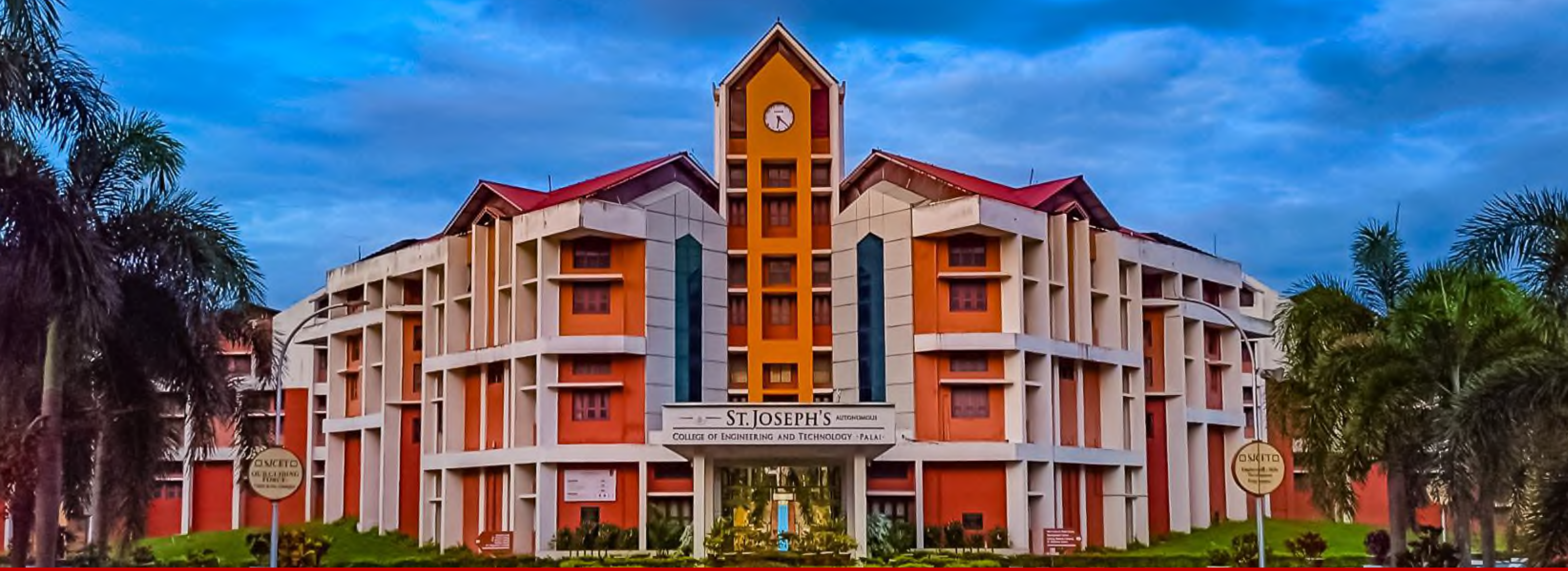
ST.JOSEPH'S
COLLEGE OF ENGINEERING
AND TECHNOLOGY,
- PALAI -
AUTONOMOUS

Choondacherry P.O., Pala, Kottayam - 686579
Kerala, India



CURRICULUM & SYLLABUS

B. Tech. (Honours) *in*

ELECTRICAL AND ELECTRONICS ENGINEERING

2024 SCHEME

CURRICULUM

B.Tech (Honours) is an enhanced version of the Bachelor of Technology degree, offering the students the opportunity to undertake additional courses within their own discipline. This pathway allows students to deepen their knowledge in emerging or advanced areas of Engineering relevant to their field of study, providing a stronger foundation for specialized career paths or further academic pursuits.

For the award of B.Tech (Honours) in Electrical and Electronics Engineeing, the student shall fulfill all the curricular requirements for B.Tech in Electrical and Electronics Engineering as per SJCET B.Tech Academic Regulations 2024 and shall earn 15 additional credits by undergoing the following courses, which shall be further governed by clause R16 of the Regulations.

<table>
<tr><th rowspan="2">Sl.No</th><th rowspan="2">Semester</th><th rowspan="2">Course Code</th><th rowspan="2">Course Name/Type</th><th colspan="4">Weekly hours</th><th colspan="2">Total Marks</th><th rowspan="2">Credits</th></tr>
<tr><th>L</th><th>T</th><th>P</th><th>SS</th><th>CIE</th><th>ESE</th></tr>
<tr><td>1</td><td>4</td><td>24SJHNEET409</td><td>Network Analysis and Synthesis</td><td>3</td><td>1</td><td>0</td><td>5</td><td>40</td><td>60</td><td>4</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">5</td><td>24SJHNEET509</td><td>Digital Simulation</td><td>3</td><td>1</td><td>0</td><td>5</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">4</td></tr>
<tr><td>24SJHNEEM5XX</td><td>Approved MOOC *</td><td colspan="4"></td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">6</td><td>24SJHNEET609</td><td>Generalised Machine Theory</td><td>3</td><td>1</td><td>0</td><td>5</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">4</td></tr>
<tr><td>24SJHNEEM6XX</td><td>Approved MOOC *</td><td colspan="4"></td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">7</td><td>24SJHNEET709</td><td>Operation and Control of Generators</td><td>3</td><td>0</td><td>0</td><td>5</td><td rowspan="2">40</td><td rowspan="2">60</td><td rowspan="2">3</td></tr>
<tr><td>24SJHNEEM7XX</td><td>Approved MOOC *</td><td colspan="4"></td></tr>
<tr><td colspan="10">Total Credits</td><td>15</td></tr>
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*MOOC to be approved by the Academic Council on recommendation of the Board of Studies.

SEMESTER 4
NETWORK ANALYSIS AND SYNTHESIS

Course Code	**24SJHNEET409**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	24SJPCEET302 Circuits and Networks	**Course Type**	Honours (Theory)

Objectives : It includes advanced topics in network analysis, basics of filter design and network synthesis concepts. This course would help students to explore more advanced concepts in the analysis of complex networks.

Syllabus

Module 1 (10 hours)

Network Topology

Linear Oriented Graphs- Incidence matrix- Loop matrix- Cutset matrix- Kirchoff's Voltage Law- Kirchoff's Current Law- Network Equilibrium Equation- Duality

Module 2 (12 hours)

Image parameter description of a reciprocal two-port network - Image impedance - Characteristic impedance - propagation constant - derivation of characteristic impedance and propagation constant for T and Pi networks under sinusoidal steady state - Attenuation constant and phase constant.

Filter terminology: Low pass, high pass, band-pass and band-reject filters.

Constant k :- Low Pass, High Pass, Band-Pass and Band-Stop Filters - Design- m-derived filters:- Low Pass & High Pass Filters – Attenuators: T, Pi and lattice.

Module 3 (12 hours)

Network Functions

Review of Network functions for one port and two port networks: – pole zero location for driving point and transfer functions-Impulse response of Network functions from pole-zero plots- Sinusoidal steady-state frequency response from pole-zero plots.

Hurwitz polynomials –properties - Positive real functions –Properties of positive real functions – passivity-necessary and sufficient conditions for positive real functions-physical realizability.

Module 4 (11 hours)

Synthesis of one port networks

Synthesis of reactive one-ports by Foster's and Cauer methods (forms I and II) -Synthesis of LC, RC and RL driving-point functions.

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes : After the completion of the course the student will be able to:

	Course Outcomes	Bloom's Knowledge Level (KL)
CO1	Apply network topology concepts in the formulation and solution of electric network problems.	K3
CO2	Apply two-port network analysis in the design and analysis of filter and attenuator networks.	K3
CO3	Identify the properties and characteristics of network functions, and verify the mathematical constraints for their physical realisation.	K2
CO4	Synthesize passive one-port networks using standard Foster and Cauer forms.	K3

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3									2
CO2	3	3									2
CO3	3	3									2
CO4	3	3									2

Text Book

1. Ravish R. Singh, "Network Analysis and Synthesis", McGraw-Hill Education, 2013

References

1. Franklin Kuo, —Network Analysis and Synthesis, 2nd Ed.,Wiley India.
2. Van Valkenburg M.E., —Introduction to Modern Network Synthesis, Wiley Eastern, 1960 (reprint 1986).
3. Van Valkenburg M.E, —Network Analysis, Prentice Hall India, 2014.
4. Charles A. Desoer and Ernest S. Kuh, —Basic Circuit Theory, Tata McGraw Hill Edition.
5. Chakrabarti, A., "Circuit Theory Analysis and Synthesis", Dhanpat Rai& Co., Seventh - Revised edition, 2018
6. S. K. Bhattacharya, —Network Analysis and Synthesis, Pearson Education India.

SEMESTER S5

DIGITAL SIMULATION

Course Code	**24SJHNEET509**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	Circuits and Networks, Analog Electronics, Probability, Random Processes and Numerical Methods	**Course Type**	Theory

Course Objectives:

1. To provide a foundation to the theory behind Numerical Simulation of electrical engineering systems
2. To give an overview of different styles of simulation tools and methodologies
3. To prepare students to explore and use the industry-standard tools like MATLAB and SPICE introduce

SYLLABUS

Module 1 (12 hours)

Introduction to Simulation

Types of simulation problems- DC Simulation - Transient Simulation - AC Simulation - Digital Circuit Simulation - Sensitivity Analysis - Noise Analysis. Examples

Problem formulation for circuit simulation

Nodal Analysis - General Rules/Steps to form the admittance matrix. Sample problems on formulation of the matrix.

Modified Nodal Analysis (MNA) - General Rules/Steps to form the admittance matrix. Sample problems on formulation of the matrix. (Assignments/Course projects may be assigned for writing code to formulate the Matrix using any high-level language). Formulation Examples.

Sparse Tableau Approach - Formulation of STA matrix. Features and comparison with MNA approach. Formulation Examples Non-linear Circuits: Application of the Newton-Raphson method - General procedure for n-th order system of equations - Formulation of Jacobian - Examples - Resources required for simulation: Computation time. Convergence issues - (Assignments/Course projects may be given for writing code to formulate the Matrix using any high-level language/pseudo code).

Module 2 (10 hours)

Fundamental Theory behind Transient Simulation:

Introduction to transient simulation: Discretization of time, idea of time - step. - Review of backward Euler, forward Euler and trapezoidal methods.

Basic ideas of Accuracy and Stability (Qualitative description only) of methods of transient analysis using numerical techniques.

Basic ideas of Explicit and Implicit methods: Concept of 'order' of a numerical method, Local Error (LE), Local Truncation Error (LTE) and Global Error (No detailed derivation needed)

Module 3 (12hours)

Application to Circuit Simulation:

Application to circuit simulation: Using BE and TRZ methods. - Second order Backward Difference Formula (BDF-2/Gear Formula, no derivation required). Equivalent Circuit Approach- Stiff systems - Features - Simple Examples.

Basic ideas behind Adaptive/variable step-size. (Qualitative treatment only).

Practical aspects in choosing numerical methods: Artificial damping and ringing induced by numerical algorithms - Assessment of accuracy -- The issue of Singular Matrix in initial / start-up condition

Module 4 (12 hours)

Introduction to SPICE and MATLAB:

Types of simulation tools: Circuit simulation tools: SPICE, equation solvers: MATLAB®/Scilab®/Octave - Features, similarities and differences.

Circuit Simulation using SPICE: Writing SPICE circuit files: SPICE Syntax - SPICE directives (Dot commands: .END, .FUNC, .NET .OPTIONS)

Performing different kinds of simulation and analysis - DC, DC sweep, AC, Transient and noise analyses. (Use of .OP, .PARAM, .TRAN,.DC, .STEP, .IC .MEASURE, .FOUR, .NOISE, .TEMP, .WAVE)

Developing circuit files for simple circuits like CE amplifiers, passive linear/non-linear circuits (Familiar Circuits with R, L, C, Diodes, Transistors).

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Micro project	Internal Examination- 1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8 x 3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4 x 9 = 36 marks)**	60

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Formulate circuit analysis matrices for computer solution.	K2
CO2	Apply numerical methods for transient simulation.	K3
CO3	Develop circuit files for SPICE simulation of circuits.	K3
CO4	Develop MATLAB/Simulink programs for simulation of simple dynamic systems.	K3

Note: *KI- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3		2	3						2
CO2	3	3		2	3						2
CO3	3	3		2	3						2
CO4	3	3		2	3						2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), No Correlation*

Text Books

1. Simulation of Power Electronic Circuits , M. B. Patil, V. Ramanarayanan and V. T. Ranganathan , arosa Publishing House , 2009
2. Numerical Methods for Engineers, Steven C. Chapra and Raymond P. Canale , Tata- McGraw Hill, New Delhi, 8th Edition 2021
3. Getting Started with MATLAB®: A Quick , Rudra Pratap Oxford University Press , 7th Edition 2017

References

1. LTSpice® [Online] http://www.ltwiki.org
2. MATLAB® [Online] https://in.mathworks.com/help/matlab/
3. Won Y. Yang, Wenwu Cao, Tae-Sang Chung and John Morris, "Applied Numerical Methods Using MATLAB®"

SEMESTER 6

GENERALISED MACHINE THEORY

Course Code	**24SJHNEET609**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	4:0:0:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	DC Machines and Transformers. Synchronous and Induction machines	**Course Type**	Honours (Theory)

Syllabus

Module 1 (10 hours)

Unified approach to the analysis of electrical machine performance - per unit system - Basic two polemodel of rotating machines- Primitive machine -Conventions -transformer and rotational voltages in the armature voltage and torque equations, resistance, inductance and torque matrix.

Module 2 (12 hours)

Transformations-passive linear transformation in machines-invariance of power- transformation from a displaced brush axis-transformation from three phase to two phase and from rotating axes to stationary axes-Physical concept of Park's transformation.

Module 3 (12 hours)

DC Machines: Application of generalized theory to separately excited DC generator: steady state and transient analysis, Separately excited DC motor- steady state and transient analysis, Transfer function of separately excited DC generator and motor- DC shunt and series motors: Steady state analysis and characteristics.

Module 4 (11 hours)

Synchronous Machines: synchronous machine reactance and time constants-Primitive machine model of synchronous machine with damper windings on both axes. Balanced steady state analysis-power angle curves.

Induction Machines: Primitive machine representation. Transformation- Steady state operation- Equivalent circuit. Torque slip characteristics.

Single phase induction motor- Revolving equivalent circuit- Voltage and Torque equations- Cross field theory-Comparison between single phase and poly phase induction motor.

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal xamination- 1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes : After the completion of the course the student will be able to:

	Course Outcomes	Bloom's Knowledge Level (KL)
CO1	Develop the basic two pole model representation of electrical machines using the basic concepts of generalized theory.	**K3**
CO2	Develop the linear transformation equations of rotating electrical machines incorporating the concept of power invariance.	**K3**
CO3	Apply linear transformation for the steady state and transient analysis of different types of rotating electrical machines.	**K3**

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2								
CO2	3	3	2	2							2
CO3	3	3	3	2							2

Text Book

1) Bhimbra P. S., "Generalized Theory of Electrical Machines", Khanna Publishers, 6thedition, Delhi 2017.
2) Charles V. Johnes, "Unified Theory of Electrical Machines". New York, Plenum Press, 1985.
3) Bernad Adkins, Ronald G Harley, "General theory of AC Machines". London, Springer Publications, 2013.

References

1) Charles Concordia," Synchronous Machines- Theory and Performance", John Wiley and Sons Incorporate, Newyork.1988.

2) Say M. G., "Introduction to Unified Theory of Electrical Machines", Pitman Publishing, 1978.

3) Alexander SLangsdorf, "Theory of Alternating Current Machinery", Tata McGraw Hill, 2nd revised edition, 2001.