Course Structure
Basket - V (Electives)

Course Code	Course Title	Credits	Type T+P+PJ
	Biomaterials	3	2-0-1
	Nanobiotechnology	3	2-0-1
	Power System Operation & Control	3	2-1-0
	Testing and Test Automation	4	2-2-0

Biomaterials

Subject Name	Code	Type of course	T-P-Pr (Credit)	Prerequisite
Biomaterials		Theory & Project	2-0-1	Biochemistry

1. Objective

- biologically derived materials or materials compatible with biology

2. Course outcome

- Production of polyphenol resins by the enzyme soybean peroxidase;
- Evaluation of the properties of biopolymers to make good biomaterials

3. Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Midterm Test	*10*	Written examination
	Assignment	*10*	Report and Presentation
	Experiments		Lab work, report
	Project	*30*	Report and presentation
	Quiz		Surprise/preannounced ones
External Examination		*50*	Written examination
Total		*100*	

4. Course outline

Module I: Introduction:

Definition of biomaterials – biologically derived materials or materials compatible with connective tissues): Structure production and its use. Fibroin (protein in silk): Production and its use. Production of these proteins by conventional cloning methods.

Module II: Carbohydrates:

Modified carbohydrates actin gas lubricants for biomedical applications; Polydextrose made from bacteria; Carbohydrates modified from enzymes; artificial wood.

Module III: Biopolymers:

Synthesis from a simple biological monomer (eghyaluronate polymers); Dextrans (used in chromatography columns); Rubberllike materials produced by bacteria and fungi (Polyhydroxybutyrate PHB), Polycaprolactone(PCL); Production of a copolymer of PHBPHV(polyhydrovaleric acid), sold as Biopol by fermentation on Alcaligeneseutrophus; Biodegradable polymers

ModuleIV:Industrial Biopolymers

Production of polyphenol resins by the enzyme soybean peroxidase; Evaluation of the properties of biopolymers to make good biomaterials; Tensile strength(both elasticity and breaking strength); Hydration, visco – elastic properties; viscosity.

Reference

Text Books:

1. Ratledge C and Kristiansen B, Basic Biotechnology, Cambridge University Press, 2nd Edition, 2001

Reference Books:

1. Doi Y, Microbial Polyesters, VCH Weinheim, 1990

Nanobiotechnology

Subject Name	Code	Type of course	T-P-Pr (Credit)	Prerequisite
Nanobiotechnology		Theory & Project	2-0-1	*Biochemistry*

1. Objective

- To focus on principles of Bio nanotechnology and its applications

2. Course outcome

- This course deals with applications resulting from the combination of biotechnology and nanotechnology in the fields of medicine and environment

3. Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Midterm Test	*10*	Written examination
	Assignment	*10*	Report and Presentation
	Experiments		Lab work, report
	Project	*30*	Report and presentation
	Quiz		Surprise/preannounced ones
External Examination		*50*	Written examination
Total		*100*	

4. Course outline

Module I

Introduction to nanobiotechnology

From Biotechnology to Bionanotechnology-Bionanomachines in action-Modern Biomaterials – The Legacy of Evolution

Module II

Bimolecular Design and Biotechnology

Recombinant DNA technology-Monoclonal antibodies-Biomolecular structure determination- Molecular Medicine

Module III

Functional Principles of nanobiotechnology

Information Driven Nanoassembly-Energetics-Chemical transformation-Regulation Biomolecular Motors Biomolecular sensing-Self-replication-Machine–Phase Bionanotechnology

Module IV

Nanomedicine

Anti-AIDS drugs-Immunotoxins as cell killers-Artificial blood- Cyclic peptides from nanotubes

Module V

Applications of Nanobiotechnology

Harnessing molecular Motors-DNA computers-Molecular design using Biological selection- Artificial life-Hybrid materials-Biosensors

5. Reference

Text Books:

1. Bionanotechnology by David S.Goodsell, 2004, Wiley Publications. Pages-337.

POWER SYSTEM OPERATION & CONTROL

Code	Course Title	(Credit)	T-P-PJ
	POWER SYSTEM OPERATION & CONTROL	3	2-1-0

Objective

- To learn the basic control technique involved in power system operation
- To provide a solid foundation in mathematical and engineering fundamentals required to control the governing system in turbine models

Course outcome

- Make Economic operation of power system and importance of LFC
- Analyze thermal and hydro power plant operation in meeting the load demand optimally
- Analyze single area load frequency control and two area load frequency control

Module – I [7 Hours]

Fundamentals of Power System:

Introduction, Single Subscript Notation, Double Subscript Notation, Power in Single Phase AC Circuit, Complex Power, The Power Triangle, Direction of Power Flow, Voltage and Current in Balanced Three Phase Circuits, Power in Balanced Three Phase Circuits, PerUnit Quantities, Changing the Base in Per-Unit Quantities, Node Equations, The Single Line or One Line Diagram, Impedance and Reactance Diagrams. The Admittance Models & Network Calculations Branch and Node Admittances, Mutually Coupled Branches in Ybus, an Equivalent Admittance Network, Modification of Ybus, the Network Incidence Matrix and Ybus.

Module – II [7 Hours]

Power Flow Solutions

The Power-Flow Problem, the Gauss-Seidal Method, the Newton-Raphson Method, the Newton-Raphson Method, Power-Flow Studies in System Design and Operation, Regulating Transformers, the Decoupled Method. Power system structure: Power factor correction, three phase loads, delta to star transformation: advanced topics as decided by the concerned faculty teaching the subject.

Module – III [7 Hours]

Economic Operation of Power System

Distribution of Load between Units within a Plant, Distribution of Load between Plants, The Transmission-Loss Equation, An interpretation of Transformation C, Classical Economic Dispatch with Losses, Automatic Generation Control, Unit Commitment, Solving the Unit Commitment Problems.

Module – IV [7 Hours]

Load Frequency Control, Control Area Concept

Automatic Load-Frequency Control of Single Area Systems: Speed-Governing System, Hydraulic Valve Actuator, Turbine-Generator Response, Static Performance of Speed Governor, Closing the ALFC Loop, Concept of Control Area, Static Response of Primary ALFC Loop, Dynamic Response of ALFC Loop, Physical Interpretation of Results, The Secondary ("Reset") ALFC Loop, Economic Dispatch Control, Load frequency control.

Module – V [6 Hours]

Two Area Systems

ALFC of Multi-Control-Area Systems (Pool Operation): The Two Area Systems, Modelling the Tie-Line, Block Diagram Representation of Two Area System, Mechanical Analog of Two Area System, Dynamic Response of Two Area System, Static System Response, Tie-Line Bias Control of Multi-Area Systems. Tie line bias control

Module- VI [6 Hours]

Power System Stability

The Stability Problem, Rotor Dynamics and the Swing Equation, Further Considerations of the Swing Equations, The Power-Angle Equation, Synchronizing Power Coefficients, Equal Area Criterion for Stability, Further Applications of the Equal-Area Criterion, Multi-machine Stability Studies: Classical Representation, Step-By-Step Solution of the Swing Curve, Computer Programs for Transient Stability Studies, Factors Affecting Transient Stability. Synchronous machine, Steady state stability, Transient Stability:

HARDWARE BASED

1. To determine negative and zero sequence synchronous reactance of an alternator.
2. To determine sub-transient direct axis and sub-transient quadrature axis synchronous reactance of a 3-ph salient pole alternator.
3. To determine fault current for L-G, L-L, L-L-G and L-L-L faults at the terminals of an alternator at very low excitation.
4. To study the IDMT over-current relay and with different plug setting and time setting multipliers and plot its time – current characteristics.
5. To determine the operating characteristics of biased different relay with different % of biasing.
6. To determine location of fault in a cable using cable fault locator.

SIMULATION BASED (USING MATLAB OR ANY OTHER SOFTWARE)

1. To obtain steady-state, transient and sub-transient short-circuit currents in an alternator.
2. To formulate the Y-Bus matrix and perform load flow analysis.
3. To compute voltage, current, power factor, regulation and efficiency at the receiving end of a three phase Transmission line when the voltage and power at the sending end are given. Use Π model.
4. To perform symmetrical fault analysis in a power system.
5. To perform unsymmetrical fault analysis in a power system.
6. Write a program in language to solve economic dispatch problem of a power system with only thermal units. Take production cost function as quadratic and neglect transmission loss.

REFERENCE:

1. Chakrabarti & Haldar, "Power System Analysis: Operation and Control", Prentice Hall of India, 2004 Edition.
2. C.L. Wadhwa, 'Power System Analysis, New Age International- 6th Edition, 2010,
3. Robert Miller, James Malinowski, 'Power System Operation', Tata McGraw Hill Publishing Company Ltd, New Delhi, 3E, JUN-09.
4. P. Kundur, Neal J. Balu, 'Power System Stability & Control', IEEE, 1998. 5. Power System Analysis by Hadi Saadat – TMH Edition.
5. https://ch.mathworks.com/solutions/power-system-analysis-and-design.html
6. https://ch.mathworks.com/solutions/utilities-energy/power-system-studies.html

Software Testing and Test Automation

Course Title	Code	Type of Course	T-P-PJ	Prerequisite
Testing and Test Automation		Theory+ Practice	2-2-0	Nil

Course Objective:

- Develop methods and procedures for software development that can scale up for large systems and that can be used to consistently produce high-quality software at low cost and with a small cycle time
- Students will learn how to use available resources to develop software, reduce cost of software and how to maintain quality of software
- Methods and tools of testing and maintenance of software's

Learning Outcome:

- Apply modern software testing processes in relation to software development and project management
- Create test strategies and plans, design test cases, prioritize and execute them
- Contribute to efficient delivery of software solutions and implement improvements in the software development processes

Evaluation Systems:

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Internal Theory	20	Written examination
	Internal Practice	30(20+10)	Lab work + Learning Record
External Examination	External Theory	30	Written examination
	External Practice	20	Lab work
Total		*100*	

Course outline

Module I: Introduction to Software Engineering (**8 Hours**)

Evolving of software engineering, Software requirements, Requirement engineering process: feasibility studies, requirements elicitation and analysis, requirements validation, requirements management. Process models: waterfall model, incremental process models, evolutionary process models, the unified process. System models: context models, behavioral models, data models, object models, structured methods.

Module II: System Design (8 Hours)

Software architecture, Data design, Architectural styles and patterns, Architectural design, SDLC, Conceptual model of UML, Basic structural modeling, Class diagrams, Sequence diagrams, Collaboration diagrams, Use case diagrams, Component diagrams, Design scenario and case studies. Test case examples.

Module III: Testing (8 Hours)

A strategic approach to software testing, Software testing life-cycle (STLC), Test scenario, Test execution, Bug tracking. Quality management: Statistical software quality assurance, Software reliability. Basics of manual testing**:** Concepts, Types, Tools, Automation testing Vs Manual testing, Unit testing, Integration testing, System testing, Black-box and white-box testing, Validation testing, Sanity Vs Smoke Testing, Regression Testing and Functional and non-functional Testing.

Module IV: Selenium - Web Testing (10 Hours)

Web Application Testing, Cross-browser Testing, Test Case Management: Sample Test Case Template, Requirements Traceability Matrix (RTM) - Test Coverage ,Test Data Management, Automation Testing using Selenium: Introduction to Selenium, Basics of Selenium Automation Testing, Selenium Web Driver and its contrast operation with RC, Web Driver Basics : First Selenium Web Driver Script: JAVA Code Example, Locators in Selenium IDE: CSS Selector, DOM, XPath, Link Text, ID, Find Element and Find Elements in Selenium Web Driver, Selenium Form Web Element: TextBox, Submit Button, sendkeys(), click()

Module V: Selenium - Web Driver Essentials (8 Hours)

How to Select Check Box and Radio Button in Selenium Web Driver, How to Click on Image in Selenium Webdriver, How to Select Value from Drop Down using Selenium Webdriver, Locate Elements by Link Text & Partial Link Text in Selenium Webdriver, Mouse Click & Keyboard Event: Action Class in Selenium Webdriver

Module VI: Selenium - File Handling Essentials (8 Hours)

How to Upload & Download a File using Selenium Webdriver, XPath in Selenium WebDriver: Alert & Popup Window Handling in Selenium WebDriver, How to Handle Web Table in Selenium WebDriver, Handling Dynamic Web Tables Using Selenium WebDriver, Desired Capabilities in Selenium WebDriver, How to Verify Tooltip using Selenium WebDriver, How to Find All/Broken links using Selenium Webdriver, Gecko (Marionette) Driver Selenium: Download, Install, Use with Firefox

Module VII: selenium - Testing (10 Hours)

TestNGl: Annotations, Framework, Examples in Selenium, TestNG Groups: Include, Exclude with Example, TestNG @Test Priority in Selenium, Parallel Execution in Selenium: Session Handling & TestNG Dependency, TestNG: How to Run Multiple Test Suites in Selenium, TestNG Listeners in Selenium: ITestListener & ITestResult Example, How to Execute Failed Test Cases in TestNG: Selenium WebDriver, TestNG Report Generation in Selenium WebDriver, Customize, PDF & Email TestNG Reports in Selenium WebDriver

Online Source (active on 25th June 2019):

1. https://s1.demo.opensourcecms.com/wordpress/
2. https://book.theautomatedtester.co.uk/