholine and Glutamate

Lecture 18 - Early evidence of GABA and Serotonin

Lecture 19 - Catecholamine and Hormones

Lecture 20 - Second messengers and Hormones

Lecture 21 - Pheromones

Lecture 22 - Revolution in Cytology

Lecture 23 - Synapse and the 'Neuronism vs Reticularism' debate

Lecture 24 - Contributions by Rene Couteaux and George Koelle

Lecture 25 - Chemical Synapse

Lecture 26 - Synapse and the Neuromuscular Junction

Lecture 27 - The Electrical Synapse and Myelin

Lecture 28 - Physiology: The Action Potential - Part 1

Lecture 29 - Recording nerve impulses and single action potentials

Lecture 30 - Recording from nerve and plant cells

Lecture 31 - Recording Local circuits, Hodgkin and Huxely contributions - Part 1

Lecture 32 - Hodgkin and Huxely model - Part 2 and Kenneth Cole Contributions

Lecture 33 - GHK equation and HH action potentials

Lecture 34 - First Electrophysiological Evidence for Synaptic Transmission

Lecture 35 - Bernard Katz

Lecture 36 - End-Plate Potential and Synaptic Quanta

Lecture 37 - Eccles and Spinal motor neuron

Lecture 38 - Invertebrate simple systems: Aplysia

Lecture 39 - Other studies of sensory responses

Lecture 40 - Legacy of Golgi and Ramo`n y Cajal

Lecture 41 - Dynamic polarization of Neuron

Lecture 42 - Modern Research

Lecture 43 - Synaptic Integration and Action Potential Initiation

Lecture 44 - Active properties of dendrites

Lecture 45 - Dendritic dominance

Lecture 46 - Dendritic spines

Lecture 47 - Rethinking the concept of Neuron Doctrine

Lecture 48 - Muscle spindles

Lecture 49 - Spinal cord pathways

Lecture 50 - Retinal Processing

Lecture 51 - Keffler Hartline

Lecture 52 - Stephen Kuffler and Horace Barlow

Lecture 53 - Expansion of the Reflex concept

Lecture 54 - Central Pptern generators

Lecture 55 - The cortical column

Lecture 56 - Vernon Mountcastle

Lecture 57 - Central Visual Processing

Lecture 58 - Central Visual Processing and Feature Detectors

Lecture 59 - Intracellular recordings from the brain - Part 1

Lecture 60 - Intracellular recordings from the brain - Part 2

Lecture 61 - Two motor systems

Lecture 62 - Auditory cortex and The pattern theory of olfaction

Lecture 63 - Arousal and Reticular activating system

Lecture 64 - Sleep and Rapid Eye Movements

- Lecture 65 - Operant Conditioning by brain stimulation
- Lecture 66 - Hypothalamus and Feeding Behavior
- Lecture 67 - Brain as a gland
- Lecture 68 - Hypothalamic-Neurohypophyseal System
- Lecture 69 - Hypothalamic-Adenohypophyseal System
- Lecture 70 - Founding Modern Neuroanatomy
- Lecture 71 - Psychology and Ethology
- Lecture 72 - Karl Lashley
- Lecture 73 - Donald Hebb
- Lecture 74 - Limbic system- Limbic Lobe and Papez Circuit
- Lecture 75 - Limbic system-Kluver-Bucy Syndrome
- Lecture 76 - The Limbic system and Amygdala
- Lecture 77 - The Hippocampus and Patient H.M
- Lecture 78 - Brenda Milner
- Lecture 79 - Neurology: Foundations of Brain Imaging
- Lecture 80 - The Neurological unit of the Boston City Hospital
- Lecture 81 - Derek Denny-Brown, Raymond Adams and C. Miller Fisher
- Lecture 82 - Montreal Neurological Institute
- Lecture 83 - Cerebral Circulation
- Lecture 84 - Spreading depression of Leo and Migraine
- Lecture 85 - The Eradication of Polio
- Lecture 86 - Origin of Neurosurgery
- Lecture 87 - Harvey Cushing
- Lecture 88 - Pituitary Surgery
- Lecture 89 - Stereotaxy
- Lecture 90 - Epilepsy
- Lecture 91 - Psychosurgery
- Lecture 92 - Antipsychotic Drugs
- Lecture 93 - Reserpine
- Lecture 94 - Monoamine Oxidase Inhibitors
- Lecture 95 - Lithium
- Lecture 96 - Benzodiazepines
- Lecture 97 - Stress

- Lecture 1 - Introduction to Genomics - 1
- Lecture 2 - Introduction to Genomics - 2
- Lecture 3 - Advent of NGS
- Lecture 4 - Genome Assembly: Few Concepts and Terminology
- Lecture 5 - Genome Assembly Approaches
- Lecture 6 - Pyrosequencing
- Lecture 7 - Reversible Chain Termination Based Sequencing
- Lecture 8 - Ph Sequencing
- Lecture 9 - Sequencing by Ligation (Solid)
- Lecture 10 - Sequencing by Ligation (Complete Genomics)
- Lecture 11 - Other Short-Read Sequencing Technologies - Part 1
- Lecture 12 - Other Short-Read Sequencing Technologies - Part 2
- Lecture 13 - Long-Read Sequencing
- Lecture 14 - Single Molecule Long-Read Sequencing
- Lecture 15 - The Omics Data Avalanche
- Lecture 16 - Evolutionary Biology and Genomics
- Lecture 17 - Ancient Genomics
- Lecture 18 - Whole-Genome Duplication
- Lecture 19 - Tests of Selection
- Lecture 20 - Genomics in Experimental Evolution
- Lecture 21 - Making Sense of Genomic Sequences
- Lecture 22 - Transcriptomics: New Tools Leading to Deeper Insights
- Lecture 23 - Single Cell Transcriptomics and Beyond
- Lecture 24 - Proteomics: A Brief Introduction
- Lecture 25 - Protein Quantification
- Lecture 26 - Introduction to Linux for Omics
- Lecture 27 - The Linux Command Line Interface
- Lecture 28 - Using the CLI-1: NCBI Datasets
- Lecture 29 - Using the CLI-2: Short Read Archive Toolkit
- Lecture 30 - UCSC and IGV genome browsers
- Lecture 31 - Mega Omics Projects

[Lecture 32 - Genotype-Tissue Expression \(GTEx\)](#)

[Lecture 33 - Encyclopedia of DNA Element \(ENCODE\)](#)

[Lecture 34 - The Cancer Genome Atlas \(TCGA\)](#)

[Lecture 35 - Eukaryotic Genome Sequencing Consortia](#)

[Lecture 36 - The Postomics Era](#)

[Lecture 37 - RNA-Seq Differential Expression Analysis](#)

[Lecture 38 - Gene Loss and its Consequences](#)

[Lecture 39 - Establishing Gene loss: Few Examples](#)

[Lecture 40 - Course Summary](#)

Lecture 1 - Statistics - Motivation

Lecture 2 - Statistics - Introduction

Lecture 3 - Statistics: Definition and Terminology - Part I

Lecture 4 - Statistics: Definition and Terminology - Part II

Lecture 5 - Data: Primary vs Secondary

Lecture 6 - Data: Quantitative vs Qualitative

Lecture 7 - Data: Presentation

Lecture 8 - Data: Static vs Dynamic

Lecture 9 - Data: Box Plot and Spider Graphs

Lecture 10 - Data: Summarising Data

Lecture 11 - Probability: Event and Sample space

Lecture 12 - Probability: Mutually exclusive and Independent Events

Lecture 13 - Probability: Random Variables

Lecture 14 - Probability: Expectation of Random Variable

Lecture 15 - Probability: Variance of Random Variable

Lecture 16 - Probability Distribution: Binomial, Poisson, Bernoulli

Lecture 17 - Probability Distribution: Normal Distribution

Lecture 18 - Central Limit Theorem: Statement

Lecture 19 - Central Limit Theorem: Illustration

Lecture 20 - Confidence Interval

Lecture 21 - Determining Sample Size

Lecture 22 - Hypothesis Test: Introduction

Lecture 23 - Hypothesis Test: Example

Lecture 24 - Hypothesis: P value

Lecture 25 - Hypothesis: Type 2 error

Lecture 26 - Hypothesis: Chi square Distribution - Part 1

Lecture 27 - Hypothesis: Chi square Distribution - Part 2

Lecture 28 - Hypothesis: Probability Plots

Lecture 29 - Hypothesis: Contingency Table Test

Lecture 30 - Multivariate Hypothesis: Two Sample Test

Lecture 31 - Multivariate Hypothesis: Paired T test

- Lecture 32 - Multivariate Hypothesis: Paired vs Unpaired Testing
- Lecture 33 - Multivariate Hypothesis: Two population variances
- Lecture 34 - Multivariate Hypothesis: Multiple Random Variables - Part 1
- Lecture 35 - Multivariate Hypothesis: Multiple Random Variables - Part 2
- Lecture 36 - Multivariate Hypothesis: Covariance and Correlation
- Lecture 37 - One Way ANOVA: Motivation and Assumptions
- Lecture 38 - One Way ANOVA: Fixed and Random effects Model
- Lecture 39 - One Way ANOVA: Derivation and Confidence Interval
- Lecture 40 - One Way ANOVA: Confidence Interval
- Lecture 41 - One Way ANOVA: Unbalanced Experiment and Residuals
- Lecture 42 - One Way ANOVA: Interpretation of Results
- Lecture 43 - Statistical Modeling: Introduction
- Lecture 44 - Statistical Modeling: Linear Regression Derivation
- Lecture 45 - Statistical Modeling: Linear Regression - Assumption and Residuals
- Lecture 46 - Statistical Modeling: Multi Linear Regression
- Lecture 47 - Statistical Modeling: Logistic Regression
- Lecture 48 - Statistical Modeling: Cross Entropy Loss
- Lecture 49 - Statistical Modeling: Gradient Descent
- Lecture 50 - Statistical Modeling: One Way Anova via Linear Regression
- Lecture 51 - Design Of Experiments: Randomised Complete Block Design - Part 1
- Lecture 52 - Design Of Experiments: Randomised Complete Block Design - Part 2
- Lecture 53 - RCBD: Math Formulation and Derivation
- Lecture 54 - RCBD: Necessity and Application
- Lecture 55 - Latin Square: Introduction
- Lecture 56 - Latin Square: Math and Formulation
- Lecture 57 - Graeco - Latin Square
- Lecture 58 - Interaction Among Variables
- Lecture 59 - Two-Way ANOVA: Introduction - Part 1
- Lecture 60 - Two-Way ANOVA: Introduction - Part 2
- Lecture 61 - Two-Way ANOVA: Math and Formulation
- Lecture 62 - Factorial Design: 2^2 Experiments
- Lecture 63 - Factorial Design: 2^k Experiments - Part 1
- Lecture 64 - Factorial Design: 2^k Experiments - Part 2

[Lecture 65 - Factorial Design: Blocking](#)

[Lecture 66 - Introduction to Python Programming for Biomedical Engineers](#)

Lecture 1 - Basic concepts in microscopy - 1

Lecture 2 - Basic concepts in microscopy - 2

Lecture 3 - Dark-field and phase contrast microscopy

Lecture 4 - Differential interference contrast and polarization

Lecture 5 - Fluorescence and confocal microscopy

Lecture 6 - Transmission electron microscopy

Lecture 7 - Transmission electron microscopy cont. and scanning electron microscopy

Lecture 8 - Basic concepts - 1

Lecture 9 - Basic concepts - 2

Lecture 10 - GM counting and Scintillation counting

Lecture 11 - Scintillation counting continued

Lecture 12 - Autoradiography and RIA

Lecture 13 - Safety aspects and applications

Lecture 14 - Introduction and Basic concepts in chromatography - 1

Lecture 15 - Basic concepts in chromatography - 2

Lecture 16 - Low-pressure liquid chromatography (LPLC) and high performance liquid chromatography (HPLC)

Lecture 17 - Ion-exchange chromatography

Lecture 18 - Gel-filtration chromatography

Lecture 19 - Affinity chromatography

Lecture 20 - Gas-liquid chromatography

Lecture 21 - Basic concepts in electrophoresis

Lecture 22 - Horizontal and vertical gel electrophoresis

Lecture 23 - Native gel electrophoresis and SDS-PAGE

Lecture 24 - Isoelectric focusing (IEF), 2-D gel electrophoresis and protein detection methods

Lecture 25 - Electrophoresis of nucleic acids

Lecture 26 - Immunoelectrophoresis and capillary electrophoresis

Lecture 27 - Introduction and Basic Concepts - 1

Lecture 28 - Basic concepts - 2

Lecture 29 - Types of centrifuges and analytical ultracentrifugation method

Lecture 30 - Separation methods in preparative ultracentrifuges

Lecture 31 - Types of rotors

[Lecture 32 - Types of rotors cont. and care of rotors](#)

[Lecture 33 - Introduction and basic concepts](#)

[Lecture 34 - UV-Visible spectroscopy](#)

[Lecture 35 - Infrared and fluorescence spectroscopy](#)

[Lecture 36 - Circular dichroism \(CD\) spectroscopy](#)

[Lecture 37 - Nuclear magnetic resonance \(NMR\) spectroscopy and X-ray crystallography](#)

[Lecture 38 - Atomic spectroscopy and mass spectrometry](#)

[Lecture 39 - Polymerase chain reaction\(PCR\)](#)

[Lecture 40 - DNA sequencing methods](#)

[Lecture 41 - Enzyme linked immunosorbent assay \(ELISA\)](#)

Lecture 1 - Introduction to Nano

Lecture 2 - Nano-Biomimicry

Lecture 3 - Synthesis of nanomaterials by Physical and Chemical Methods

Lecture 4 - Synthesis of nanomaterials by Biological Methods

Lecture 5 - Characterisation of Nanomaterials

Lecture 6 - DNA Nanotechnology

Lecture 7 - Protein and Glyco Nanotechnology

Lecture 8 - Lipid Nanotechnology

Lecture 9 - Bio-Nanomachines

Lecture 10 - Carbon nanotubes and Its Bio-Applications

Lecture 11 - Nanomaterials for Cancer Diagnosis

Lecture 12 - Nanomaterials for Cancer therapy

Lecture 13 - Nanotechnology in Tissue Engineering

Lecture 14 - Nano artificial cells

Lecture 15 - Nanotechnology in Organ Printing

Lecture 16 - Nanotechnology in Point-of-Care Diagnostics

Lecture 17 - Nano-Pharmacology and Drug Targeting

Lecture 18 - Cellular uptake mechanisms of nanomaterials

Lecture 19 - In vitro Methods to study antibacterial and anticancer properties of nanomaterials

Lecture 20 - Nanotoxicology

- Lecture 1 - Life Cycle of an Angiosperm
- Lecture 2 - Characteristics of Plant Growth and Development - I
- Lecture 3 - Characteristics of Plant Growth and Development - II
- Lecture 4 - Molecular Genetics of Plant Development - I
- Lecture 5 - Molecular Genetics of Plant Development - II
- Lecture 6 - Molecular Genetics of Plant Development - III
- Lecture 7 - Molecular Genetics of Plant Development - IV
- Lecture 8 - Molecular Genetics of Plant Development (Continued...) - I
- Lecture 9 - Molecular Genetics of Plant Development (Continued...) - II
- Lecture 10 - Molecular Genetics of Plant Development (Continued...) - III
- Lecture 11 - Root Development
- Lecture 12 - Root Development (Continued...)
- Lecture 13 - Root Development (Vascular Development)
- Lecture 14 - Root Branching: Lateral Root Development
- Lecture 15 - Shoot Development: SAM Maintenance
- Lecture 16 - Shoot Development: Organogenesis
- Lecture 17 - Shoot Development: Leaf Development
- Lecture 18 - Shoot Development: Flowering
- Lecture 19 - Cell-Cell Communication During Plant Development
- Lecture 20 - Techniques Used in Lab

NPTEL : NOC:Structural Biology (Biotechnology)

Co-ordinators : Prof. Saugata Hazra

Lecture 1 - Introduction: Why to Study Structural Biology

Lecture 2 - Introduction to Biological Macromolecules

Lecture 3 - Introduction: Decoding Biological Macromolecules

Lecture 4 - Introduction: Genome Sequencing

Lecture 5 - Introduction: Post Genomic Era

Lecture 6 - Amino acids and their properties

Lecture 7 - Protein: Protein Chemistry, Chirality, Peptide bond and Levels of protein structures

Lecture 8 - Protein: Dihedral angles, Peptide bond and Ramachandran Plot

Lecture 9 - Protein: Super Secondary Structures, Motif, Domains, Non-covalent interactions

Lecture 10 - Protein: Folding of Protein, Thermodynamics and Kinetics of protein folding, Characterization of Proteins

Lecture 11 - Introduction to Structural Biology Techniques - Part I

Lecture 12 - Introduction to Structural Biology Techniques - Part II

Lecture 13 - X-ray Crystallography: Crystallization - Part I

Lecture 14 - X-ray Crystallography: Crystallization - Part II

Lecture 15 - X-ray Crystallography: Crystal Mounting

Lecture 16 - X-ray Crystallography: Production of X-ray and its properties

Lecture 17 - X-ray Crystallography: Journey to 3D land

Lecture 18 - X-ray Crystallography: Crystal Symmetry

Lecture 19 - X-ray Crystallography: Instrumentation in X-ray Crystallography

Lecture 20 - X-ray Crystallography: Data collection and processing

Lecture 21 - X-ray Crystallography: Data Analysis - Part I

Lecture 22 - X-ray Crystallography: Data Analysis - Part II

Lecture 23 - X-ray Crystallography: Phase Problem - Part I

Lecture 24 - X-ray Crystallography: Phase Problem - Part II

Lecture 25 - X-ray Crystallography: Refinement and Structure deposition to PDB

Lecture 26 - Introduction to Spectroscopy and NMR

Lecture 27 - Basic Principles of NMR and Instrumentation

Lecture 28 - NMR Sample Preparation and Chemical Shift related concepts

Lecture 29 - Factors effecting NMR Spectra (1D and 2D)

Lecture 30 - 2D and 3D NMR Spectroscopy focusing on protein structure

Lecture 31 - Introduction to Spectroscopy

Lecture 32 - UV-Vis and CD spectroscopy

Lecture 33 - Fluorescence Spectroscopy and Green Fluorescence Protein (GFP)

Lecture 34 - Infrared and Raman Spectroscopy for protein

Lecture 35 - Raman Spectroscopy, Raman Microscopy and Raman Crystallography for studying protein

Lecture 36 - Introduction to Microscopy

Lecture 37 - Functioning details of Cryo Electron Microscopy (Cryo EM)

Lecture 38 - Cryo Electron Microscopy: Data Collection and Analysis

Lecture 39 - A concise story of advancement Cryo-EM

Lecture 40 - Protein Data Bank

Lecture 41 - History of Molecular Visualizations of Biological Macromolecules

Lecture 42 - Description of structure related files (.pdb, .mmCIF, .mtz, etc.)

Lecture 43 - Demonstration of COOT

Lecture 44 - 3D visualization using Pymol

Lecture 45 - Demonstration of Pymol

Lecture 46 - Why we need MD Simulation

Lecture 47 - Molecular Dynamic Simulation Process - Part I

Lecture 48 - Molecular Dynamic Simulation Process - Part II

Lecture 49 - Molecular Dynamic Simulation Process - Part III

Lecture 50 - Application of Molecular Dynamic Simulation

Lecture 51 - What, How and Which of Protein Engineering

Lecture 52 - How to make logical Protein Engineering: Process of Rational design

Lecture 53 - Success story of Rational Protein designing: Focusing on De Novo Process

Lecture 54 - Designing Protein by mimicking nature: Process of Directed Evolution

Lecture 55 - Achievement, Challenges, and Future direction in the field of Protein Engineering

Lecture 56 - Introduction to Structure Based Drug Discovery (SBDD)

Lecture 57 - Rational Drug Discovery

Lecture 58 - Docking Based Virtual Screening: Progress, Challenges and Future perspective

Lecture 59 - What makes a small molecule an ideal drug: Developing in silico ADMETox Model

Lecture 60 - Structure Based Drug Discovery: Case study and Conclusion

Lecture 1 - Introduction to Learning and Memory - I : Historical perspective

Lecture 2 - Introduction to Learning and Memory - II : Classification

Lecture 3 - Associative Learning I : Rules of Associative learning

Lecture 4 - Associative learning II : Garcia and Koelling's Experiment, Kamin's Blocking Experiment

Lecture 5 - Introduction to the Rescorla Wagner Model

Lecture 6 - Application of Rescorla Wagner Model - I

Lecture 7 - Application of Rescorla Wagner Model - II

Lecture 8 - Application of Rescorla Wagner Model - III

Lecture 9 - Application of Rescorla Wagner Model - IV

Lecture 10 - Limitations of Rescorla Wagner Model

Lecture 11 - Introduction of Reinforcement Learning - I : Thorndike's view, Tolman's views, Skinner Box

Lecture 12 - Introduction of Reinforcement Learning - II : Classification, Thorndike's view, Tolman's views, Skinner Box (Continued...)

Lecture 13 - Introduction of Reinforcement Learning - III : Understanding scheduling of reinforcers in operant conditioning

Lecture 14 - Sign Tracking vs Goal Oriented/Tracking; Linking complex behaviors to simple molecules

Lecture 15 - Sign Tracking vs Goal Oriented; Learning Linking complex behaviors to simple molecules - II

Lecture 16 - Memory in Molecular Terms - I : Protein synthesis in memory consolidation

Lecture 17 - Memory in Molecular Terms - II : Long term potentiation

Lecture 18 - Memory in Molecular Terms - III : Properties of a memory molecule

Lecture 19 - Memory in Molecular Terms - IV : Remote memory and its characteristics

Lecture 20 - Memory in Molecular Terms - V : Selective labelling of memory encoding neurons and their manipulation

Lecture 1 - Drug Delivery Introduction and Pharmacokinetics

Lecture 2 - Pharmacokinetics (Continued...)

Lecture 3 - Pro-drugs and Polymers Introduction

Lecture 4 - Polymers - Synthesis

Lecture 5 - Polymers - Properties

Lecture 6 - Biomedical Polymers

Lecture 7 - Biodegradable Polymers and Polymer Drug Conjugates - I

Lecture 8 - Polymer Drug Conjugates - II

Lecture 9 - Research Paper Discussion and Diffusion Controlled Systems

Lecture 10 - Controlled Release: Reservoir System - I

Lecture 11 - Controlled Release: Reservoir Systems and Non-erodible Systems

Lecture 12 - Controlled Release: Non-erodible Systems and Erodible systems

Lecture 13 - Math Exercise

Lecture 14 - Hydrogels - I

Lecture 15 - Hydrogels - II

Lecture 16 - Hydrogels - III

Lecture 17 - Hydrogels - IV

Lecture 18 - Nano and Micro-particles - I

Lecture 19 - Nano and Micro-particles - II

Lecture 20 - Nano and Micro-particles - III

Lecture 21 - Nano and Micro-particles - IV

Lecture 22 - Nano and Micro-particles - V

Lecture 23 - Nano and Micro-particles - VI

Lecture 24 - Nano and Micro-particles - VII

Lecture 25 - Protein Adsorption - I

Lecture 26 - Protein Adsorption - II

Lecture 27 - Protein Adsorption - III

Lecture 28 - Tissue Engineering - I

Lecture 29 - Tissue Engineering - II

Lecture 30 - Tissue Engineering - III

Lecture 31 - Drug Delivery in Tissue Engineering - I

- Lecture 32 - Drug Delivery in Tissue Engineering - II
- Lecture 33 - Implant Associated Infections - I
- Lecture 34 - Implant Associated Infections - II
- Lecture 35 - Route Specific Delivery: Oral Route - I
- Lecture 36 - Route Specific Delivery: Oral Route - II
- Lecture 37 - Route Specific Delivery: Oral and Subcutaneous Route
- Lecture 38 - Route Specific Delivery: Intramuscular, Transdermal - I
- Lecture 39 - Route Specific Delivery: Transdermal - II
- Lecture 40 - Route Specific Delivery: Transdermal and Inhalation Route
- Lecture 41 - Route Specific Delivery: Inhalation - II, Buccal and Rectal Administration
- Lecture 42 - Research Paper Discussion: Dry Powder Particle Delivery
- Lecture 43 - Route Specific Delivery: Intra-articular and Intravenous Administration
- Lecture 44 - Intravenous Administration: Approved Nanocarriers and Immune System
- Lecture 45 - Immune System - II
- Lecture 46 - Complement System and Blood Clotting
- Lecture 47 - Blood Clotting and Hemocompatibility of Materials; Adaptive Immune Response
- Lecture 48 - Adaptive Immune Response and Vaccine
- Lecture 49 - Vaccines
- Lecture 50 - Vaccines and Immuno-isolated Cell Therapy
- Lecture 51 - Immuno-isolated Cell Therapy
- Lecture 52 - Immuno-isolated Cell and Gene Therapy
- Lecture 53 - Gene Delivery: Vectors
- Lecture 54 - Gene Delivery: Polymers
- Lecture 55 - Genes as Vaccines
- Lecture 56 - Vaccines: Gene Delivery and Other Variants
- Lecture 57 - Cancer Vaccines
- Lecture 58 - Cancer Vaccine: Immunotherapy
- Lecture 59 - Responsive Delivery Systems - I
- Lecture 60 - Responsive Delivery Systems - II
- Lecture 61 - Targeted Drug Delivery System
- Lecture 62 - Targeted Drug Delivery System: Research Paper Discussion
- Lecture 63 - Nanotoxicology and Translation Pathways

Lecture 1 - Introduction

Lecture 2 - Substrate

Lecture 3 - Substrate (Continued...)

Lecture 4 - Introduction to cleanroom

Lecture 5 - Contamination and surface cleaning

Lecture 6 - Advanced cleaning techniques

Lecture 7 - Defects

Lecture 8 - Diffusion

Lecture 9 - Diffusion - Advanced Concepts

Lecture 10 - Ion Implantation

Lecture 11 - Ion Implantation (Continued...)

Lecture 12 - Native Films

Lecture 13 - Native Films: Advanced Concepts

Lecture 14 - Native Films: Defects at Si/SiO₂ interface

Lecture 15 - Methods and Some Definitions

Lecture 16 - Chemical Vapor Deposition: Basics

Lecture 17 - Chemical Vapor Deposition: Precursor Transport

Lecture 18 - Chemical Vapor Deposition: Types of CVD Equipment

Lecture 19 - Chemical Vapor Deposition: Nucleation and Growth

Lecture 20 - Chemical Vapor Deposition: Other Details

Lecture 21 - Atomic Layer Deposition

Lecture 22 - Atomic Layer Deposition (Continued...)

Lecture 23 - Physical Vapor Deposition: Basics

Lecture 24 - Physical Vapor Deposition: Evaporation

Lecture 25 - Physical Vapor Deposition: Sputtering

Lecture 26 - Metallization: Contact resistance

Lecture 27 - Metallization: Electromigration and Epilogue

Lecture 28 - Pattern Transfer Basics

Lecture 29 - Optical lithography basics: resist process - 1

Lecture 30 - Optical lithography basics: resist process - 2

Lecture 31 - Optical Lithography: Contact and Proximity printing

- Lecture 32 - Optical Lithography: Stepper and Scanner
- Lecture 33 - Projection Lithography: Image formation basics
- Lecture 34 - Projection Lithography: Image formation in photoresist
- Lecture 35 - Optical lithography: Surface Reflection
- Lecture 36 - Optical Lithography: Mask Technology
- Lecture 37 - Lithography process technology glossary
- Lecture 38 - Optical Lithography: Resolution enhancement
- Lecture 39 - Electron beam lithography: Basics
- Lecture 40 - Electron beam lithography: Resist process
- Lecture 41 - Emerging lithography techniques
- Lecture 42 - Etching Figures of Merit
- Lecture 43 - Wet etching Basics
- Lecture 44 - Wet Etching Recipes
- Lecture 45 - Wet Etching Recipes
- Lecture 46 - Dry etch: Plasma Basics
- Lecture 47 - Dry etch: Plasma etching basics
- Lecture 48 - Dry etch: Plasma tool configuration
- Lecture 49 - Dry etch: Etch mechanism
- Lecture 50 - Dry etch: Etch chemistry
- Lecture 51 - Chemical Mechanical Polishing (CMP): Basics
- Lecture 52 - Chemical Mechanical Polishing (CMP): Tool and process
- Lecture 53 - Design for Manufacturability - 1
- Lecture 54 - Design for Manufacturability - 2
- Lecture 55 - Design for Manufacturability: Case study
- Lecture 56 - Process integration
- Lecture 57 - PV integration
- Lecture 58 - CMOS integration
- Lecture 59 - Lab demo: Silicon Nitride cantilever fabrication - 1
- Lecture 60 - Lab demo: Silicon Nitride cantilever fabrication - 2
- Lecture 61 - CMOS process for photonics application

**NPTEL : NOC:Optical Spectroscopy and Microscopy: Fundamentals of Optical Measurements and Instrumentation
(Biotechnology)**

Co-ordinators : Prof. Balaji Jayaprakash

- Lecture 1 - Optical Focus and Localisation of Light
- Lecture 2 - Relating Photon's Momentum to Spot Size
- Lecture 3 - Shortest Pulse of Light: How fast can we shutter the light?
- Lecture 4 - Behaviour of light through polarizers: Introduction
- Lecture 5 - Nature of Light: Introduction to Photo Multiplier Tubes
- Lecture 6 - Revisiting Polarisation Through Ket Vectors
- Lecture 7 - Light through Polarisers: Detailed Description - I
- Lecture 8 - Light through Polarisers: Detailed Description - II
- Lecture 9 - Time Dependent Perturbation Theory (TDPT): Overview
- Lecture 10 - TDPT in Steps-1: Unperturbed and Perturbed Hamiltonian
- Lecture 11 - TDPT in Steps-2: Introducing the switch and first approximation
- Lecture 12 - TDPT in Steps-3: Finding the co-efficients
- Lecture 13 - Fermi's Golden Rule
- Lecture 14 - Beer Lambert's Law from TDPT
- Lecture 15 - Einstein's Phenomenology
- Lecture 16 - Einstein's Coefficients, Fluorescence and Lifetime
- Lecture 17 - Fock States and Photonic Treatment of Light
- Lecture 18 - Operators in Fock State Space
- Lecture 19 - Light Matter Interaction and Rudimentary Feynman Diagrams
- Lecture 20 - Emergence of Spontaneous and Stimulated Emission Processes
- Lecture 21
- Lecture 22
- Lecture 23
- Lecture 24
- Lecture 25
- Lecture 26 - Introduction to LASER
- Lecture 27 - LASER population dynamics
- Lecture 28 - LASER population dynamics - Part- 2
- Lecture 29 - Real world LASER and characteristics of LASER emission
- Lecture 30 - Temporal and Spatial Coherence

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

- Lecture 31 - Transverse and Longitudinal modes of LASER
- Lecture 32 - Pulsed LASER
- Lecture 33 - Q-switching in detail
- Lecture 34 - Q-switching in detail - Part 2
- Lecture 35 - Basics of mode locking
- Lecture 36 - Basics of mode locking - Part 2
- Lecture 37 - Pulse compression
- Lecture 38 - Real world system (Mode lock Part-2)
- Lecture 39 - TEM mode
- Lecture 40 - Alignment basics
- Lecture 41 - Non-Linear Optics
- Lecture 42 - Confocal Detection
- Lecture 43 - Interference Filters
- Lecture 44 - Laser Scanning System - 1
- Lecture 45 - Laser Scanning System - 2
- Lecture 46 - Alignment of Moving Beams
- Lecture 47 - Decoding an Objective Lens - 1
- Lecture 48 - Decoding an Objective Lens - 2
- Lecture 49 - Designing Lens Systems
- Lecture 50 - Astigmatism and Field Curvature
- Lecture 51 - Intro to Lab Session
- Lecture 52 - Optics in LAB: Aligning light through an optical fiber - 1
- Lecture 53 - Optics in Lab: Telescope
- Lecture 54 - Kinematic Mounts
- Lecture 55 - Alignment with out iris
- Lecture 56 - Fluorescence Spectrometer - 1
- Lecture 57 - Fluorescence Spectrometer - 2
- Lecture 58 - Ti:Sapphire Laser and Two Photon Fluorescence

Lecture 1 - Introduction to Cell Biology, Cell components, organization and processes - Part I

Lecture 2 - Introduction to Cell Biology, Cell components, organization and processes - Part II

Lecture 3 - DNA: The genetic material - Part I

Lecture 4 - DNA: The genetic material - Part II

Lecture 5 - Regulation of the cell cycle - Part I

Lecture 6 - Regulation of the cell cycle - Part II

Lecture 7 - Checkpoints: The DNA damage and DNA replication checkpoints

Lecture 8 - The Ubiquitin Proteasome system

Lecture 9 - S-phase: Regulation of entry into S-phase and DNA Replication

Lecture 10 - DNA replication - Part I

Lecture 11 - DNA Replication - Part II

Lecture 12 - DNA Replication - Part III

Lecture 13 - DNA Replication - Part IV

Lecture 14 - Mitosis - Part I

Lecture 15 - Cytokinesis

Lecture 16 - Aging and Senescence

Lecture 17 - Apoptosis - Part I

Lecture 18 - Apoptosis - Part II

Lecture 19 - Meiosis - Part I

Lecture 20 - Meiosis - Part II

Lecture 21 - Nuclear organization

Lecture 22 - SMC proteins and chromosome organization - Real-Time imaging of DNA loop-extrusion by SMC complexes

Lecture 23 - The cohesin complex and its functions - The mysterious biological function of chromosome loops

Lecture 24 - Chromatin organization

Lecture 25 - SMC proteins and chromosome organization - Introduction

Lecture 26 - Meiosis - Part III

Lecture 27 - Mitosis - Part II

Lecture 28 - Cell diversity and properties of specialized cells-Budding yeast as a model system

Lecture 29 - The Plant Cell

Lecture 30 - Stem cells - Part I Intro-SL

Lecture 31 - Stem cells - Part II

[Lecture 32 - Nerve cells](#)

[Lecture 33 - The Cancer Cell](#)

Lecture 1 - Course Introduction - I

Lecture 2 - Course Introduction - II

Lecture 3 - Neuro anatomy for Neurosurgery

Lecture 4 - Neural Implant Fabrication: PVD - I

Lecture 5 - Neural Implant Fabrication: PVD - II

Lecture 6 - Rodent Neuroanatomy

Lecture 7 - Basics of BCI and Signal Processing

Lecture 8 - Neural Implant Fabrication: Sputtering and CVD

Lecture 9 - Principles of Stereotactic Rodent MicroNeurosurgery

Lecture 10 - Neural Signal Processing: Demonstrations

Lecture 11 - Neural Implant Fabrication: Photolithography - I

Lecture 12 - Neural Implant Fabrication: Photolithography - II

Lecture 13 - Craniotomy and Stereotactic Implantation Surgeries

Lecture 14 - Lithography Numericals

Lecture 15 - IDE Patterning

Lecture 16 - Etching

Lecture 17 - Introduction to Cleanroom and Gowning

Lecture 18 - E-Beam Evaporation Demonstration

Lecture 19 - Craniotomy and Cranial Window Surgeries

Lecture 20 - Flexible MEA: Introduction and Process Flow

Lecture 21 - Flexible MEA: EIB, Characterization and Analyses

Lecture 22 - Stereotactic Implantation Surgeries

Lecture 23 - Sputtering Demonstration

Lecture 24 - 3D Printing - Part I

Lecture 25 - Bioresorbable Microelectrode Array-based System

Lecture 26 - Fundamentals of Spinal Neuroanatomy

Lecture 27 - 3D Printing - Part II

Lecture 28 - Neural Implant - Microneedle

Lecture 29 - Spinal Cord Structure, and Circuits

Lecture 30 - Surgical Steps in Spinal Surgeries

Lecture 31 - 3D Printing - Part III

- Lecture 32 - 3D Printing - Demonstration
- Lecture 33 - Wet Etching Demonstration
- Lecture 34 - Neural Implants for Parkinson's Disease
- Lecture 35 - Spinal micro neuro Surgery
- Lecture 36 - Anesthesia in Rodents
- Lecture 37 - Physiological Monitoring in Rodents
- Lecture 38 - Lithography Demonstration
- Lecture 39 - Electronic System Development for Neural Engineering - I
- Lecture 40 - Anesthesia Administration Equipments and Vital Monitoring
- Lecture 41 - Standard Safety Practices
- Lecture 42 - Euthanasia
- Lecture 43 - Euthanasia in Rodents
- Lecture 44 - Electronic System Development for Neural Engineering - II
- Lecture 45 - Rodent Brain and Spinal Cord Harvest
- Lecture 46 - Rodent Behavioural Setups
- Lecture 47 - Study Plan for Behavioural Setups: Stroke Model
- Lecture 48 - PCB Design Demonstration for Neural Systems
- Lecture 49 - Electronic Systems for Brain Stimulation - I
- Lecture 50 - Behavioural Tasks in Rodent Models - I
- Lecture 51 - Behavioural Tasks in Rodent Models - II
- Lecture 52 - Behavioural Setup for Rodents: Parkinsonism Model - I
- Lecture 53 - Behavioural Setup for Rodents: Parkinsonism Model - II
- Lecture 54 - Electronic Systems for Brain Stimulation - II
- Lecture 55 - Course Concluding Remarks