THE COURSE OUTLINE:

- The course on Six-Sigma will focus on detailed strategic and operational issues of process improvement and variation reduction. Six-sigma is a measure of quality that strives for near perfection. It is a disciplined, data-driven approach for eliminating defects (driving towards six standard deviations between the mean and the nearest specification limit) in any process—from manufacturing to transactional and from product to service.

- A Six-sigma defect is anything outside of customer specifications. To be tagged Six Sigma, a process must not produce more than 3.4 defects per million opportunities.

- Six-sigma employs a systematic approach of DMAIC (Define, Measure, Analyze, Improve and Control) for the process improvement. This course will provide a detailed understanding on various issues specific to each phase of DMAIC.

- The course is designed with a practical orientation and includes cases, industry examples and MINITAB software applications.

- The course is designed to satisfy the need of both industry professionals and University students.

- The content is beneficial to both manufacturing and service industry.

ABOUT INSTRUCTOR:

Prof. Jitesh J. Thakkar is a Professor and Director of MBA, BBA & BSc programs at National Rail and Transportation Institute (NRTI), Vadodara – India’s first University dedicated in the field of Rail and Transportation education. He has served as a faculty at Department of Industrial and Systems Engineering, IIT Kharagpur for 10 years. He has professional experience of more than 20 years. He holds a Ph.D in Supply Chain Management from IIT Delhi, M.Tech. in Industrial Engineering from IIT Delhi and Bachelors of Engineering in Mechanical Engineering conferred with Gold Medal from one of the oldest Government Engineering College - Birla Vishvakarma Mahavidyalaya Engineering College, Sardar Patel University. His areas of interests include Transportation Management, Logistics and Supply Chain Management, Project Management, Service Operations Management, Six Sigma, Lean Manufacturing, Optimization, Statistical Modeling and System Dynamics. He has supervised 10 Ph.D. and 80 B.Tech./M.Tech. projects at IIT Kharagpur. He is a productive researcher with H-index 28 and 75 research papers published in SCI/SCOPUS listed journals. The research papers are published in high impact factor, A* & A grade journals of ABDC (Australian Business Deans Council) such as International Journal of Production Economics, Transportation Research (Part-E), International Journal of Production Research, Computers and Industrial Engineering, Production Planning and Control, Expert Systems with Applications, Journal of Cleaner Production. He has published three books – Structural Equation Modeling, Multi-Criteria Decision Making and Project Management with Springer. He is contributing as Associate Editor of the journals – i) International Journal of Productivity and Performance Management, Emerald and ii) OPSEARCH, Springer. He has executed number of large scale research and consultancy projects sponsored by DST, DRDO, NLC, ICSSR, and MHRD. He has extended training/consulting to various organizations such as L&T, DRDO, Food Corporation of India, Neyvelli Lignite Corporation, Tata Steel, Tata Hitachi, Essar Steel, Ordnance Factory, Lakshmi Machine Works Ltd., Godrej, Qatar Chemical. His online course on “Six Sigma” offered by NPTEL has been attended by more than 20,000 University students and Industry professionals in last five years. He has delivered more than 100 invited sessions at various reputed platforms. He has been invited as a faculty expert by IIT Kanpur, IIT Madras, IIM Indore, NITIE Mumbai, NIT Surat, NIT Trichy, IRMA, AMA, BCCI Kolkata, L&T-PMI.
## COURSE PLAN:

**Week 1: QUALITY: FUNDAMENTALS AND KEY CONCEPTS**
- **Lecture 1:** Brief overview of the course
- **Lecture 2:** Quality concepts and definition
- **Lecture 3:** History of continuous improvement
- **Lecture 4:** Six Sigma Principles and Focus Areas (Part 1)
- **Lecture 5:** Six Sigma Principles and Focus Areas (Part 2)
- **Lecture 6:** Six Sigma Applications

**Week 2: QUALITY: FUNDAMENTALS AND KEY CONCEPTS**
- **Lecture 7:** Quality Management: Basics and Key Concepts
- **Lecture 8:** Fundamentals of Total Quality Management
- **Lecture 9:** Cost of quality
- **Lecture 10:** Voice of customer
- **Lecture 11:** Quality Function Deployment (QFD)
- **Lecture 12:** Management and Planning Tools (Part 1)
- **Lecture 13:** Management and Planning Tools (Part 2)

**Week 3: DEFINE**
- **Lecture 14:** Six Sigma Project Identification, Selection and Definition
- **Lecture 15:** Project Charter and Monitoring
- **Lecture 16:** Process characteristics and analysis
- **Lecture 17:** Process Mapping: SIPOC

**Week 4: MEASURE**
- **Lecture 18:** Data Collection and Summarization (Part 1)
- **Lecture 19:** Data Collection and Summarization (Part 2)
- **Lecture 20:** Measurement systems: Fundamentals
- **Lecture 21:** Measurement systems analysis: Gage R&R study
- **Lecture 22:** Fundamentals of statistics
- **Lecture 23:** Probability theory

**Week 5: MEASURE**
- **Lecture 24:** Process capability analysis: Key Concepts
- **Lecture 25:** Process capability analysis: Measures and Indices
- **Lecture 26:** Process capability analysis: Minitab Application
- **Lecture 27:** Non-normal process capability analysis

**Week 6: ANALYZE**
- **Lecture 28:** Hypothesis testing: Fundamentals
- **Lecture 29:** Hypothesis Testing: Single Population Test
- **Lecture 30:** Hypothesis Testing: Two Population Test
- **Lecture 31:** Hypothesis Testing: Two Population: Minitab Application
- **Lecture 32:** Correlation and Regression Analysis
- **Lecture 33:** Regression Analysis: Model Validation

**Week 7: ANALYZE**
- **Lecture 34:** One-Way ANOVA
- **Lecture 35:** Two-Way ANOVA
- **Lecture 36:** Multi-vari Analysis
- **Lecture 37:** Failure Mode Effect Analysis (FMEA)

**Week 8: IMPROVE**
- **Lecture 38:** Introduction to Design of Experiment
- **Lecture 39:** Randomized Block Design
- **Lecture 40:** Randomized Block Design: Minitab Application
- **Lecture 41:** Factorial Design
- **Lecture 42:** Factorial Design: Minitab Application

**Week 9: IMPROVE**
- **Lecture 43:** Fractional Factorial Design
- **Lecture 44:** Fractional Factorial Design: Minitab Application
- **Lecture 45:** Taguchi Method: Key Concepts
- **Lecture 46:** Taguchi Method: Illustrative Application

**Week 10: CONTROL**
- **Lecture 47:** Seven QC Tools
- **Lecture 48:** Statistical Process Control: Key Concepts
- **Lecture 49:** Statistical Process Control: Control Charts for Variables
- **Lecture 50:** Operating Characteristic (OC) Curve for Variable Control charts
- **Lecture 51:** Statistical Process Control: Control Charts for Attributes
- **Lecture 52:** Operating Characteristic (OC) Curve for Attribute Control charts
- **Lecture 53:** Statistical Process Control: Minitab Application

**Week 11: CONTROL**
- **Lecture 54:** Acceptance Sampling: Key Concepts
- **Lecture 55:** Design of Acceptance Sampling Plans for Attributes (Part 1)
- **Lecture 56:** Design of Acceptance Sampling Plans for Attributes (Part 2)
- **Lecture 57:** Design of Acceptance Sampling Plans for Variables
- **Lecture 58:** Acceptance Sampling: Minitab Application

**Week 12: SIX SIGMA IMPLEMENTATION CHALLENGES**
- **Lecture 59:** Design for Six Sigma (DFSS): DMADV, DMADOV
- **Lecture 60:** Design for Six Sigma (DFSS): DFX
- **Lecture 61:** Team Management
- **Lecture 62:** Six Sigma: Case study
- **Lecture 63:** Six Sigma: Summary of key concepts