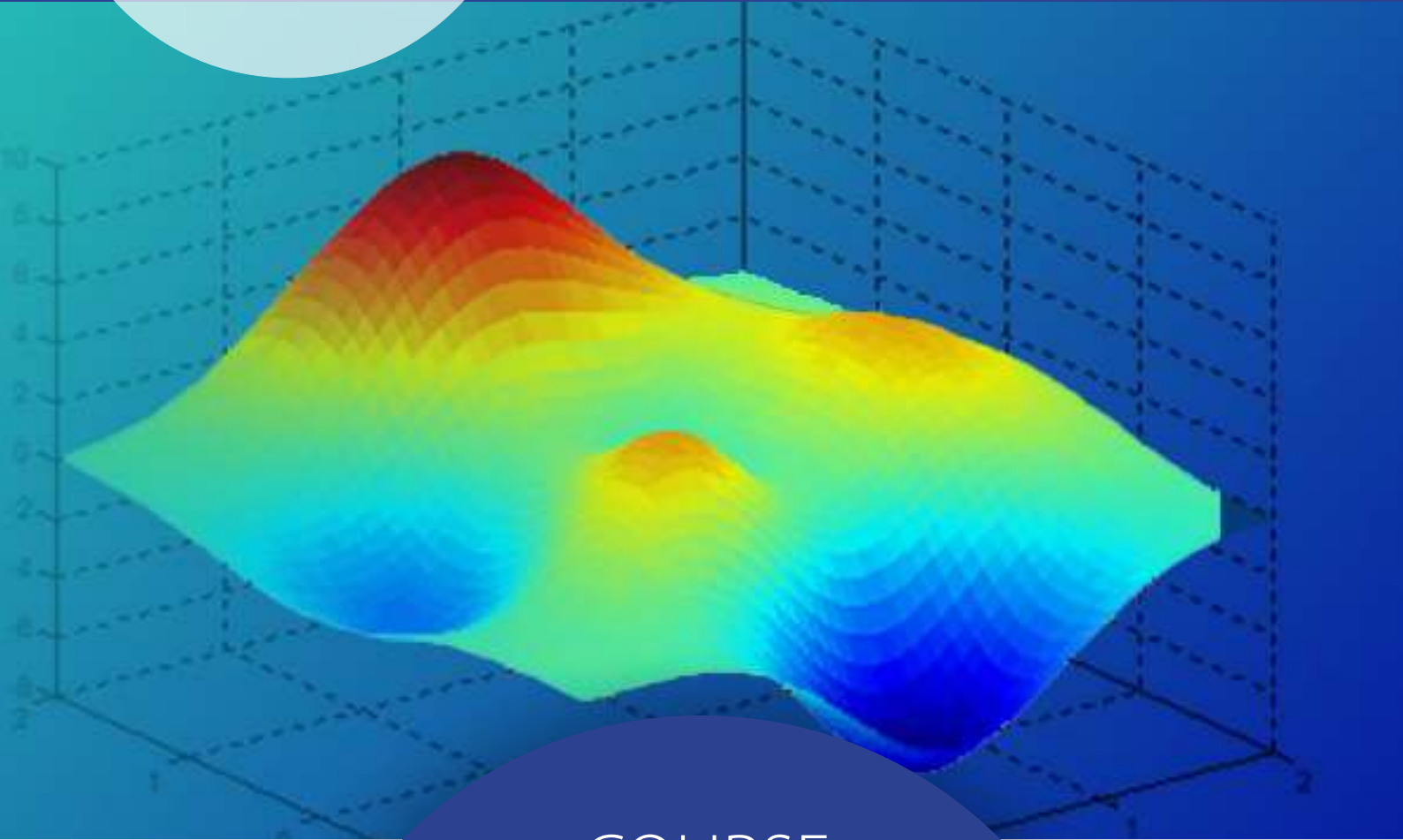




**SHARDA**  
UNIVERSITY  
*Beyond Boundaries*



**SHARDA SCHOOL OF  
ENGINEERING  
& SCIENCE**



— COURSE —

**OPTIMIZATION  
TECHNIQUES USING  
MATLAB-SIMULINK  
INTEGRATION**

(NV36011)

**VALUE ADDED**  
**COURSE BROCHURE-30 HRS**  
**2026-27**

## ABOUT THE UNIVERSITY

Sharda University is a leading educational institution based out of Greater Noida, Delhi NCR. A venture of the renowned Sharda Group of Institutions (SGI), The University has established itself as a high-quality education provider with prime focus on holistic learning and imbining competitive abilities in students. The University is approved by UGC and prides itself in being the only multidiscipline campus in the NCR, spread over 63 acres and equipped with world class facilities.

Sharda University promises to become one of the India's leading universities with an acknowledged reputation for excellence in research and teaching. With its outstanding faculty, world class teaching standards, and innovative academic programs, Sharda intends to set a new benchmark in the Indian education system. Sharda School of Basic Sciences and Research (SSBSR) boasts of providing an interdisciplinary approach, exposure to different disciplines in science including Chemistry, Biochemistry, Physics, Mathematics, Life Sciences, and Environmental Sciences.

## ABOUT SCHOOL

The Sharda School of Engineering & Sciences (SSES) provides a vibrant academic ecosystem that integrates engineering and scientific education with real-world relevance, research excellence and interdisciplinary learning. It serves as a platform where students are empowered to explore, innovate and build impactful careers across a wide spectrum of disciplines. SSES combines the strengths of engineering and basic sciences to create a dynamic environment that fosters innovation and technical excellence along with a sense of social responsibility. With high-ranked programmes in engineering and robust offerings in pure and applied sciences, the school provides a comprehensive and future-ready education. The school has a legacy of excellence in the fields of Physics, Chemistry, Biochemistry, Mathematics, Data Science and Environmental Sciences. The academic programmes at SSES span undergraduate, postgraduate and doctoral levels and are aligned with the latest technology and scientific advancements in alliance with the NEP 2020. The school is deeply involved in academic research, industry collaboration, and consultancy projects—providing students with an exposure to both theoretical knowledge and practical applications.

## ABOUT DEPARTMENT

Department of Electrical Electronics and Communication Engineering is one of the premier departments of School of Engineering and Sciences, Sharda University. The department offers B.Tech, M.Tech and Ph.D programmes. The department has people of eminence from academia as well as industry, who have exposure to future cutting – edge research programs in the field of Power system, Power electronics, control engineering, smart grid communication Engineering, Internet of Things, LTE, Embedded systems, Microwave Engineering, Wireless Sensor Networks and VLSI, Robotics.

## ABOUT COURSE

VACs are relevant academic method in order to fill the gaps in students knowledge and add competitive edge to their job prospects. A well defined of offspring VACs in the courses makes them extremely useful for improving employability quotient of students by building a range of competencies. It helps students to build a creative foundation for their passion in an area (literary, visual and performing arts, etc) in addition to their professional courses creating dimensions which can help in converting their passion into profession. VAC can also serve as top-up courses to make students industry-ready by exposing them to the current technology and practices than those covered in their formal degree courses.

# COURSE CONTENT

| Week | Topics Covered                                         | Subtopics / Activities                                          |
|------|--------------------------------------------------------|-----------------------------------------------------------------|
| 1.   | Fundamentals of Optimization and MATLAB Implementation | MATLAB basics for optimization, Optimization Toolbox functions  |
| 2.   | Classical Optimization Techniques                      | Gradient-based optimization methods, Steepest descent method    |
| 3.   | Metaheuristic Optimization Algorithms                  | Grey Wolf Optimization (GWO), Harris Hawks Optimization (HHO),  |
| 4.   | Optimization Applications in Engineering Systems       | Economic load dispatch, Optimal DG placement, MPPT optimization |
| 5.   | Simulink-Based Optimization and Mini Projects          | Simulink model development                                      |
| 6.   | Simulink-Based Optimization and Mini Projects          | Parameter tuning in Simulink, Hybrid AI optimization methods    |

## Resource Person

**Dr. Sushma Kakkar** is working as an Associate Professor in the department of Electrical, Electronics and Communication Engineering, School of Engineering and Technology at Sharda University, Greater Noida. She received her B.E in Electrical Engineering from NIT Kurukshetra, M.Tech in Power Electronics, Electric Machines and Drives from IIT Dehli and Ph.D from IIT(ISM) Dhanbad. Her research interests include Power electronics, Electric Drives and Renewable Energy Integration. She has authored and co-authored several research papers in reputed journals and international conferences, and is reviewer of many reputed journals.

|                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                              |            |
|------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|------------|
| <b>School: SSES</b><br><b>Programme: M.Tech</b><br><b>Branch: EECE</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Batch : 2026-2027</b><br><b>Current Academic Year: 2026-2027</b><br><b>Semester : III</b> |            |
| 1. COURSE CODE                                                         | Nv36111                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                              |            |
| 2. Course Title                                                        | Optimization Techniques using MATLAB-Simulink Integration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                              |            |
| 3. Credits                                                             | Audit Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                              |            |
| 4. Contact Hours (L-T-P)                                               | 30 Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                              |            |
| Course Type                                                            | Value added course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                              |            |
| 5. Course Objective                                                    | The course is designed to provide students with a comprehensive understanding of classical and modern optimization techniques for engineering applications. The course aims to develop the ability to formulate optimization problems, implement optimization algorithms using MATLAB, and integrate these algorithms with Simulink models for real-time engineering analysis. Students will gain hands-on experience in applying optimization methods such as Genetic Algorithm, Particle Swarm Optimization, Grey Wolf Optimization, and Harris Hawks Optimization to control, power, and signal processing systems. The course also focuses on convergence analysis, parameter tuning, and performance evaluation of optimization algorithms, enabling students to develop simulation-based solutions suitable for research, industrial applications, and advanced engineering design.                                                          |                                                                                              |            |
| 6. Course Outcomes                                                     | CO1: Understand the fundamentals of optimization techniques and formulate engineering optimization problems with objective functions and constraints. (K2)<br>CO2: Implement classical optimization techniques using MATLAB tools and optimization functions for engineering applications. (K3)<br>CO3: Develop and analyse metaheuristic optimization algorithms such as GA, PSO, GWO, and HHO using MATLAB. (K4)<br>CO4: Apply optimization techniques for controller tuning, power system operation, renewable energy systems, and signal processing applications using MATLAB-Simulink integration. (K3)<br>CO5: Design simulation-based engineering solutions by integrating optimization algorithms with Simulink models for real-world applications. (K6)<br>CO6: Evaluate and compare the performance of optimization algorithms based on convergence characteristics, computational efficiency, and engineering performance indices. (K4) |                                                                                              |            |
| 7. Course Description                                                  | This course introduces students to classical and modern optimization techniques using MATLAB-Simulink integration for engineering applications. It covers problem formulation, optimization toolbox functions, and metaheuristic algorithms such as Genetic Algorithm (GA), Particle Swarm Optimization (PSO), Grey Wolf Optimization (GWO), and Harris Hawks Optimization (HHO). The course emphasizes hands-on implementation, convergence analysis, controller tuning, and simulation-based optimization for applications in engineering.                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                              |            |
| 8. Outline syllabus                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                              | CO Mapping |
| Unit 1                                                                 | Fundamentals of Optimization and MATLAB Implementation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                              |            |
| A                                                                      | Introduction to optimization, Objective functions and constraints                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                              | CO1        |
| B                                                                      | Local and global optimum, Linear and nonlinear optimization                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                              | CO1        |
| C                                                                      | MATLAB basics for optimization, Optimization Toolbox functions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                              | CO1        |
| Unit 2                                                                 | Classical Optimization Techniques                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                              |            |
| A                                                                      | Gradient-based optimization methods, Steepest descent method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                              | CO2        |
| B                                                                      | Newton-Raphson optimization, least squares optimization                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                              | CO2        |
| C                                                                      | Lagrange multiplier method, Constrained optimization techniques                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                              | CO2        |
| Unit 3                                                                 | Metaheuristic Optimization Algorithms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                              |            |
| A                                                                      | Genetic Algorithm (GA), Particle Swarm Optimization (PSO)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                              | CO3, CO6   |
| B                                                                      | Grey Wolf Optimization (GWO), Harris Hawks Optimization (HHO),                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                              | CO3, CO6   |
| C                                                                      | Slime Mould Algorithm (SMA)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                              | CO3, CO6   |
| Unit 4                                                                 | Optimization Applications in Engineering Systems                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                              |            |
| A                                                                      | PID controller tuning using optimization                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                              | CO4, CO6   |
| B                                                                      | Economic load dispatch, Optimal DG placement, MPPT optimization                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                              | CO4, CO6   |
| C                                                                      | FIR filter optimization, Noise minimization techniques                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                              | CO4, CO6   |
| Unit 5                                                                 | Simulink-Based Optimization and Mini Projects                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                              |            |
| A                                                                      | Simulink model development                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                              | CO5, CO6   |
| B                                                                      | MATLAB-Simulink integration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                              | CO5, CO6   |
| C                                                                      | Parameter tuning in Simulink, Hybrid AI optimization methods                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                              | CO5, CO6   |
| Mode of examination                                                    | Assignments / Quizzes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                              |            |