

# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



SCHOOL OF ENGINEERING

Department of Mechanical Engineering



Regulation - R22

## COURSE STRUCTURE

(Applicable from the batch admitted during 2022-23 onwards)

### III YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1.	22PC0ME19	Dynamics of Machinery	3	0	0	3
2.	22PC0ME20	Design of Machine Elements	3	0	0	3
3.	22PC0ME21	Metrology & Machine Tools	3	0	0	3
4.	22SS0MB01	Business Economics & Financial Analysis	3	0	0	3
5.	22PC0ME22	Steam Power & Jet Propulsion	3	0	0	3
6.	22PC0ME23	CAD/CAM	2	0	0	2
7.	22PC0ME24	Thermal Engineering Laboratory	0	0	2	1
8.	22PC0ME25	Metrology & Machine Tools Laboratory	0	0	2	1
9.	22PC0ME26	Kinematics & Dynamics Laboratory	0	0	2	1
10.	22MC0MB03	Intellectual Property Rights	3	0	0	0
		<b>Total</b>	<b>20</b>	<b>0</b>	<b>6</b>	<b>20</b>

Dr. A. Raj Kumar  
(Chairman, BOS)

Dr. Ch. Sridhar Reddy  
(JNTUH Nominee)

Dr. L. Siva Rama Krishna  
(Academic Council Nominee)

Dr. B. Lakshmana Swamy  
(Academic Council Nominee)

Dr. J. Chidanandappa  
(Industry Representative)

Dr. B. Sai Venkata Krishna  
(Alumni)

Dr. M. Anjaiah  
(Member)

Dr. M. Prakash Babu  
(Member)

Dr. V. Ananda Mohan  
(Member)

# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



SCHOOL OF ENGINEERING

Department of Mechanical Engineering

Regulation - R22



## COURSE STRUCTURE

(Applicable from the batch admitted during 2022-23 onwards)

### III YEAR II SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1.	22PC0ME27	Machine Design	3	0	0	3
2.	22PC0ME28	Heat Transfer	3	0	0	3
3.	22PC0ME29	Finite Element Methods	3	0	0	3
4.	22PE0ME1X	Professional Elective - I	3	0	0	3
5.	22OE0ME1X	Open Elective - I	3	0	0	3
6.	22PC0ME30	Heat Transfer Lab	0	0	2	1
7.	22PC0ME31	Computer Aided Engineering Laboratory	0	0	2	1
8.	22HS0EN03	Advanced English Communication Skills Laboratory	0	0	2	1
9.	22PR0ME02	Industry Oriented Mini Project/ Internship	0	0	4	2
10.	22MC0CH03	Environmental Science	3	0	0	0
		<b>Total</b>	<b>18</b>	<b>0</b>	<b>10</b>	<b>20</b>

Environmental Science in III Year II Sem Should be Registered by Lateral Entry Students Only.

Dr. A. Raj Kumar  
(Chairman, BOS)

Dr. Ch. Sridhar Reddy  
(JNTUH Nominee)

Dr. L. Siva Rama Krishna  
(Academic Council Nominee)

Dr. B. Lakshmana Swamy  
(Academic Council Nominee)

Dr. J. Chidanandappa  
(Industry Representative)

Dr. B. Sai Venkata Krishna  
(Alumni)

Dr. M. Anjaiah  
(Member)

Dr. M. Prakash Babu  
(Member)

Dr. V. Ananda Mohan  
(Member)

# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



SCHOOL OF ENGINEERING

Department of Mechanical Engineering



Regulation - R22

## COURSE STRUCTURE


(Applicable from the batch admitted during 2022-23 onwards)

### IV YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1.	22PC0ME32	Industrial Management	2	0	0	2
2.	22PC0ME33	Refrigeration & Air Conditioning	3	0	0	3
3.	22PE0ME2X	Professional Elective – II	3	0	0	3
4.	22PE0ME3X	Professional Elective – III	3	0	0	3
5.	22PE0ME4X	Professional Elective - IV	3	0	0	3
6.	22OE0XX2X	Open Elective - II	3	0	0	3
7.	22PR0ME03	Project Stage - I	0	0	6	3
<b>Total</b>			<b>17</b>	<b>0</b>	<b>6</b>	<b>20</b>

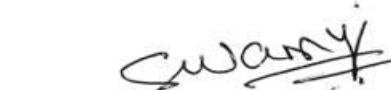
### IV YEAR II SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1.	22PE0ME5X	Professional Elective – V	3	0	0	3
2.	22PE0ME6X	Professional Elective - VI	3	0	0	3
3.	22OE0XX3X	Open Elective - III	3	0	0	3
4.	22PR0ME04	Project Stage – II including seminar	0	0	22	11
<b>Total</b>			<b>9</b>	<b>0</b>	<b>22</b>	<b>20</b>

  
Dr. A. Raj Kumar  
(Chairman, BOS)


  
Dr. Ch. Sridhar Reddy  
(JNTUH Nominee)

  
Dr. L. Siva Rama Krishna  
(Academic Council Nominee)

  
Dr. B. Lakshmana Swamy  
(Academic Council Nominee)

  
Dr. J. Chidanandappa  
(Industry Representative)

  
Dr. B. Sai Venkata Krishna  
(Alumni)

  
Dr. M. Anjaiah  
(Member)

  
Dr. M. Prakash Babu  
(Member)

  
Dr. V. Ananda Mohan  
(Member)

# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



SCHOOL OF ENGINEERING

Department of Mechanical Engineering

Regulation - R22



## COURSE STRUCTURE

(Applicable from the batch admitted during 2022-23 onwards)

### PROFESSIONAL ELECTIVES OFFERED IN R22

#### Professional Elective - I


22PE0ME1A	Unconventional Machining Processes
22PE0ME1B	Production Planning & Control
22PE0ME1C	Operations Research
22PE0ME1D	Microprocessors in Automation


#### Professional Elective - II

22PE0ME2A	Additive Manufacturing
22PE0ME2B	Automation in Manufacturing
22PE0ME2C	Artificial Intelligence in Mechanical Engineering
22PE0ME2D	Mechatronics


#### Professional Elective - III

22PE0ME3A	Power plant Engineering
22PE0ME3B	Automobile Engineering
22PE0ME3C	Non-Conventional Energy Sources
22PE0ME3D	Solar Energy Technology

  
Dr. A. Raj Kumar  
(Chairman, BOS)


  
Dr. Ch. Sridhar Reddy  
(JNTUH Nominee)

  
Dr. L. Siva Rama Krishna  
(Academic Council Nominee)

  
Dr. B. Lakshmana Swamy  
(Academic Council Nominee)

  
Dr. J. Chidanandappa  
(Industry Representative)

  
Dr. B. Sai Venkata Krishna  
(Alumni)

  
Dr. M. Anjaiah  
(Member)

  
Dr. M. Prakash Babu  
(Member)

  
Dr. V. Ananda Mohan  
(Member)

# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



SCHOOL OF ENGINEERING

Department of Mechanical Engineering

Regulation - R22



## COURSE STRUCTURE

(Applicable from the batch admitted during 2022-23 onwards)

### PROFESSIONAL ELECTIVES OFFERED IN R22

#### Professional Elective - IV

22PE0ME4A	Re-Engineering
22PE0ME4B	Computational Fluid Dynamics
22PE0ME4C	Turbo Machinery
22PE0ME4D	Fluid Power System


#### Professional Elective - V

22PE0ME5A	Industrial Robotics
22PE0ME5B	Mechanical Vibrations
22PE0ME5C	Composite Materials
22PE0ME5D	Energy Conservation and Management


#### Professional Elective - VI

22PE0ME6A	Industry 4.0
22PE0ME6B	Fuzzy Logic and ANN
22PE0ME6C	Electric and Hybrid Vehicles
22PE0ME6D	Total Quality Management

  
Dr. A. Raj Kumar  
(Chairman, BOS)

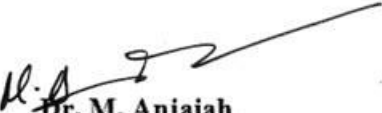
  
Dr. Ch. Sridhar Reddy  
(JNTUH Nominee)

  
Dr. L. Siva Rama Krishna  
(Academic Council Nominee)

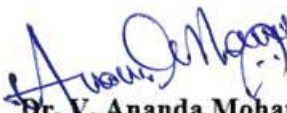
  
Dr. B. Lakshmana Swamy  
(Academic Council Nominee)

  
Dr. J. Chidanandappa  
(Industry Representative)

  
Dr. B. Sai Venkata Krishna  
(Alumni)

  
Dr. M. Anjaiah  
(Member)

  
Dr. M. Prakash Babu  
(Member)

  
Dr. V. Ananda Mohan  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



SCHOOL OF ENGINEERING

Department of Mechanical Engineering

Regulation - R22



## COURSE STRUCTURE

(Applicable from the batch admitted during 2022-23 onwards)

### OPEN ELECTIVES OFFERED IN R22

#### Open Elective - I

22OE0ME1A	Basic mechanical engineering
22OE0ME1B	Renewable energy sources

#### Open Elective - II

22OE0ME2A	Quantitative analysis for business decisions
22OE0ME2B	Industrial engineering & management

#### Open Elective - III

22OE0ME3A	Entrepreneurship development
22OE0ME3B	Elements of electric and hybrid vehicles

Dr. A. Raj Kumar  
(Chairman, BOS)

Dr. Ch. Sridhar Reddy  
(JNTUH Nominee)

Dr. L. Siva Rama Krishna  
(Academic Council Nominee)

Dr. B. Lakshmana Swamy  
(Academic Council Nominee)

Dr. J. Chidanandappa  
(Industry Representative)

Dr. B. Sai Venkata Krishna  
(Alumni)

Dr. M. Anjaiah  
(Member)

Dr. M. Prakash Babu  
(Member)

Dr. V. Ananda Mohan  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### DYNAMICS OF MACHINERY (22PC0ME19)

B.Tech. III Year I Sem.

L T P C  
3 0 0 3

**Pre-Requisites: Kinematics of Machinery**

#### Course Objectives:

- To study the inertia forces, torques and energy involved in different machine members.
- To learn the theory involved in the analysis of clutches, brakes, dynamometers, governors, and flywheels.
- To Understand the balancing of reciprocating and rotary parts.
- To be Aware of situations like speed fluctuations, rotor imbalance and machine vibrations in industries.
- To Understand the importance of resonance and critical speed.

**Course Outcomes:** At the end of the course, student will be able to

- Analyze the effect of a gyroscope on ships, aeroplanes, and automobile
- Explain the inertia forces in the working of important machine elements like flywheels, connecting rod etc.
- Understand the types of brakes and the roll of friction.
- Understand the working of governors and estimate the unbalanced forces in a multi-cylinder reciprocating engine.
- Estimate the longitudinal, transverse, and torsional vibrations to avoid resonance.

#### UNIT – I:

**Precession:** Gyroscopes – effect of precession – motion on the stability of moving vehicles such as motorcycle – motorcar – aeroplanes and ships.

**Static and Dynamic Force Analysis:** Static force analysis of planar mechanisms – Analytical Method – Dynamic Force Analysis – D’Alembert’s principle, Dynamic Analysis of 4-link mechanism, Slider Crank Mechanism.

#### UNIT – II:

**Turning Moment Diagram and Flywheels:** Engine Force Analysis – Piston Effort, Crank Effort, etc., Inertia Force in Reciprocating Engine – Graphical Method - Turning moment diagram – fluctuation of energy – flywheels and their design - Inertia of connecting rod- inertia force in reciprocating engines – crank effort and torque diagrams.

#### UNIT – III:

**Friction:** pivots and collars – uniform pressure, uniform wear – friction circle and friction axis: lubricated surfaces – boundary friction – film lubrication. Clutches – Types – Single plate, multi-plate, and cone clutches.

**Brakes and Dynamometers:** Types of brakes: Simple block brake, band, and block brake - internal expanding shoe brake-effect of braking of a vehicle. Dynamometers – absorption and transmission types. General description and methods of operation.

**UNIT – IV:**

**Governors:** Types of governors - Watt, Porter, and Proell governors. Spring loaded governors – Hartnell and Hartung with auxiliary springs. Sensitiveness, isochronism, and hunting – stability – effort and power of the governors.

**Balancing:** Balancing of rotating masses- Primary, Secondary, and higher balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples. Examination of “V” and multi cylinder in-line and radial engines for primary and secondary balancing- locomotive balancing – Hammer blow – Swaying couple – variation of tractive effort.

**UNIT – V:**

**Vibrations:** Free Vibration of mass attached to vertical spring- Damped free vibrations– Transverse loads – vibrations of beams with concentrated and distributed loads. Dunkerly’s method – Raleigh’s method. Whirling of shafts – critical speed – torsional vibrations – one, two and three rotor systems.

**TEXT BOOKS:**


1. Theory of Machines, S. S. Rattan, Mc Graw Hill, 2017
2. Theory of Machines /Sadhu Singh/ Pearson.

**REFERENCE BOOKS:**

1. Theory of Machines and Mechanisms, Joseph E. Shigley, Fifth Edition, Oxford University Press
2. Mechanism and Machine Theory, Rao, J.S & R.V. Duggipati, New Age
3. Bansal R.K, Brar J.S, Theory of Machines, Lakshmi Publications (P) Ltd, 2016 Edition.

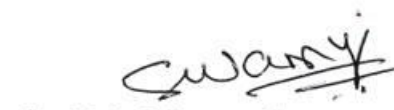
**WEB SOURCE REFERENCE:**

1. <https://archive.nptel.ac.in/courses/112/104/112104114/>

  
**Dr. A. Raj Kumar**  
(Chairman, BOS)

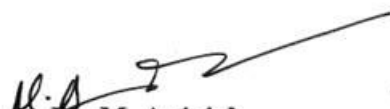
  
**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)

  
**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)

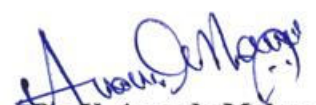
  
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)

  
**Dr. J. Chidanandappa**  
(Industry Representative)

  
**Dr. B. Sai Venkata Krishna**  
(Alumni)

  
**Dr. M. Anjaiah**  
(Member)

  
**Dr. M. Prakash Babu**  
(Member)

  
**Dr. V. Ananda Mohan**  
(Member)





# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### DESIGN OF MACHINE ELEMENTS (22PC0ME20)

B.Tech. III Year I Sem.

L	T	P	C
3	0	0	3

**Note:** Design Data books are not permitted in the Examinations. The design must not only satisfy strength criteria but also rigidity criteria.

**Pre-requisites:** Engineering mechanics, mechanics of solids, manufacturing processes, metallurgy, and material science.

#### Course Objectives:

- To understand the general design procedures and principles in the design of machine elements.
- To study different materials of construction and their properties and factors determining the selection of material for various applications.
- To determine stresses under different loading conditions.
- To learn the design procedure of different fasteners, joints, shafts, and couplings.

#### Course Outcomes:

- The student acquires the knowledge about the principles of design, material selection, component behavior subjected to loads, and criteria of failure.
- Understands the concepts of principal stresses, stress concentration in machine members and fatigue loading.
- Design based on strength and rigidity and analyze the stresses and strains induced in a machine element.

#### UNIT – I:

**Introduction:** General considerations in the design of Engineering Materials and their properties – selection – Manufacturing consideration in design. Tolerances and fits – BIS codes of steels. Design for Static Strength: Simple stresses – Combined stresses – Torsional and Bending stresses – Impact stresses – Stress strain relation – Various theories of failure – Factor of safety – Design for strength and rigidity – preferred numbers. The concept of stiffness in tension, bending, torsion and combined situations.

#### UNIT – II:

**Design for Fatigue Strength:** Stress concentration – Theoretical stress Concentration factor – Fatigue stress concentration factor – Notch Sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength – Gerber's curve – Goodman's line – Soderberg's line.

### UNIT – III:

**Riveted, Welded and Bolted Joints:** Riveted joints- methods of failure of riveted joints-strength equations-efficiency of riveted joints-eccentrically loaded riveted joints. Welded joints-Design of fillet welds-axial loads-circular fillet welds under bending, torsion. Welded joints under eccentric loading. Bolted joints – Design of bolts with pre-stresses – Design of joints under eccentric loading – locking devices – bolts of uniform strength.

### UNIT – IV:

**Keys, Cotters, and Knuckle Joints:** Design of keys-stresses in keys-cottered joints-spigot and socket, sleeve and cotter, Gib and cotter joints-Knuckle joints.

### UNIT – V:

**Shafts:** Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Shaft sizes – BIS code. - Gaskets and seals (stationary & rotary)

**Shaft Couplings:** Rigid couplings – Muff, Split muff, and Flange couplings. Flexible couplings – Flange coupling (Modified).

### TEXT BOOKS:

1. Design of Machine Elements, V B Bhandari, Fifth Edition, McGraw-Hill
2. Machine Design, Jindal, Pearson.

### REFERENCE BOOKS:

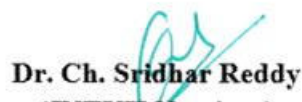
1. Design of Machine Elements, V. M. Faires, Macmillan.
2. Design of Machine Elements-I, Annaiah, M.H, New Age International Publishers.

### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/112/105/112105125/>




**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)




**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)



**Dr. J. Chidanandappa**  
(Industry Representative)



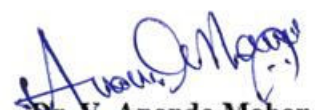
**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### METROLOGY AND MACHINE TOOLS (22PC0ME21)

B.Tech. III Year I Sem.

L T P C  
3 0 0 3

#### Course Objectives:

- To impart the fundamental aspects of the metal cutting principles and their application in studying the behavior of various machining processes.
- To train in knowing the fundamental parts of various machine tools and their kinematic schemes.
- To improve problem solving skills by determining the machining time of various machining processes.
- To provide technical understanding of basic concepts of engineering metrology and its practice in the industry.
- To make the student to improve applications aspect in the measurements and control of a process in manufacturing.

**Course Outcome:** At the end of the course, the student will be able to

- Explain the principles of metal cutting and working of lathe machine tools.
- Understand working of drilling, boring, shaping, slotting, planing machine tools and estimation of machining time.
- Describe the Principles of working and operations performed on milling and grinding machines.
- Explain the use of various measuring instruments, gauges and system of limits, fits, and tolerances.
- Describe the process of measuring the surface roughness, screw thread parameters & principles of coordinate measuring machines.

#### UNIT – I:

**Metal cutting:** Introduction, elements of cutting process – Geometry of single point tool, Chip formation and types of chips, tool materials, tool life, tool wear, cutting fluids, Analysis of orthogonal cutting- Merchant's force diagram, Machinability. Engine lathe – Principle of working, types of lathes, specifications, operations on lathe, Taper turning methods, Lathe attachments. Capstan and Turret lathe – Single spindle and multi-spindle automatic lathes – tool layouts.

#### UNIT – II:

**Drilling and Boring Machines** – Geometry of twist drill, Principles of working, specifications, types, operations performed, machining time calculations, Types of Boring machines, and applications. Shaping, slotting, and planing machines –Principles of working, specifications, types of operations performed, applications, quick return mechanisms, machining time calculations.

#### UNIT – III:

**Milling machines** – Principles of working – Types of milling machines – Geometry of milling cutters methods of indexing. Grinding – theory of grinding – classification of grinding machines. Types of abrasives, bonds. Selection of a grinding wheel. Lapping, honing and broaching machines, comparison and Constructional features, machining time calculations.

#### UNIT – IV:

**Introduction to Metrology:** Need, Types, Terminology, Methods of measurements, Selection of measuring Instruments Linear Measurement: Line and end standard, slip gauges, micrometers, spirit level.

**Limits, fits, and tolerances-** Types of Fits - Unilateral and bilateral tolerance system, hole, and shaft basis system. Interchangeability and selective assembly.

**Limit Gauges:** Taylor's principle, Design of GO, and NO-GO gauges. Measurement of angles using Bevel protractor and Sine bar. Measurement of flatness using straight edges, surface plates, optical flat and auto collimator.

#### UNIT – V:

**Surface Roughness Measurement:** Factors affecting the surface roughness, reasons for controlling the surface texture, elements of surface texture-Roughness, Waviness, evaluation of surface roughness-CLA, RMS, Rz Values. Methods of measurement of surface finish, Talysurf. Screw thread measurement, Gear measurement; Machine Tool Alignment Tests on lathe, milling and drilling machines. Coordinate Measuring Machines: Types and Applications of CMM.

#### TEXT BOOKS:


1. Machine Tool Practices/ Kibbe, John. Neely, T. White, Rolando O. Meyer/ Pearson
2. Engineering Metrology/ R.K. Jain/ Khanna Publishers.

#### REFERENCE BOOKS:


1. Gupta I.C., Engineering Metrology, Dhanpati Rai Publications (P) Ltd, 2021 Edition.
2. Principles of Machine Tools, Bhattacharyya A and Sen. G.C / New Central Book Agency.
3. Fundamentals of Dimensional Metrology / Connie Dotson / Thomson
4. Fundamentals of Metal Machining and Machine Tools / Geoffrey Boothroyd / McGraw Hill
5. Metrology and Measurement/ Bewoor & Kulkarni/ Tata Mc Graw Hill.

#### WEB SOURCE REFERENCES:

1. <https://archive.nptel.ac.in/courses/112/106/112106179/>
2. <https://archive.nptel.ac.in/courses/112/105/112105233/>




**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



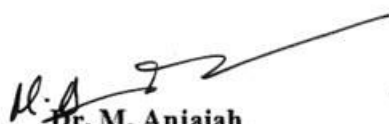
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)




**Dr. J. Chidanandappa**  
(Industry Representative)



**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### BUSINESS ECONOMICS & FINANCIAL ANALYSIS (22SS0MB01)

B.Tech. III Year I Sem.

L T P C  
3 0 0 3

**Course Objective:** To learn the basic Business types, impact of the Economy on Business and Firms specifically. To analyze the Business from the Financial Perspective.

**Course Outcome:** The students will understand the various Forms of Business and the impact of economic variables on the Business. The Demand, Supply, Production, Cost, Market Structure, Pricing aspects are learnt. The students can study the firm's financial position by analysing the Financial Statements of a Company.

#### UNIT – I: Introduction to Business and Economics

**Business:** Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.

**Economics:** Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply in Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

#### UNIT – II: Demand and Supply Analysis

**Elasticity of Demand:** Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

**Supply Analysis:** Determinants of Supply, Supply Function & Law of Supply.

#### UNIT – III: Production, Cost, Market Structures & Pricing

**Production Analysis:** Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.

**Cost analysis:** Types of Costs, Short run, and long run Cost Functions.

**Market Structures:** Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, Monopolistic Competition.

**Pricing:** Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, Cost Volume Profit Analysis.



#### **UNIT – IV: Financial Accounting:**

Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts.

#### **UNIT – V: Financial Analysis through Ratios:**

Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems). Introduction to Fund Flow and Cash Flow Analysis (simple problems).

#### **TEXT BOOKS:**

1. D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata McGraw Hill, 2017.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata McGraw Hill Education Pvt. Ltd. 2017

#### **REFERENCE BOOKS:**


1. Paresh Shah, Financial Accounting for Management 2e, Oxford University Press, 2019.
2. S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013.

#### **WEB SOURCE REFERENCE:**

1. <https://nptel.ac.in/courses/110101005>




**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)




**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)




**Dr. J. Chidanandappa**  
(Industry Representative)



**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### STEAM POWER & JET PROPULSION (22PC0ME22)

**B.Tech. III Year I Sem.**

**L T P C**

**3 0 0 3**

**Note:** Steam Table book Permitted.

**Pre-requisite:** Thermodynamics

**Course Objective:** To apply the laws of Thermodynamics to analyze steam and gas turbine cycles and to perform analysis of the major components of steam and gas turbine plants and their applications.

**Course Outcomes:** At the end of the course, the student will be able to

- Develop state – space diagrams based on the schematic diagrams of process flow of steam and gas turbine plants
- Apply the laws of Thermodynamics to analyze thermodynamic cycles
- Differentiate between vapour power cycles and gas power cycles
- Infer from property charts and tables and to apply the data for the evaluation of performance parameters of the steam and gas turbine plants
- Understand the functionality of major components of steam and gas turbine plants and to do the analysis of these components

#### **UNIT – I:**

**Steam Power Plant:** Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration & reheating.

**Boilers** – Classification – Working principles with sketches including H.P. Boilers – Mountings and Accessories – Working principles- Boiler horse power, Equivalent Evaporation, Efficiency and Heat balance – Draught- Classification – Height of chimney for given draught and discharge- Condition for maximum discharge- Efficiency of chimney.

#### **UNIT – II:**

**Steam Nozzles:** Stagnation Properties- Function of nozzle – Applications and Types- Flow through nozzles- Thermodynamic analysis – Assumptions -Velocity of nozzle at exit-Ideal and actual expansion in nozzle- Velocity coefficient- Condition for maximum discharge- Critical pressure ratio- Criteria to decide nozzle shape- Super saturated flow, its effects, Degree of super saturation and Degree of under cooling - Wilson line.

#### **UNIT – III:**

**Steam Turbines:** Classification – Impulse turbine; Mechanical details – Velocity diagram – Effect of friction – Power developed, Axial thrust, Blade, or diagram efficiency – Condition for maximum efficiency. De-Laval Turbine - its features- Methods to reduce rotor speed-Velocity compounding and Pressure compounding- Velocity and Pressure variation along the flow – Combined velocity diagram for a velocity compounded impulse turbine.

**Reaction Turbine:** Mechanical details – Principle of operation, Thermodynamic analysis of a stage, Degree of reaction – Velocity diagram – Parson’s reaction turbine – Condition for maximum efficiency.

**UNIT – IV:**

**Steam Condensers:** Requirements of steam condensing plant – Classification of condensers – Working principle of different types – Vacuum efficiency and Condenser efficiency – Air leakage, sources and its affects, Air pump- Cooling water requirement.

**Gas Turbines:** Simple gas turbine plant – Ideal cycle, essential components – Parameters of performance – Regeneration, Inter cooling and Reheating – Closed and Semi-closed cycles – Merits and Demerits- Combustion chambers and turbines of Gas Turbine Plant- Brief Concepts, combined cycle.

**UNIT – V:**

**Jet Propulsion:** Principle of Operation – Classification of jet propulsive engines – Working Principles with schematic diagrams and representation on T-S diagram - Thrust, Thrust Power and Propulsion Efficiency – Turbo jet engines – Needs and Demands met by Turbo jet – Schematic Diagram, Thermodynamic Cycle, Performance Evaluation Thrust Augmentation – Methods.

**Rockets:** Application – Working Principle – Classification – Propellant Type – Thrust, Propulsive Efficiency – Specific Impulse – Solid and Liquid propellant Rocket Engines.

**TEXT BOOKS:**

1. Thermal Engineering / Mahesh M Rathore/ Tata Mc Graw Hill.
2. Gas Turbines – V. Ganesan /Tata Mc Graw Hill.

**REFERENCE BOOKS:**

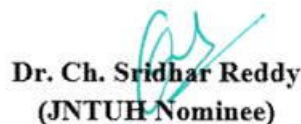
1. Gas Turbine Theory/ Saravanamuttoo, Cohen, Rogers, Straznicky, Nix / Pearson.
2. Fundamentals of Engineering Thermodynamics / Radhakrishnan/ PHI.
3. Thermal Engineering/ R.K. Rajput/ Lakshmi Publications.

**WEB SOURCE REFERENCE:**

1. <https://archive.nptel.ac.in/courses/112/103/112103307/>



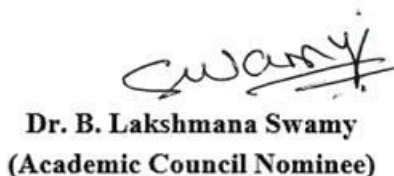
**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



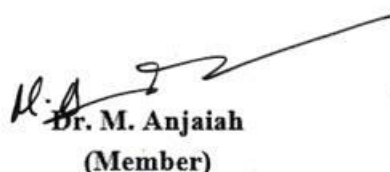
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)



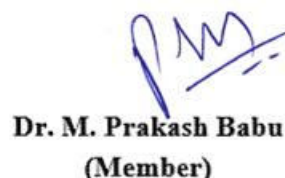
**Dr. J. Chidanandappa**  
(Industry Representative)



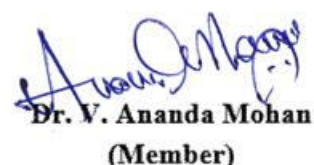
**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### CAD/CAM (22PC0ME23)

B.Tech. III Year I Sem.

L T P C

2 0 0 2

**Pre-requisites:** To learn the importance and use of computer in design and manufacture.

**Course objectives:** To provide an overview of how computers are being used in design, development of manufacturing plans and manufacture. To understand the need for integration of CAD and CAM.

**Course Outcomes:** At the end of the course, the student will be able to

- Understand geometric transformation techniques in CAD.
- Develop mathematical models to represent curves and surfaces.
- Model engineering components using solid modeling techniques.
- Develop programs for CNC to manufacture industrial components.
- Understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

#### UNIT – I:

Fundamentals of CAD/ CAM, Application of computers for Design and Manufacturing, Benefits of CAD/ CAM - Computer peripherals for CAD/ CAM, Design workstation, Graphic terminal, CAD/ CAM software- definition of system software and application software, CAD/ CAM database and structure.

**Geometric Modeling:** Wire frame modeling, wire frame entities, Interpolation and approximation of curves, Concept of parametric and non-parametric representation of curves, Curve fitting techniques, definitions of cubic spline, Bezier, and B-spline.

#### UNIT – II:

**Surface modeling:** Algebraic and geometric form, Parametric space of surface, blending functions, parametrization of surface patch, Subdividing, Cylindrical surface, ruled surface, Surface of revolution Spherical surface, Composite surface, Bezier surface. B-spline surface, Regenerative surface, and pathological conditions.

**Solid Modelling:** Definition of cell composition and spatial occupancy enumeration, Sweep representation, Constructive solid geometry, Boundary representations.

#### UNIT – III:

**NC Control Production Systems:** Numerical control, Elements of NC system, NC part programming: Methods of NC part programming, manual part programming, Computer assisted part programming, Post Processor, Computerized part program, SPPL (A Simple Programming Language). CNC, DNC, and Adaptive Control Systems.

#### UNIT – IV:

**Group Technology:** Part families, Parts classification, and coding. Production flow analysis, Machine cell design.

**Computer aided process planning:** Difficulties in traditional process planning, Computer aided process planning: retrieval type and generative type, Machinability data systems.

**Computer aided manufacturing resource planning:** Material resource planning, inputs to MRP, MRP output records, Benefits of MRP, Enterprise resource planning, Capacity requirements planning

#### UNIT – V:

**Flexible manufacturing system:** F.M.S equipment, FMS layouts, Analysis methods for FMS benefits of FMS.

**Computer aided quality control:** Automated inspection- Off-line, On-line, contact, Non-contact; Coordinate measuring machines, Machine vision.

**Computer Integrated Manufacturing:** CIM system, Benefits of CIM.

#### TEXT BOOKS:

1. CAD/CAM Concepts and Applications / Alavala / PHI.
2. CAD/CAM Principles and Applications / P. N. Rao / Mc Graw Hill.
3. CAD/CAM: Computer Aided Design and manufacturing, Groover M.P., Zimmers / Pearson.

#### REFERENCE BOOKS:

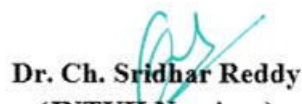
1. CAD/CAM/CIM/ Radhakrishnan and Subramanyam / New Age.

#### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/112/102/112102101/>



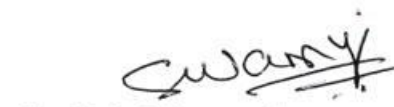
Dr. A. Raj Kumar  
(Chairman, BOS)



Dr. Ch. Sridhar Reddy  
(JNTUH Nominee)



Dr. L. Siva Rama Krishna  
(Academic Council Nominee)



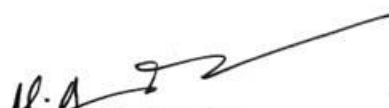
Dr. B. Lakshmana Swamy  
(Academic Council Nominee)




Dr. J. Chidanandappa  
(Industry Representative)




Dr. B. Sai Venkata Krishna  
(Alumni)



Dr. M. Anjaiah  
(Member)



Dr. M. Prakash Babu  
(Member)



Dr. V. Ananda Mohan  
(Member)





# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### THERMAL ENGINEERING LABORATORY (22PC0ME24)

B.Tech. III Year I Sem.

L T P C  
0 0 2 1


**Pre-Requisite:** Thermodynamics & Thermal Engineering - I

**Objective:** To understand the working principles of IC Engines, Compressors.

#### List of Experiments


1. I.C. Engines Valve / Port Timing Diagrams
2. I.C. Engines Performance Test for 4 Stroke SI engines
3. I.C. Engines Performance Test for 2 Stroke SI engines
4. I.C. Engines Morse, Retardation, Motoring Tests
5. I.C. Engine Heat Balance – CI/SI Engines
6. I.C. Engines Economical speed Test on a SI engine
7. I.C. Engines effect of A/F Ratio in a SI engine
8. Performance Test on Variable Compression Ratio Engine
9. IC engine Performance Test on a 4S CI Engine at constant speed
10. Volumetric efficiency of Air – Compressor Unit
11. Dis-assembly / Assembly of Engines
12. Study of Boilers

**Note:** Perform a minimum of any 10 out of the 12 Exercises.

  
Dr. A. Raj Kumar  
(Chairman, BOS)

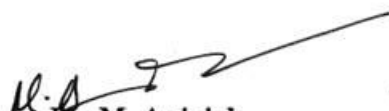
  
Dr. Ch. Sridhar Reddy  
(JNTUH Nominee)

  
Dr. L. Siva Rama Krishna  
(Academic Council Nominee)

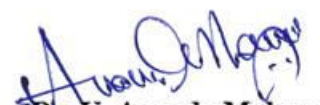
  
Dr. B. Lakshmana Swamy  
(Academic Council Nominee)

  
Dr. J. Chidanandappa  
(Industry Representative)

  
Dr. B. Sai Venkata Krishna  
(Alumni)

  
Dr. M. Anjaiah  
(Member)

  
Dr. M. Prakash Babu  
(Member)

  
Dr. V. Ananda Mohan  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### METROLOGY & MACHINE TOOLS LABORATORY (22PC0ME25)

B.Tech. III Year I Sem.

L T P C  
0 0 2 1

**Pre-requisites:** Theoretical exposure to Metrology and machine tools.

**Course Objectives:**

1. To impart practical exposure to the metrology equipment & Machine Tools.
2. To conduct experiments and understand the working of the same.

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

- Identify parts of Lathe and perform different operations on Lathe.
- Identify parts of drilling machine and perform operations on drilling machine.
- Identify parts of Milling Shaping and Planning machine and perform operations on Milling, Shaping and Planning machine.
- Identify various measuring instruments and use them appropriately.
- Measure surface finish of machined components.

**List of Experiments:**

1. Step turning on lathe machine
2. Taper turning on lathe machine
3. Thread cutting and knurling on lathe machine (2 exercises)
4. Measurement of cutting forces on lathe
5. Machining of holes using Drilling and boring machines.
6. Gear cutting on the Milling machine
7. Grinding of Tool angles using Cylindrical / Surface Grinding
8. Measurement of lengths, heights, diameters by vernier calipers, micrometers.
9. Measurement of Diameter of bores by internal micrometers and dial bore indicators.
10. Use of gear teeth vernier calipers for checking the chordal addendum and chordal height of the spur gear.
11. Angle and taper measurements by bevel protractor and sine bars.
12. Thread measurement by 2-wire and 3-wire methods.
13. Surface roughness measurement by Tally Surf.
14. Use of mechanical comparator

**Note:** Perform a minimum of any 10 out of the 14 Exercises.



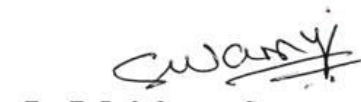
Dr. A. Raj Kumar  
(Chairman, BOS)



Dr. Ch. Sridhar Reddy  
(JNTUH Nominee)



Dr. L. Siva Rama Krishna  
(Academic Council Nominee)



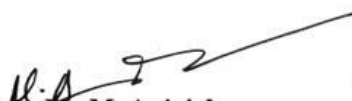
Dr. B. Lakshmana Swamy  
(Academic Council Nominee)



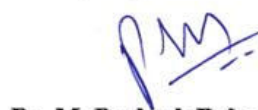
Dr. J. Chidanandappa  
(Industry Representative)



Dr. B. Sai Venkata Krishna  
(Alumni)



Dr. M. Anjaiah  
(Member)



Dr. M. Prakash Babu  
(Member)



Dr. V. Ananda Mohan  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### KINEMATICS & DYNAMICS LAB (22PC0ME26)

B.Tech. III Year I Sem.

L T P C  
0 0 2 1

**Pre-requisites:** Prerequisites for the graduate-level course are Kinematics, Dynamics, differential equations, motion simulation, displacement, velocity, acceleration, force, torque, power, Newton's motion laws, vibration, Gyroscopic Effect, Cams, Bearings.


**Course Objectives:** The objective of the lab is to understand the kinematics and dynamics of mechanical elements such as linkages, gears, cams and learn to design such elements to accomplish desired motions or tasks.


**Course Outcomes:** Upon successful completion of this lab, students should be able to:


1. Understand types of motion.
2. Analyze forces and torques of components in linkages.
3. Understand static and dynamic balance.
4. Understand forward and inverse kinematics of open-loop mechanisms.

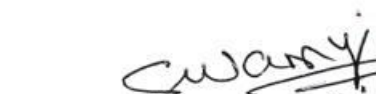
**List of Experiments:** (Perform a minimum of any 10 out of the 12 Exercises)

1. To determine the frequency of torsional vibration
2. The balance masses statically for single rotating mass systems
3. The balance masses dynamically for single rotating mass systems
4. For a simple pendulum determine time period and its natural frequency.
5. For compound pendulum determine time period and its natural frequency.
6. Determine the effect of gyroscope for different motions.
7. Determine time period, amplitude and frequency of undamped free longitudinal vibration of single degree spring mass system.
8. Determine time period, amplitude and frequency of damped free longitudinal vibration of single degree spring mass system.
9. Field balancing of the thin rotors using vibration pickups
10. Determination of damped natural frequency of vibration of a vibrating system with different viscous oils.
11. Determination of natural frequency of a given structure using FFT analyzer
12. Diagnosis of a machine using FFT analyzer.

  
Dr. A. Raj Kumar  
(Chairman, BOS)

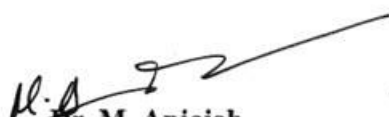
  
Dr. Ch. Sridhar Reddy  
(JNTUH Nominee)


  
Dr. L. Siva Rama Krishna  
(Academic Council Nominee)

  
Dr. B. Lakshmana Swamy  
(Academic Council Nominee)

  
Dr. J. Chidanandappa  
(Industry Representative)

  
Dr. B. Sai Venkata Krishna  
(Alumni)

  
Dr. M. Anjaiah  
(Member)

  
Dr. M. Prakash Babu  
(Member)

  
Dr. V. Ananda Mohan  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### INTELLECTUAL PROPERTY RIGHTS (22MC0MB03)

B.Tech. III Year I Sem.

L T P C

3 0 0 0

#### Course Objectives:

- Significance of intellectual property and its protection
- Introduce various forms of intellectual property

#### Course Outcomes:

- Distinguish and explain various forms of IPRs.
- Identify criteria to fit one's own intellectual work in particular form of IPRs.
- Apply statutory provisions to protect particular form of IPRs.
- Appraise new developments in IPR laws at national and international level

#### UNIT – I

**Introduction to Intellectual property:** Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

#### UNIT – II

**Trade Marks:** Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

#### UNIT – III

**Law of copyrights:** Fundamental of copyright law, originality of material, rights of reproduction, rights to perform the work publicly, copyright ownership issues, copyright registration, notice of copyright, international copyright law. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.

#### UNIT – IV

**Trade Secrets:** Trade secret law, determination of trade secret status, liability for misappropriations of trade secrets, protection for submission, trade secret litigation. Unfair competition: Misappropriation right of publicity, false advertising.

## UNIT – V

**New development of intellectual property:** new developments in trade mark law; copyright law, patent law, intellectual property audits. International overview on intellectual property, international – trade mark law, copyright law, international patent law, and international development in trade secrets law.

### TEXT BOOK:

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.

### REFERENCE BOOK:

1. Intellectual property right – Unleashing the knowledge economy, Prabuddha Ganguli, Tata McGraw Hill Publishing company ltd.

### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/110/105/110105139/>




**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



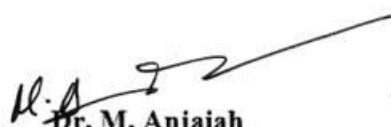
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)



**Dr. J. Chidanandappa**  
(Industry Representative)



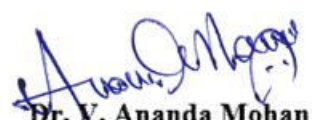
**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)





# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### MACHINE DESIGN (22PC0ME27)

B.Tech. III Year II Sem.

L T P C  
3 0 0 3

**Note:** Design Data Book is permitted. Design of all components should include design for strength and rigidity apart from engineering performance requirements.

**Pre-requisites:** Study of engineering mechanics, design of machine members-I and theory of machines.

#### Course objectives:

- To gain knowledge about designing the commonly used important machine members such as bearings, engine parts, springs, belts, gears etc.
- To design the components using the data available in design data books.

**Course Outcomes:** At the end of the course, the student will be able to

- Understand the types of bearings, bearing material, bearing design using different empirical relations.
- Estimate the life of rolling element bearings and their selection for given service conditions.
- Design of engine components like piston, connecting rod.
- Design of springs, pulleys and belts.
- Design of gears.

#### UNIT – I:

**Sliding contact bearings:** Types of Journal bearings – Lubrication – Bearing Modulus – Full and partial bearings – Clearance ratio – Heat dissipation of bearings, bearing materials – journal bearing design.

#### UNIT – II:

**Rolling contact bearings:** Ball and roller bearings – Static load – dynamic load – equivalent radial load – design and selection of ball & roller bearings.

### UNIT – III:

**Engine Parts:** Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends –Pistons, Forces acting on piston – Construction, Design and proportions of piston.

### UNIT – IV:

**Mechanical Springs:** Stresses and deflections of helical springs – Extension and compression springs – Design of springs for fatigue loading – natural frequency of helical springs – Energy storage capacity – helical torsion springs – Design of co-axial springs, Design of leaf springs.

**Belts & Pulleys:** Transmission of power by Belt and Rope Drives, Transmission efficiencies, Belts – Flat and V types – Ropes - pulleys for belt and rope drives.

### UNIT – V:

**Gears:** Spur gears& Helical gears- Brief introduction involving important concepts – Design of gears using AGMA procedure involving Lewis and Buckingham equations. Check for wear.

### TEXT BOOKS:


1. Design of Machine Elements / Spotts/ Pearson
2. Machine Design / Pandya & Shah, 21st Edition, 2022 / Charoathar

### REFERENCE BOOKS:

1. Design of Machine Elements-II / Annaiah, Suresh kumar, chandrapa / New Age.
2. Design of Machine Elements / Sharma and Purohit/PHI.
3. Design Data Book/ P.V. Ramana Murti & M. Vidyasagar/ B.S. Publications.
4. Design Data Handbook/ S. Md. Jalaludeen/ Anuradha Publishers.

### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/112/106/112106137/>




**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



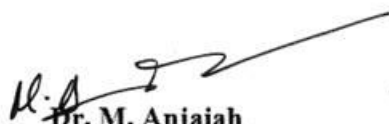
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)



**Dr. J. Chidanandappa**  
(Industry Representative)



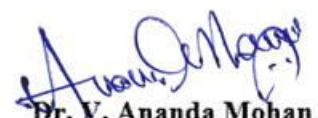
**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### HEAT TRANSFER (22PC0ME28)

B.Tech. III Year II Sem.

L T P C  
3 0 0 3

**Note:** Heat Transfer Data Book is permitted.

**Pre-requisite:** Thermodynamics

**Course Objectives:** To provide knowledge about application of conduction, convection, and radiation heat transfer concepts to different practical applications

**Course Outcomes:** At the end of this course, student will be able to

- Understand the basic modes of heat transfer.
- Compute one dimensional steady state heat transfer with and without heat generation.
- Understand and analyze heat transfer through extended surfaces.
- Understand one dimensional transient conduction heat transfer.
- Understand concepts of continuity, momentum, and energy equations.
- Interpret and analyze forced and free convective heat transfer.
- Understand the principles of boiling, condensation, and radiation heat transfer.
- Design of heat exchangers using LMTD and NTU methods.

#### UNIT – I:

**Introduction:** Modes and mechanisms of heat transfer – Basic laws of heat transfer – General discussion about applications of heat transfer.

**Conduction Heat Transfer:** Fourier rate equation – General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates – simplification and forms of the field equation – steady, unsteady, and periodic heat transfer – Initial and boundary conditions

**One Dimensional Steady State Conduction Heat Transfer:** Homogeneous slabs, hollow cylinders, and spheres- Composite systems– overall heat transfer coefficient – Electrical analogy – Critical radius of insulation

#### UNIT – II:

**One Dimensional Steady State Conduction Heat Transfer:** Variable Thermal conductivity – systems with heat sources or Heat Generation-Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin, Application to error measurement of Temperature.

**One Dimensional Transient Conduction Heat Transfer:** Systems with negligible internal resistance – Significance of Biot and Fourier Numbers –Infinite bodies- Chart solutions of transient conduction systems- Concept of Semi-infinite body.

#### UNIT – III:

**Convective Heat Transfer:** Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow – Dimensional analysis as a tool for experimental investigation – Buckingham II Theorem and method, application for developing semi – empirical non- dimensional correlation for convection heat transfer – Significance of non-dimensional numbers – Concepts of Continuity, Momentum and Energy Equations – Integral Method as approximate method - Application of Von Karman Integral Momentum Equation for flat plate with different velocity profiles.

**Forced convection: External Flows:** Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer -Flat plates and Cylinders.

**UNIT – IV:**

**Internal Flows:** Concepts about Hydrodynamic and Thermal Entry Lengths – Division of internal flow based on this –Use of empirical relations for Horizontal Pipe Flow and annulus flow.

**Free Convection:** Development of Hydrodynamic and thermal boundary layer along a vertical plate - Use of empirical relations for Vertical plates and pipes.

**Heat Exchangers:** Classification of heat exchangers – overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods - Problems using LMTD and NTU methods.

**UNIT – V:**

**Heat Transfer with Phase Change: Boiling:** Pool boiling – Regimes – Calculations on Nucleate boiling, Critical Heat flux and Film boiling.

**Condensation:** Film wise and drop wise condensation –Nusselt’s Theory of Condensation on a vertical plate - Film condensation on vertical and horizontal cylinders using empirical correlations.

**Radiation Heat Transfer:** Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchoff, Lambert, Stefan, and Boltzmann– heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between grey bodies – radiation shields – electrical analogy for radiation networks.

**TEXT BOOKS:**

1. Fundamentals of Engineering Heat and Mass Transfer, R.C. Sachdeva, New Age.
2. Heat Transfer, J.P. Holman, Tenth Edition, Mc Graw Hill.

**REFERENCE BOOKS:**

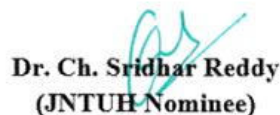
1. Heat Transfer by a Practical Approach, Yunus Cengel, Boles, TMH.
2. Heat transfer, A conceptual Approach, P. K. Sarma, Rama Krishna, New Age.
3. Heat and mass Transfer, Dr. D. S. Kumar, S. K. Kataria & Sons.
4. Essential Heat Transfer - Christopher A Long / Pearson.
5. Heat Transfer – Ghosh Dastidar / Oxford.
6. Heat and Mass Transfer data book, CP Kodanda Raman, Subramanyan, New Age.

**WEB SOURCE REFERENCE:**

1. <https://archive.nptel.ac.in/courses/103/105/103105140/>



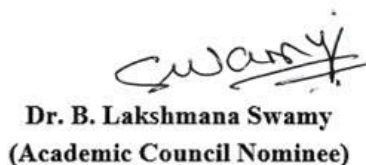
Dr. A. Raj Kumar  
(Chairman, BOS)



Dr. Ch. Sridhar Reddy  
(JNTUH Nominee)



Dr. L. Siva Rama Krishna  
(Academic Council Nominee)



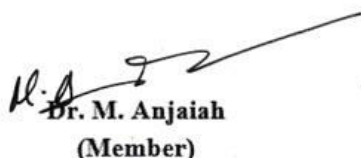
Dr. B. Lakshmana Swamy  
(Academic Council Nominee)



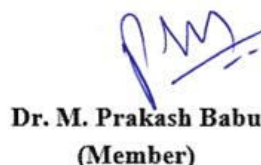
Dr. J. Chidanandappa  
(Industry Representative)




Dr. B. Sai Venkata Krishna  
(Alumni)



Dr. M. Anjaiah  
(Member)



Dr. M. Prakash Babu  
(Member)



Dr. V. Ananda Mohan  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### FINITE ELEMENT METHODS (22PC0ME29)

B.Tech. III Year II Sem.

L T P C  
3 0 0 3

**Pre-requisites:** Mechanics of Solids

**Course Objectives:** The aim of the course is to provide the students.

- Basics of Finite Element Analysis.
- Use of available material models for structural materials, soils, and interfaces/joints.
- Modeling of engineering systems and Soil–Structure Interaction (SSI).
- Importance of interfaces and joints on the behavior of engineering systems.
- Implementation of material model in finite element method and applications.

**Course Outcomes:** At the end of the course, the student will be able to

- Apply finite element method to solve problems in solid mechanics, fluid mechanics and heat transfer
- Formulate and solve problems in one-dimensional structures including trusses, beams and frames.
- Formulate FE characteristic equations for two dimensional elements and analyze plain stress, plain strain, axi-symmetric and plate bending problems.
- Use of ANSYS, ABAQUS, NASTRAN, etc.

#### UNIT – I:

**Introduction to Finite Element Methods:** General Procedure – Engineering Applications – Stress and Equilibrium, Strain – Displacement relations. Stress – strain relations: Finite Elements: 1- Dimensional, 2 – Dimensional, 3-Dimensional & Interpolation Elements.

**One Dimensional Problems:** 1-D Linear and 1-D Quadratic Elements - Finite element modeling, Coordinates, and shape functions. Assembly of Global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

#### UNIT – II:

**Analysis of Trusses:** Derivation of Stiffness Matrix for Plane Truss, Displacement of Stress Calculations.

**Analysis of Beams:** Element stiffness matrix for two-noded, two degrees of freedom per node beam element, Load Vector, Deflection.



### UNIT – III:

Finite element modeling of two-dimensional stress analysis with constant strain triangles and treatment of boundary conditions, Estimation of Load Vector, Stresses  
Finite element modeling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular elements. Two dimensional four-noded Iso-parametric elements and numerical integration.

### UNIT – IV:

**Steady State Heat Transfer Analysis:** one dimensional analysis of Slab, fin and two-dimensional analysis of thin plate.

### UNIT – V:

**Dynamic Analysis:** Formulation of finite element model, element - Mass matrices, evaluation of Eigen values and Eigen vectors for a stepped bar, truss, and beam. Finite element – formulation to 3 D problems in stress analysis, convergence requirements, Mesh generation. techniques such as semi-automatic and fully Automatic use of software such as ANSYS, ABAQUS, NASTRAN using Hexahedral and Tetrahedral Elements.

### TEXT BOOKS:


1. Finite Element Methods: Basic Concepts and applications/Alavala/PHI.
2. Introduction to Finite Elements in Engineering, Chandrupatla, Ashok and Belegundu /Pearson.

### REFERENCE BOOKS:


1. An Introduction to the Finite Element Method / J. N. Reddy/ Mc Graw Hill.
2. Finite Element Analysis / SS Bhavikatti / New Age.
3. Finite Element Method/ Dixit/Cengage.

### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/112/105/112105308/>



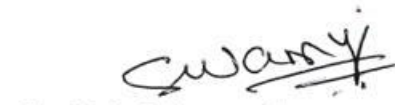
Dr. A. Raj Kumar  
(Chairman, BOS)



Dr. Ch. Sridhar Reddy  
(JNTUH Nominee)



Dr. L. Siva Rama Krishna  
(Academic Council Nominee)



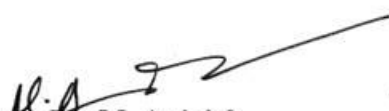
Dr. B. Lakshmana Swamy  
(Academic Council Nominee)




Dr. J. Chidanandappa  
(Industry Representative)



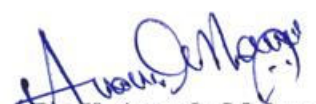
Dr. B. Sai Venkata Krishna  
(Alumni)



Dr. M. Anjaiah  
(Member)



Dr. M. Prakash Babu  
(Member)



Dr. V. Ananda Mohan  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)  
Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### UNCONVENTIONAL MACHINING PROCESSES (22PE0ME1A) (PROFESSIONAL ELECTIVE-I)

B.Tech. III Year II Sem.

L T P C  
3 0 0 3

**Course Overview:** The objective of this course is to introduce the student to more advanced topics in the machining processes. To bring out the need for Unconventional Machining Processes which will overcome the difficulties associated with Traditional Machining.

#### Course Objectives:

- To differentiate conventional and Unconventional Machining Processes and Ultrasonic Machining.
- To understand the process capabilities of abrasive, water jet and electro-chemical machining processes.
- To understand the working principle & important features of electrical discharge machining process.
- To understand the process parameters, accuracy and surface finish of electron beam & laser beam machining Processes.
- To understand the working principle & metal removal rate of plasma arc machining and abrasive finishing process.

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

- Study the need for unconventional machining processes and explain ultrasonic machining process.
- Describe Abrasive jet, Water jet, and Abrasive water jet machining and electrochemical machining process.
- Describe working principle and process variables of EDM process.
- Explain the process capabilities and process parameters of Electron Beam machining and Laser Beam machining.
- Describe the working of Plasma Arc machining, chemical machining and Abrasive Finishing processes.

#### UNIT – I:

**Introduction** – Need for non-traditional machining methods-Classification of modern machining processes – considerations in process selection. Materials. Applications. Ultrasonic machining – Elements of the process, mechanics of metal removal process, parameters, economic considerations, applications and limitations, recent development.

#### UNIT – II:

**Abrasive Jet Machining, Water Jet Machining and Abrasive Water Jet Machining:** Basic principles, equipment, process variable, and mechanics of metal removal, MRR, application and limitations.

**Electro – Chemical Processes:** Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring processes, metal removal rate in ECM, Tool design, Surface finish and accuracy, economic aspects of ECM – Simple problems for estimation of metal removal rate.

**UNIT – III:**

**Thermal Metal Removal Processes:** General Principle and applications of Electric Discharge Machining, Electric Discharge Grinding and electric discharge wire cutting processes – Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection. Wire EDM, principle, applications.

**UNIT – IV:**

Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes –General Principle and application of laser beam machining – thermal features, cutting speed and accuracy of cut.

**UNIT – V:**

Application of plasma for machining, metal removing mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries. Chemical machining – principle - maskants - applications. Magnetic abrasive finishing, Abrasive flow finishing, Electro stream drilling, shaped tube electrolyte machining.

**TEXT BOOKS:**

1. Advanced Machining Processes / VK Jain / Allied publishers.
2. Modern Machining Processes - P. C. Pandey, H. S. Shan/ Mc Graw Hill.


**REFERENCE BOOKS:**

1. Unconventional Manufacturing Processes/ Singh M.K/ New Age Publishers.
2. Advanced Methods of Machining/ J.A. McGeough/ Springer International.
3. Non-Traditional Manufacturing Processes/ Benedict G.F./ CRC Press.

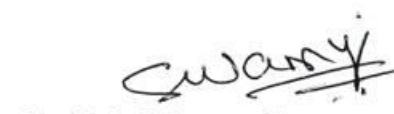
**WEB SOURCE REFERENCES:**

1. <https://archive.nptel.ac.in/courses/112/105/112105212/>
2. <https://archive.nptel.ac.in/courses/112/103/112103202/>

  
**Dr. A. Raj Kumar**  
(Chairman, BOS)

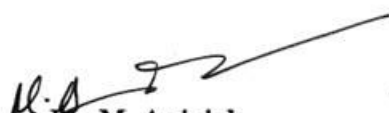
  
**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)

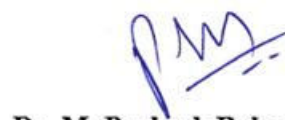
  
**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)

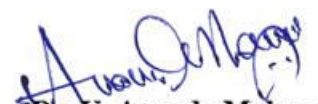
  
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)

  
**Dr. J. Chidanandappa**  
(Industry Representative)

  
**Dr. B. Sai Venkata Krishna**  
(Alumni)

  
**Dr. M. Anjaiah**  
(Member)

  
**Dr. M. Prakash Babu**  
(Member)

  
**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)  
Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### PRODUCTION PLANNING & CONTROL (22PE0ME1B) (PROFESSIONAL ELECTIVE-I)

**B.Tech. III Year II Sem.**

**L T P C**  
**3 0 0 3**

**Pre-requisites:** Management Science & Productivity.

**Course Objectives:** Understand the importance of Production planning & control. Learning way of carrying out various functions so as to produce right product, right quantity at right time with minimum cost.

**Course Outcomes:** At the end of the course, the student will be able to

- Understand production systems and their characteristics.
- Evaluate MRP and JIT systems against traditional inventory control systems.
- Describe and apply methods of line balancing and routing techniques.
- Apply various types of scheduling techniques to production systems.
- Apply dispatching and follow up techniques to the production control and management system.

#### UNIT – I:

**Introduction:** Definition – Objectives of Production Planning and Control – Functions of production planning and control - Types of production systems - Organization of production planning and control department.

**Forecasting** – Definition- uses of forecast- factors affecting the forecast- types of forecasting- their uses - general principle of forecasting. Forecasting techniques- quantitative and qualitative techniques. Measures of forecasting errors.

#### UNIT – II:

**Inventory management** – Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – Basic EOQ model- Inventory control systems –continuous review systems and periodic review systems, MRP I, MRP II, ERP, JIT Systems - Basic Treatment only.

**Aggregate planning** – Definition – aggregate-planning strategies – aggregate planning methods – transportation model.

#### UNIT – III:

**Line Balancing:** Terminology, Methods of Line Balancing, RPW method, Largest Candidate method and Heuristic method.

**Routing**– Definition – Routing procedure – Factors affecting routing procedure, Route Sheet.

#### UNIT – IV:

**Scheduling** –Definition – Scheduling Policies – types of scheduling methods – differences with loading – flow shop scheduling – job shop scheduling, line of balance (LOB) – objectives - steps involved.

#### UNIT – V:

**Dispatching:** Definition – activities of dispatcher – dispatching procedures – various forms used in dispatching.

**Follow up:** Definition – types of follow up – expediting – definition – expediting procedures-Applications of computers in planning and control.

#### TEXT BOOKS:


1. Operations management/ Heizer/Pearson/13th Edition, 2019.
2. Production and Operations Management / Ajay K Garg / Mc Graw Hill, 1st Edition, 2017.

#### REFERENCE BOOKS:

1. Production Planning and Control- Text& cases/ SK Mukhopadhyaya /PHI, 2nd Edition, 2007.
2. Production Planning and Control- Jain & Jain – Khanna publications, 8th Edition, 1999.

#### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/110/107/110107141/>




**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



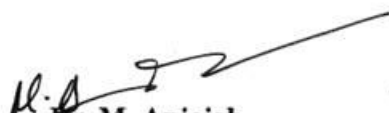
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)



**Dr. J. Chidanandappa**  
(Industry Representative)



**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)





# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### OPERATIONS RESEARCH (22PE0ME1C) (PROFESSIONAL ELECTIVE-I)

**B.Tech. III Year II Sem.**

**L T P C**  
**3 0 0 3**

#### **Course Objectives:**

To Understand the importance of optimization model and solving it.

**Course Outcome:** At the end of the course, the student will be able to

- Understand the problem, identify the variables & constants.
- Formulate the optimization model and apply appropriate optimization technique.

#### **UNIT – I:**

Development-definition-characteristics and phases-Types of models-Operations Research models - applications.

**Allocation:** Linear Programming Problem Formulation-Graphical solution- Simplex method - Artificial variable techniques: Two-phase method, Big-M method.

#### **UNIT – II:**

**Transportation problem** - Formulation-Optimal solution, unbalanced transportation problem - Degeneracy.

**Assignment problem**- Formulation-Optimal solution, - Variants of Assignment problem- Travelling salesman problem.

#### **UNIT – III:**

**Sequencing**- Introduction-Flow-Shop sequencing- n jobs through two machines – n jobs through three machines- Job shop sequencing-two jobs through ‘m’ machines.

**Replacement:** Introduction- Replacement of items that deteriorate with time- when money value is not counted and counted- Replacement of items that fail completely- Group Replacement.

#### **UNIT – IV:**

**Theory of Games:** Introduction- Terminology- Solution of games with saddle points and without saddle points. 2 x 2 games- dominance principle- m x 2 & 2 x n games- Graphical method.

**Inventory:** Introduction- Single item, Deterministic models- purchase inventory models with one price break and multiple price breaks- Stochastic models - Demand may be discrete variable or continuous variable- single period model and no setup cost.

**UNIT – V:**

**Waiting lines:** Introduction- Terminology- Single channel- Poisson arrivals and Exponential service times with infinite population.

**Dynamic Programming:** Introduction- Terminology, Bellman's principle of optimality- Applications of Dynamic programming- shortest path problem- linear programming problem.

**TEXT BOOK:**


1. Operations Research Theory and Applications / J. K. Sharma sixth Edition, Trinity.
2. Introduction to Operations Research/ Hillier & Lieberman/MGH.


**REFERENCE BOOKS:**

1. Operations Research: An Introduction, Hamdy A. Taha/PHI.
2. Operations Research/NVS Raju/SMS Education/3rd Revised Edition.
3. Operations Research /A. M. Natarajan, P. Balasubramaniam, A. Tamilarasi/Pearson Education.
4. Operations Research/ Wagner/ PHI Publications.
5. Operations Research/M.V. Durga Prasad, K. Vijaya Kumar Reddy, J. Suresh Kumar/Cengage Learning.


**WEB SOURCE REFERENCE:**

1. <https://archive.nptel.ac.in/courses/112/106/112106134/>

  
**Dr. A. Raj Kumar**  
(Chairman, BOS)


  
**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)


  
**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)


  
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)

  
**Dr. J. Chidanandappa**  
(Industry Representative)

  
**Dr. B. Sai Venkata Krishna**  
(Alumni)

  
**Dr. M. Anjaiah**  
(Member)

  
**Dr. M. Prakash Babu**  
(Member)

  
**Dr. V. Ananda Mohan**  
(Member)



# **GURU NANAK INSTITUTIONS TECHNICAL CAMPUS**

(An UGC Autonomous Institution - Affiliated to JNTUH)  
Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## **R22 B.Tech. Mechanical Engineering**

### **MICROPROCESSORS IN AUTOMATION (22PE0ME1D) (PROFESSIONAL ELECTIVE-I)**

**B.Tech. III Year II Sem.**

**L T P C  
3 0 0 3**

#### **UNIT - I: Basic Concepts of Digital Circuits**

Number Systems, Logic Gates, Combinational Circuits, Flip-flops, Sequential Logic Circuits: Counters, Shift Registers. Basic components and computer architecture- CPU, Memory, and Peripherals

#### **UNIT - II: Architecture of Microprocessor**

Introduction, Origin, Historical Developments, Introduction to 8085 Functional Block Diagram, Registers, ALU, Bus Systems, Timing and Control Signals, PIN diagram, Machine Cycles, Instruction Cycle and Timing States, Instruction Timing Diagrams, Addressing Modes. Concept of Interrupt, Need for Interrupts, Interrupt structure, Multiple Interrupt requests and their handling, Programmable interrupt controller.

#### **UNIT - III: Assembly Language Programming**

Instruction Set, Simple programs in 8085 mainly on Addition, Subtraction, Multiplication, Rotation, Ascending and Descending of the given data.

#### **UNIT - IV: Memory and I/O Device Interfacing**

Memory Interfacing - Memory structure and its requirements, Basic Concept in Memory Interfacing, Address Decoding, Interfacing Circuits, Address Decoding and Memory Addresses, Typical Examples on Memory interfacing: Interface (2k x 8) ROM, (8k x 8) EPROM, and (1k x 8) RAM with 8085.

IO Interfacing – Basic Interfacing Concepts-Peripheral I/O instructions, I/O Execution, Device Selection, and data transfer, absolute vs. Partial Decoding, Input Interfacing, Interfacing I/Os using Decoders

## UNIT - V: Architecture of Microcontroller

Introduction to Microcontrollers and how they differ from microprocessors, Block diagram of Microcontrollers, Architecture of 8051 microcontroller, Pin Diagram, Instruction set, simple 8051 programming, introduction to ARM microcontroller and its applications.

### TEXT BOOKS:

1. Microprocessor Architecture, Programming, and Applications with the 8085, Ramesh Gaonkar, PENRAM International Publishers.
2. The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D, Mckinlay, 2nd Edition, Pearson publication, 2007.

### REFERENCE BOOKS:

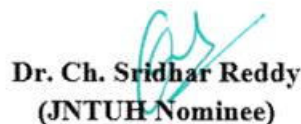
1. Microprocessors and Interfacing: Programming and Hardware, Douglas V. Hall
2. Microcomputer Experimentation with the Intel SDK-85, Lance A. Leventhal, Prentice Hall
3. Introduction to Microprocessors, Aditya P Mathur, Tata McGraw-Hill, Europe; 3rd Edition, 1990.
4. Digital Electronics: An Introduction to Theory and Practice, William H. Gothmann, PHI Learning Private Limited.
5. Digital and microprocessor technology, Patrick J O'Connor, Prentice-Hall, 1983.
6. Digital and Microprocessor Engineering, S. J. Cahill, Ellis Horwood Limited (John Wiley & Sons).
7. Digital Control Systems, Benjamin C. Kuo, Oxford University Press (2/e, Indian Edition, 2007).
8. Digital Computer Electronics: An Introduction to Microcomputers, Albert Pual Malvino, Tata McGraw-Hill Publishing Company Ltd.

### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/108/105/108105102/>



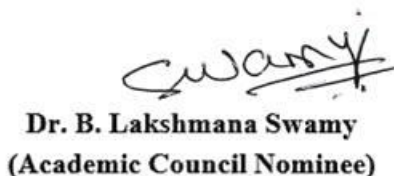
Dr. A. Raj Kumar  
(Chairman, BOS)



Dr. Ch. Sridhar Reddy  
(JNTUH Nominee)



Dr. L. Siva Rama Krishna  
(Academic Council Nominee)



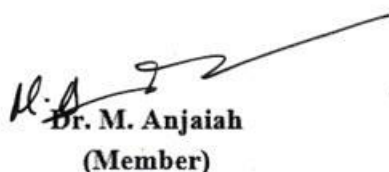
Dr. B. Lakshmana Swamy  
(Academic Council Nominee)



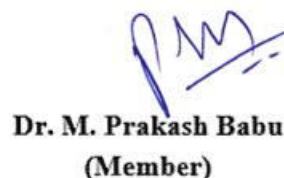
Dr. J. Chidanandappa  
(Industry Representative)



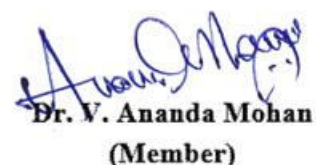
Dr. B. Sai Venkata Krishna  
(Alumni)



Dr. M. Anjaiah  
(Member)



Dr. M. Prakash Babu  
(Member)



Dr. V. Ananda Mohan  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)  
Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### BASIC MECHANICAL ENGINEERING (22OE0ME1A) (OPEN ELECTIVE-I)

**B.Tech. III Year II Sem.**

**L T P C**  
**3 0 0 3**

**Course objectives:** To provide the essential basic knowledge of Mechanical Engineering to the students.

**Course Outcomes:** At the end of the course, student will be able to

- Understand different types of power generation, working of refrigerator
- Summarize different types of manufacturing processes and Power transmission systems
- Discuss about conventional and non-conventional sources of energy
- Identify automation of various manufacturing processes in engineering practice.
- Describe the basic concepts and applications of industrial robotics

#### **UNIT- I:**

**Energy:** Power Generation: External and internal combustion engines-Thermal Power Plants-Working Principle, layouts, element/component description, advantages, disadvantages, applications. 2-Stroke, 4-Stroke Engines and their Components.

**Refrigeration:** Mechanical Refrigeration and types – units of refrigeration – Air Refrigeration system, Vapour Compression Refrigeration System- Principle of operation.

#### **UNIT- II:**

**Machine and Mechanisms** - Degrees of Freedom, functions of Flywheel and Governors, Types of joints-Riveted, welded, and bolted joints. Applications, Merits and Demerits.

**Power Transmission Elements:** Gears terminology of spur, helical and bevel gears, gear trains. Belt drives (types). Chain drives.



### UNIT- III:

**Manufacturing Processes:** Primary and secondary process.

**Casting:** Types, equipment, applications. Metal forming processes-rolling, extrusion.

**Welding:** Types – Equipment –Techniques employed – advantages / disadvantages – Gas cutting – Brazing and soldering.

### UNIT- IV:

**Machine Tools:** Introduction to lathe, drilling machine, milling machine, grinding machine-Operations performed. CNC Machines- Basic elements, advantages. Limits, fits and tolerances, Surface finish of various manufacturing process.

### UNIT- V:


**Non-conventional sources of energy** - Solar, wind, tidal, biogas and nuclear-Principles. Robotics – Joints, end effectors, applications. Introduction to 3D Printing.

### TEXT BOOKS:


1. Sadhu Singh, Basic Mechanical Engineering, S. Chand & Co. Ltd, New Delhi, 2013
2. Pravin Kumar, Basic mechanical Engineering, 2018, Pearson

### REFERENCE BOOKS:

1. Hajra Choudhary, S.K. and Hajra Choudhary, A. K., Elements of Workshop Technology Vol. I & II, Indian Book Distributing Company Calcutta, 2007.
2. Nag, P.K., Power Plant Engineering, Tata McGraw-Hill, New Delhi, 2008. 3. Rattan, S.S., Theory of Machines, Tata McGraw-Hill, New Delhi, 2010.




**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)




**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)




**Dr. J. Chidanandappa**  
(Industry Representative)




**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### RENEWABLE ENERGY SOURCES (22OE0ME1B) (OPEN ELECTIVE-I)

B.Tech. III Year II Sem.

L T P C  
3 0 0 3

#### Course Objectives:

- To introduce energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternate energy sources and their technology and application.
- To explore society's present needs and future energy demands, examine conventional energy sources and systems, including fossil fuels and nuclear energy.
- To focus on alternate, renewable energy sources such as solar, biomass (conversions), wind power, geothermal, and hydro, Energy conservation methods.

**Course Outcomes:** At the end of the of course, student will be able to

- Explain the main sources of energy including Solar energy and their primary applications in Global Context.
- Describe the challenges and problems associated with the use of solar energy sources and its Economic Evaluation
- Discuss significance of Wind energy systems and its components with basic working principles
- Elaborate the sources of energy from water by various means such as OTEC, Tidal energy etc.
- Narrate the importance and potential of geo thermal energy and MHD power generation

#### UNIT- I:

**Solar Radiation and Collecting Devices:** Solar Incident Flux, Extra-terrestrial Radiation, Clear Sky Irradiation, Solar Radiation Measurement, Monthly Average Radiation on Tilted Surfaces. Cover plates, Collector Plate Surfaces, Collector Performance, Collector Improvement, Effect of Incident Angle, Heat Transfer to Fluids, Heat Transfer Factors, Concentrating Collectors, Reflectors.

#### UNIT- II:

**Solar System Design and Economic Evaluation:** Hot water heating, heating and hot water systems, pumps and fans, sizing pipe and duct work, fundamentals of economic analysis, systems optimization.

### UNIT- III:

**Wind Energy Systems:** Orientation systems and Regulating devices, Types of Wind Turbines, Operating Characteristics, Basics of Airfoil Theory, Wind energy for water pumping and generation of electricity, Installation operation and maintenance of small wind energy conversion systems.

### UNIT-IV:

**Energy from Water:** OTEC–Principle of operation, Open and Closed OTEC cycles, Wave energy: Wave energy conversion machines and recent advances Tidal Energy: Single basin and double basin tidal systems Small-Mini-Micro hydro system: Concepts, Types of turbines, Hydrological analysis.

### UNIT- V:

**Geothermal Energy:** Introduction, Classification of Geo-thermal areas, Applications of Geo-thermal energy for power generation, Economics of Geo-thermal energy. MHD POWER GENERATION: Principles of MHD Power Generation, Ideal MHD–Generator Performance, Practical MHD Generator: Faraday and Hall Configurations, MHD Technology.

### TEXT BOOKS:


1. Nonconventional sources of Energy by G. D. Rai, Kanna Publications.
2. Nonconventional Energy resources, BH Khan, McGraw-Hill.

### REFERENCE BOOKS:


1. Fundamentals of Renewable Energy Sources, G. N. Tiwari, Ghosal, Alpha Science.
2. Solar Energy Fundamentals and Applications, H. P. Garg, Prakash, TMH.
3. Solar Energy: Principles of thermal storage, S. P. Sukhatme, TMH.

### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/121/106/121106014/>




**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



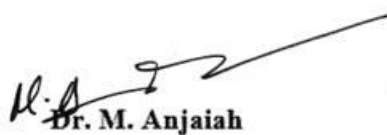
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)




**Dr. J. Chidanandappa**  
(Industry Representative)




**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### HEAT TRANSFER LAB (22PC0ME30)

**B.Tech. III Year II Sem.**

**L T P C**  
**0 0 2 1**

**Pre-requisite:** Thermodynamics.


**Course Objectives:** To enable the student to apply conduction, convection, and radiation heat transfer concepts to practical applications


**Course Outcome:** At the end of the lab sessions, the student will be able to

- Perform steady state conduction experiments to estimate thermal conductivity of different materials
- Perform transient heat conduction experiment
- Estimate heat transfer coefficients in forced convection, free convection, condensation, and correlate with theoretical values
- Obtain variation of temperature along the length of the pin fin under forced and free convection
- Perform radiation experiments: Determine surface emissivity of a test plate and Stefan-Boltzmann's constant and compare with theoretical value

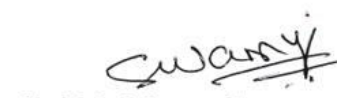
**Minimum ten experiments from the following:**

1. Composite Slab Apparatus – Overall heat transfer co-efficient.
2. Heat transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere
4. Thermal Conductivity of given metal rod.
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction
7. Heat transfer in forced convection apparatus.
8. Heat transfer in natural convection
9. Parallel and counter flow heat exchanger.
10. Emissivity apparatus.
11. Stefan Boltzmann Apparatus.
12. Critical Heat flux apparatus.
13. Study of heat pipe and its demonstration.
14. Film and drop wise condensation apparatus

  
Dr. A. Raj Kumar  
(Chairman, BOS)

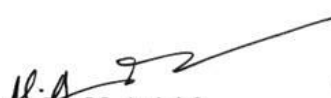
  
Dr. Ch. Sridhar Reddy  
(JNTUH Nominee)


  
Dr. L. Siva Rama Krishna  
(Academic Council Nominee)

  
Dr. B. Lakshmana Swamy  
(Academic Council Nominee)

  
Dr. J. Chidanandappa  
(Industry Representative)

  
Dr. B. Sai Venkata Krishna  
(Alumni)

  
Dr. M. Anjaiah  
(Member)

  
Dr. M. Prakash Babu  
(Member)

  
Dr. V. Ananda Mohan  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### COMPUTER AIDED ENGINEERING LAB (22PC0ME31)

B.Tech. III Year II Sem.

L T P C

0 0 2 1

#### Course Objectives:

- To be able to understand and handle design problems in a systematic manner.
- To be able to apply CAD in real life applications.
- To understand the basic principles of different types of analysis.

#### Course Outcomes:

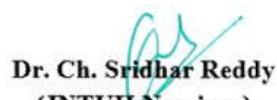
- To understand the analysis of various aspects in design
- To have exposure to usage of software tools for design and manufacturing.
- To acquire the skills needed to analyze and simulate engineering systems.

#### Note: Conduct any TEN exercises from the list given below:

1. Drafting: Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances.
2. Part Modeling: Generation of various 3D Models through Protrusion, revolve, sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling and Assembly Modeling. Study of various standard Translators. Design of simple components.
3. Determination of deflection and stresses in 2D and 3D trusses and beams.
4. Determination of deflections, principal and Von-mises stresses in plane stress, plane strain and Axi-symmetric components.
5. Determination of stresses in 3D and shell structures (at least one example in each case)
6. Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
7. Study state heat transfer analysis of plane and axi-symmetric components.
8. Development of process sheets for various components based on Tooling and Machines.
9. Development of manufacturing defects and tool management systems.
10. Study of various post processors used in NC Machines.
11. Development of NC code for free form and sculptured surfaces using CAM software.
12. Machining of simple components on NC lathe and Mill by transferring NC Code / from CAM software.



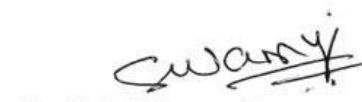
Dr. A. Raj Kumar  
(Chairman, BOS)




Dr. Ch. Sridhar Reddy  
(JNTUH Nominee)



Dr. L. Siva Rama Krishna  
(Academic Council Nominee)



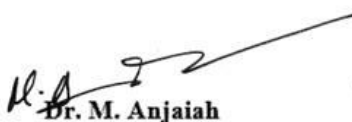
Dr. B. Lakshmana Swamy  
(Academic Council Nominee)




Dr. J. Chidanandappa  
(Industry Representative)



Dr. B. Sai Venkata Krishna  
(Alumni)



Dr. M. Anjaiah  
(Member)



Dr. M. Prakash Babu  
(Member)



Dr. V. Ananda Mohan  
(Member)





# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### ADVANCED ENGLISH COMMUNICATION SKILLS LAB (22HS0EN03)

B.Tech. III Year II Sem.

L T P C  
0 0 2 1

#### 1. Introduction

The introduction of the Advanced English Communication Skills Lab is considered essential at the B.Tech. 3rd year level. At this stage, the students need to prepare themselves for their career which may require them to listen to, read, speak, and write in English both for their professional and interpersonal communication in the globalized context.

The proposed course should be a laboratory course to enable students to use appropriate English and perform the following:

1. Gathering ideas and information to organize ideas relevantly and coherently.
2. Making oral presentations.
3. Writing formal letters.
4. Transferring information from non-verbal to verbal texts and vice-versa.
5. Writing project/research reports/technical reports.
6. Participating in group discussions.
7. Engaging in debates.
8. Facing interviews.
9. Taking part in social and professional communication.

#### 2. Objectives:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, with a focus on vocabulary
- To enable them to listen to English spoken at normal conversational speed by educated English speakers
- To respond appropriately in different socio-cultural and professional contexts
- To communicate their ideas relevantly and coherently in writing
- To prepare the students for placements.

#### 3. Syllabus:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

**1. Activities on Listening and Reading Comprehension:** Active Listening – Development of Listening Skills Through Audio clips - Benefits of Reading – Methods and Techniques of Reading – Basic Steps to Effective Reading – Common Obstacles – Discourse Markers or Linkers - Subskills of reading - Reading for facts, negative facts, and Specific Details- Guessing Meanings from Context, Inferring Meaning - Critical Reading — Reading Comprehension – Exercises for Practice.

**2. Activities on Writing Skills:** Vocabulary for Competitive Examinations - Planning for Writing – Improving Writing Skills - Structure and presentation of different types of writing – Free Writing and Structured Writing - Letter Writing – Writing a Letter of Application – Resume vs. Curriculum Vitae – Writing a Résumé – Styles of Résumé - e-Correspondence – Emails – Blog Writing - (N)etiquette – Report Writing – Importance of Reports – Types and Formats of Reports– Technical Report Writing– Exercises for Practice.

**3. Activities on Presentation Skills** - Starting a conversation – responding appropriately and relevantly – using the right language and body language – Role Play in different situations including Seeking Clarification, Making a Request, Asking for and Refusing Permission, Participating in a Small Talk – Oral presentations (individual and group) through JAM sessions- PPTs – Importance of Presentation Skills – Planning, Preparing, Rehearsing and Making a Presentation – Dealing with Glossophobia or Stage Fear – Understanding Nuances of Delivery - Presentations through Posters/Projects/Reports – Checklist for Making a Presentation and Rubrics of Evaluation.

**4. Activities on Group Discussion (GD):** Types of GD and GD as a part of a Selection Procedure - Dynamics of Group Discussion- Myths of GD - Intervention, Summarizing - Modulation of Voice, Body Language, Relevance, Fluency and Organization of Ideas – Do’s and Don’ts - GD Strategies – Exercises for Practice.

**5. Interview Skills:** Concept and Process - Interview Preparation Techniques - Types of Interview Questions – Pre-interview Planning, Opening Strategies, Answering Strategies - Interview Through Tele-conference & Video-conference - Mock Interviews.

**4. Minimum Requirement:** The Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:


- Spacious room with appropriate acoustics
- Round Tables with movable chairs • Audio-visual aids
- LCD Projector • Public Address system
- One PC with latest configuration for the teacher
- T. V, a digital stereo & Camcorder
- Headphones of High quality

**5. Suggested Software:** The software consisting of the prescribed topics elaborated above should be procured and used.


- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- Oxford Advanced Learner’s Dictionary, 10th Edition
- Cambridge Advanced Learner’s Dictionary
- DELTA’s key to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dreamtech.

## 6. Books Recommended:

1. Rizvi, M. Ashraf (2018). Effective Technical Communication. (2nd ed.). McGraw Hill Education (India) Pvt. Ltd.
2. Suresh Kumar, E. (2015). Engineering English. Orient BlackSwan Pvt. Ltd.
3. Bailey, Stephen. (2018). Academic Writing: A Handbook for International Students. (5th Edition). Routledge.
4. Koneru, Aruna. (2016). Professional Communication. McGraw Hill Education (India) Pvt. Ltd.
5. Raman, Meenakshi & Sharma, Sangeeta. (2022). Technical Communication, Principles and Practice. (4TH Edition) Oxford University Press.
6. Anderson, Paul V. (2007). Technical Communication. Cengage Learning Pvt. Ltd. New Delhi.
7. McCarthy, Michael; O'Dell, Felicity & Redman, Stuart. (2017). English Vocabulary in Use Series. Cambridge University Press
8. Sen, Leela. (2009). Communication Skills. PHI Learning Pvt Ltd., New Delhi.
9. Elbow, Peter. (1998). Writing with Power. Oxford University Press.
10. Goleman, Daniel. (2013). Emotional Intelligence: Why it can matter more than IQ. Bloomsbury Publishing.



**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



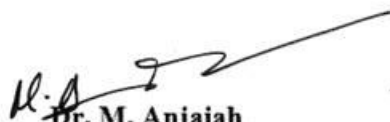
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)



**Dr. J. Chidanandappa**  
(Industry Representative)



**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### ENVIRONMENTAL SCIENCE (22MC0CH03)

B.Tech. III Year II Sem.

L T P C  
3 0 0 0

#### Course Objectives:

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures
- Understanding the environmental policies and regulations

#### Course Outcomes:

Based on this course, the Engineering graduate will understand/evaluate/develop technologies based on ecological principles and environmental regulations which in turn helps in sustainable development.

#### UNIT – I:

**Ecosystems:** Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

#### UNIT – II:

**Natural Resources: Classification of Resources:** Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

#### UNIT – III:

**Biodiversity and Biotic Resources:** Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic, and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

#### UNIT – IV:

**Environmental Pollution and Control Technologies: Environmental Pollution:** Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards.

**Water pollution:** Sources and types of pollution, drinking water quality standards.

**Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil.

**Noise Pollution:** Sources and Health hazards, standards,

**Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management.

**Pollution control technologies:** Wastewater Treatment methods: Primary, secondary, and Tertiary. Overview of air pollution control technologies, Concepts of bioremediation.

**Global Environmental Problems and Global Efforts:** Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol.

**UNIT – V:**

**Environmental Policy, Legislation & EIA:** Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

**TEXT BOOKS:**

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

**REFERENCE BOOKS:**

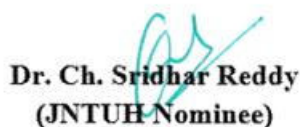
1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley India edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.

**WEB SOURCE REFERENCE:**

1. <https://archive.nptel.ac.in/courses/127/105/127105018/>



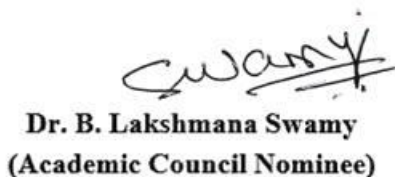
Dr. A. Raj Kumar  
(Chairman, BOS)



Dr. Ch. Sridhar Reddy  
(JNTUH Nominee)



Dr. L. Siva Rama Krishna  
(Academic Council Nominee)



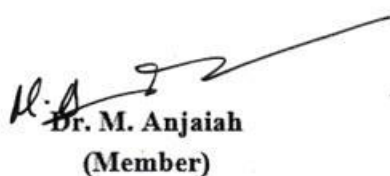
Dr. B. Lakshmana Swamy  
(Academic Council Nominee)



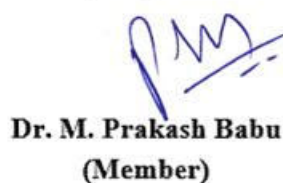
Dr. J. Chidanandappa  
(Industry Representative)



Dr. B. Sai Venkata Krishna  
(Alumni)



Dr. M. Anjaiah  
(Member)



Dr. M. Prakash Babu  
(Member)



Dr. V. Ananda Mohan  
(Member)





# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### INDUSTRIAL MANAGEMENT (22PC0ME32)

**B.Tech. IV Year I Sem.**

**L T P C**  
**2 0 0 2**

**Prerequisites:** None

#### **Course objectives:**

- Understand the philosophies of management gurus
- Understand the various types of organization structures and their features, and Their advantages and disadvantages.
- Learning various Industrial Engineering Practices like Operations Management techniques, work study, statistical quality control techniques, Job evaluation techniques and network analysis techniques.

**Course outcomes:** At the end of the course, the student would be able to

- apply principles of management.
- design the organization structure.
- apply techniques for plant location, design plant layout and value analysis.
- carry out work study to find the best method for doing the work and establish standard time for a given method.
- apply various quality control techniques and sampling plans.
- do job evaluation and network analysis.

#### **UNIT – I:**

**Introduction to Management:** Entrepreneurship and organization – Nature and Importance of Management, Functions of Management, Taylor’s Scientific Management Theory, Fayol’s Principles of Management, Maslow’s Theory of Human Needs, Douglas McGregor’s Theory X and Theory Y, Herzberg’s Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management

#### **UNIT – II:**

**Designing Organizational Structures:** Departmentalization and Decentralization, Types of Organization structures – Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organization, Cellular Organization, team structure, boundary less organization, inverted pyramid structure, lean and flat organization structure and their merits, demerits, and suitability.

#### **UNIT – III:**

**Operations Management:** Objectives- product design process- Process Selection- Types of production system (Job, batch, and Mass Production), Plant location-factors- Urban-Rural sites comparison- Types of Plant Layouts- Design of product layout- Line balancing (RPW method) Value Analysis – Definition - types of values- Objectives- Phases of value analysis- Fast diagram

#### UNIT - IV:

**Work Study:** Introduction — definition — objectives — steps in work study — Method study — definition, objectives — steps of method study. Work Measurement — purpose — types of study — stop watch methods — steps — key rating — allowances — standard time calculations — work sampling.

**Statistical Quality Control:** variables-attributes, Shewart control charts for variables-chart, R chart, – Attributes- Defective-Defect- Charts for attributes- p-chart - c chart (simple Problems), Acceptance Sampling- Single sampling- Double sampling plans-OC curves.

#### UNIT – V:

**Job Evaluation:** Methods of job evaluation — simple routing objective systems — classification method factor comparison method, point method, benefits of job evaluation and limitations.

**Project Management (PERT/CPM):** Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (simple problems)

#### TEXT BOOKS:

1. Industrial Engineering and Management/O.P. Khanna/Khanna Publishers.
2. Industrial Engineering and Management Science/T.R. Banga and S.C. Sarma/Khanna Publishers.

#### REFERENCE BOOKS:


1. Motion and Time Study by Ralph M Barnes John Willey & Sons Work Study by ILO.
2. Human factors in Engineering & Design/Ernest J McCormick /TMH.
3. Production & Operation Management /Paner Selvam/PHI.
4. Industrial Engineering Management/NVS Raju/Cengage Learning.
5. Industrial Engineering Hand Book/Maynard.
6. Industrial Engineering Management I Ravi Shankar/Galgotia.

#### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/112/107/112107142/>



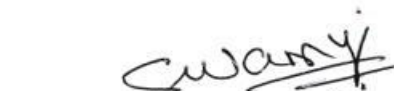
Dr. A. Raj Kumar  
(Chairman, BOS)



Dr. Ch. Sridhar Reddy  
(JNTUH Nominee)



Dr. L. Siva Rama Krishna  
(Academic Council Nominee)



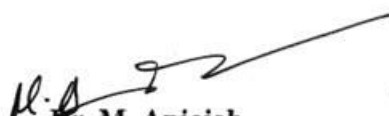
Dr. B. Lakshmana Swamy  
(Academic Council Nominee)



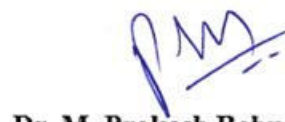
Dr. J. Chidanandappa  
(Industry Representative)



Dr. B. Sai Venkata Krishna  
(Alumni)



Dr. M. Anjaiah  
(Member)



Dr. M. Prakash Babu  
(Member)



Dr. V. Ananda Mohan  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### REFRIGERATION & AIR CONDITIONING (22PC0ME33)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

**Prerequisites:** Thermodynamics

#### Course Objectives:

- Apply the principles of thermodynamics to analyze different types of refrigeration and HAV
- To understand the functionality of the major components of the refrigeration and HAV
- To apply the knowledge in effective refrigeration and HAV systems for better performances in real context
- Discuss the heating procedure by Air conditioning process
- Explain the requirement of ventilation devices/processes

#### Course Outcomes:

- Differentiate between different types of refrigeration systems with respect to application as well as conventional & unconventional refrigeration systems.
- Analyse thermodynamically low temperature refrigeration and Vapour absorption refrigeration for evaluation of performance parameters.
- Apply the air refrigeration principles for different types of Air craft refrigeration systems.
- Elaborate the principles of psychometrics to design the air conditioning heating /cooling loads for industrial applications.
- explain the requirement of ventilation air, various sources of infiltration air, ventilation, and infiltration as a part of cooling load.

#### UNIT– I:

**Vapour Compression Refrigeration:** Performance of Complete vapor compression system. Actual Vs Ideal cycle - Effect of operating parameters on COP

**Components of Vapor Compression System:** The condensing unit – Evaporators – Expansion valve – Refrigerants – Properties – ODP & GWP - Load balancing of vapor compression Unit.

**Compound Compression:** Flash inter-cooling – flash chamber – Multi-evaporator & Multistage systems.

#### UNIT– II:

**Production of Low Temperature:** Liquefaction system, Liquefaction of gases, Hydrogen and Helium, Cascade System – Applications– Dry ice system.

**Vapor absorption system** – Simple and modified aqua – ammonia system – Representation on Enthalpy –Concentration diagram. Lithium – Bromide system Three fluid system – HCOP.

#### UNIT– III:

**Air Refrigeration:** Applications – Air Craft Refrigeration -Simple, Bootstrap, Regenerative and Reduced ambient systems – Problems based on different systems.

**Steam Jet refrigeration system:** Representation on T-s and h-s diagrams – limitations and applications.

**Unconventional Refrigeration system** – Thermo-electric – Vortex tube & Pulse tube – working principles.

#### UNIT– IV:

**Air Conditioning:** Psychometric properties and processes – Construction of Psychometric chart. Requirements of Comfort Air –conditioning – Thermodynamics of human body – Effective temperature and Comfort chart – Parameters influencing the Effective Temperature.

**Heating Load Calculations:** Summer/ Winter heating load calculation-heat losses through structure-heat losses due to infiltration. Effects of solar radiation and internal heat sources on heating loads. Air Heating System: Classification - gravity warm heating system, forced warm air heating system balancing a warm air heating system, warm air furnaces, air cleaners, humidifiers & De-humidifiers

#### UNIT– V:

**Air Conditioning Systems:** All Fresh air, Re-circulated air with and without bypass, with reheat systems – Calculation of Bypass Factor, ADP, RSHF, ESHF and GSHF for different systems.

**Ventilation:** Ventilation and Infiltration: Requirement of ventilation air, various sources of infiltration air, ventilation, and infiltration as a part of cooling load. Fans and Blowers: Types, performance characteristics, series and parallel arrangement, selection procedure. Equipment and Controls: Chillers, Condensing units, Cooling coils, bypass factors, humidifiers, dehumidifiers

#### TEXT BOOKS:

1. Refrigeration & Air Conditioning by C.P. Arora, TMH.
2. Refrigeration & Air Conditioning by Arora & Domkundwar, Dhanpat Rai.
3. Refrigeration and Air Conditioning by Manohar Prasad

#### REFERENCE BOOKS:


1. Basic Refrigeration & Air Conditioning by P.N. Anantha Narayanan, McGraw Hill.
2. Refrigeration and Air Conditioning by Stoecker, Mc Graw Hill.
3. Refrigeration and Air Conditioning by Dr. S.S. Thipse, Jaico.
4. Refrigeration and Air Conditioning by Jordan & Preister, Prentice Hall.
5. Refrigeration and Air Conditioning by Dossat, Mc Graw Hill

#### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/112/105/112105129/>




Dr. A. Raj Kumar  
(Chairman, BOS)



Dr. Ch. Sridhar Reddy  
(JNTUH Nominee)



Dr. L. Siva Rama Krishna  
(Academic Council Nominee)



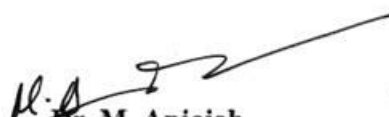
Dr. B. Lakshmana Swamy  
(Academic Council Nominee)




Dr. J. Chidanandappa  
(Industry Representative)



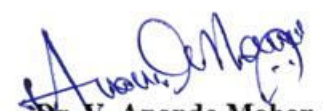
Dr. B. Sai Venkata Krishna  
(Alumni)



Dr. M. Anjaiah  
(Member)



Dr. M. Prakash Babu  
(Member)



Dr. V. Ananda Mohan  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### ADDITIVE MANUFACTURING (22PE0ME2A) (PROFESSIONAL ELECTIVE – II)

**B.Tech. IV Year I Sem.**

**L T P C**  
**3 0 0 3**

**Pre-requisites:** Manufacturing Processes, Engineering Materials

#### Course Objectives:

- To understand the fundamental concepts of Additive Manufacturing (i.e. Rapid Prototyping) and 3-D printing, its advantages, and limitations.
- To classify various types of Additive Manufacturing Processes and know their working principle, advantages, limitations etc.
- To have a holistic view of various applications of these technologies in relevant fields such as mechanical, Bio-medical, Aerospace, electronics etc.

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

- Explain and summarize the principles and key characteristics of additive manufacturing technologies and commonly used 3D printing and additive manufacturing systems.
- Describe various liquid based Rapid Prototyping systems.
- Understand and apply different powder based Rapid Prototype systems.
- Describe various CAD issues for 3D printing and rapid prototyping and related operations for STL model manipulation.
- Understand and apply Rapid prototyping in various applications like forensic science, anthropology, and medicine etc.

#### UNIT – I:

**Introduction:** Prototyping fundamentals, Historical development, Fundamentals of Rapid Prototyping, Advantages and Limitations of Rapid Prototyping, commonly used Terms, Classification of RP process, Rapid Prototyping Process Chain: Fundamental Automated Processes.

#### UNIT – II:

**Liquid-based Rapid Prototyping Systems:** Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies Solid-based Rapid Prototyping Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

#### UNIT – III:

**Powder Based Rapid Prototyping Systems:** Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.



**Three-dimensional Printing (3DP):** Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling Vs RT, Need for RT. Rapid Tooling Classification; Indirect Rapid Tooling Methods: Spray Metal Deposition, RTV Epoxy Tools, Ceramic tools, Investment Casting, Spin Casting, Die casting, Sand Casting, 3D Keltool process. Direct Rapid Tooling: Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.

**UNIT – IV:**

**Rapid Prototyping Data Formats:** STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats. Rapid Prototyping Software's: Features of various RP software's like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor.

**UNIT – V:**

**RP Applications:** Application - Material Relationship, Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Biomolecules.

**TEXT BOOKS:**

1. Rapid prototyping; Principles and Applications /Chua C.K., Leong K.F. and LIM C.S/World Scientific Publications/3rd Edition, 2010
2. Rapid Manufacturing /D.T. Pham and S.S. Dimov/Springer/1st Edition, 2012

**REFERENCE BOOKS:**

1. Terry Wohlers, Wholers Report 2000, Wohlers Associates.
2. Rapid Prototyping and Manufacturing /Paul F. Jacobs/ASME/ 1st Edition, 1993.

**WEB SOURCE REFERENCE:**

1. <https://archive.nptel.ac.in/courses/112/103/112103306/>



**Dr. A. Raj Kumar**  
(Chairman, BOS)



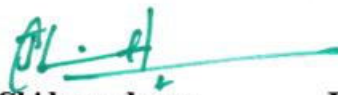
**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



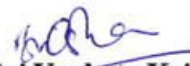
**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



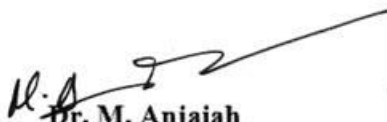
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)



**Dr. J. Chidanandappa**  
(Industry Representative)



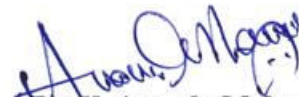
**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)  
Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### AUTOMATION IN MANUFACTURING (22PE0ME2B) (PROFESSIONAL ELECTIVE – II)

B.Tech. IV Year I Sem.

L T P C  
3 0 0 3

#### Course Objectives:

- To understand types of Automation and production system technologies in modern manufacturing.
- To understand importance of automated flow lines in manufacturing a product.
- To understand the Assembly system and Line Balancing in Manufacturing System.
- To understand Automated Material handling equipment and Automated Storage Systems.
- To understand industrial control and automatic inspection techniques.

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

- Describe the importance of Automation implementation in Manufacturing.
- Analyze the various Automated flow lines.
- Perform Line balancing of assembly system.
- Describe automated Material Handling and automated storage
- Explain Industrial Process controls and automatic inspection.

#### UNIT – I:

**Introduction:** Types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools. Mechanical feeding and tool changing and machine tool control transfer the automaton.

#### UNIT – II:

**Automated flow lines:** Methods or work part transport transfer Mechanical buffer storage control function, design, and fabrication consideration.

**Analysis of Automated flow lines:** General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

### UNIT – III:

**Assembly system and line balancing:** Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

### UNIT –IV:

**Automated material handling:** Types of equipment, functions, analysis and design of material handling systems conveyor systems, automated guided vehicle systems. Automated storage systems, Automated storage, and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

### UNIT –V:

Fundamentals of Industrial controls: Review of control theory, logic controls, sensors and actuators, Data communication and LAN in Manufacturing. Business process Re-engineering: Introduction to BPE logistics, ERP, Software configuration of BPE.

### TEXT BOOKS:

1. Automation, Production Systems and Computer Integrated Manufacturing: M.P. Groover. /Pearson Education/4th Edition, 2016.
2. Computer Control of Manufacturing Systems/ Yoram koren/ Mc Graw Hill/ 1st Edition, 1983.

### REFERENCE BOOKS:

1. Computer Aided Manufacturing/Tien-Chien Chang, Richard A. Wyskand Hsu-Pin Wang/Pearson/ 3rd Edition, 2005.
2. Automation /W. Buekinsham/PHI Publications/ 1st Edition, 2011.

### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/112/103/112103293/>



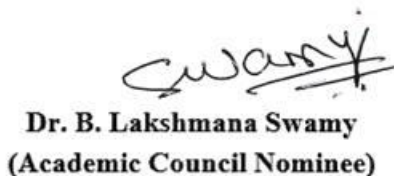
**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH-Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



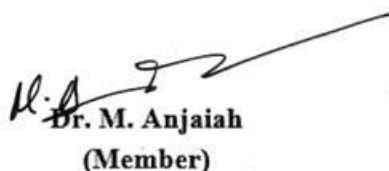
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)



**Dr. J. Chidanandappa**  
(Industry Representative)



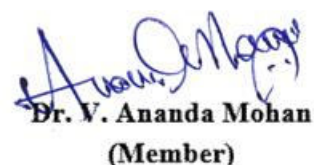
**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### ARTIFICIAL INTELLIGENCE IN MECHANICAL ENGINEERING (22PE0ME2C) (PROFESSIONAL ELECTIVE – II)

**B.Tech. IV Year I Sem.**

**L T P C**

**3 0 0 3**

#### **UNIT - I:**

**Introduction to Artificial Intelligence:** Definition, History, Present state of Artificial Intelligence (AI), Phases of AI, Approaches to AI - Hard or Strong AI, Soft or Weak AI, Applied AI, Cognitive AI, and Applications domains focused on mechanical engineering,

#### **UNIT - II:**

**Problem Solving Methods:** Problem solving methods-1. Uninformed search includes Depth First Search (DFS), Breadth First Search (BFS), Uniform Cost Search (UCS), Depth Limited Search, Iterative Deepening Depth First Search (IDDFS) and bidirectional search. 2. Informed Search (heuristic search) includes greedy best first search, A\* search, memory bounded heuristic search, learning to search better, Simple problems

#### **UNIT - III:**

**Neural Networks:** Introduction to Perceptron and Neural Networks, Activation and Loss functions, Single Neuron of Human and Human Brain Modelling, ANN architecture-Input layer, Hidden layer and output layer, Types of Neural Networks-Single layer feed-forward network, Multilayer feed-forward network, Multi-Layer Perceptron (MLP), Recurrent networks or feedback ANN, Characteristics of Neural Networks, Simple problems on Back Propagation Algorithms to minimize the error

#### **UNIT - IV:**

**Machine Learning:** Unsupervised learning- Definition, basic concepts, applications, K-means Clustering, hierarchical Clustering, Dimension Reduction-PCA, Simple Examples Supervised Learning - Definition, basic concepts, applications, Linear Regression, Multiple Variable Linear Regression, Logistic Regression, Naive Bayes Classifiers, k-NN Classification, Support Vector Machine, Simple Examples. Reinforcement Learning (RL) - Framework, Component of RL Framework, Types of RL Systems. Q-learning, Examples of RL Systems, Simple Examples

#### **UNIT - V:**

**Ensemble Learning Techniques:** Introduction on ensemble methods, Decision Trees, Bagging, Random Forests, Boostin, Simple Examples.

**TEXT BOOK:**


1. Artificial Intelligence: A Modern Approach, Stuart Russell & Peter Norvig, Prentice-Hall, Third Edition (2009).

**REFERENCE BOOKS:**


1. Artificial Intelligence, Ela Kumar, Wiley, 2021
2. Artificial Intelligence: Concepts and Applications, Lavika Goel, Kindle Edition, Wiley, 2021.
3. Nature-Inspired Optimization in Advanced Manufacturing Processes and Systems, Edited by Ganesh M. Kakandikar and Dinesh G. Thakur, CRC press, First edition, 2021.

**WEB SOURCE REFERENCE:**

1. <https://archive.nptel.ac.in/courses/112/103/112103280/>




**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)



**Dr. J. Chidanandappa**  
(Industry Representative)



**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)





# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### MECHATRONICS (22PE0ME2D) (PROFESSIONAL ELECTIVE – II)

**B.Tech. IV Year I Sem.**

**L T P C**  
**3 0 0 3**

#### UNIT - I:

**Introduction:** Overview, History of mechatronics, Scope and significance of Mechatronics systems, elements of Mechatronic systems, Needs and benefits of Mechatronics in manufacturing.

**Sensors:** Classification of sensors basic working principles, displacement sensor – linear and rotary potentiometers, LVDT and RVDT, incremental and absolute encoders, Proximity and range sensors – Eddy current sensor, ultrasonic sensor, laser interferometer transducer, hall Effect sensor, inductive Proximity switch, Light sensors – Photodiodes, Phototransistors, Flow Sensors – ultrasonic Sensor, Laser Doppler Anemometer, Tactile Sensors – PVDF tactile sensor, micro-switch and reed switch, Piezoelectric sensors, Vision Sensor.

#### UNIT - II:

**Actuators: Electrical Actuators:** Solenoids, relays, diodes, thyristors, triacs, BJT, FET, DC motor, Servo Motor, BLDC Motor, AC Motor, Stepper Motor, Hydraulic & pneumatic devices – Power supplies, valves, Cylinder sequencing, Design of hydraulic & pneumatic circuits. Piezo Electric Actuators, Shape memory alloys.

#### UNIT - III:

**Basic System models & Analysis:** Modeling of one & two degrees of freedom Mechanical, Electrical, fluid, and thermal systems, block diagram representations of these systems. Dynamic Responses of System: Transfer function, modeling dynamic systems, first order systems, second order systems.

#### UNIT - IV:

**Digital Electronics:** Number systems, BCD codes and arithmetic, gray codes, self-complementing codes, Error detection and correction principles. Boolean functions using Karnaugh Map, Design of combinational circuits, design of arithmetic circuits, Design of code converters, encoders, and decoders.

**Signal Conditioning:** Operational amplifiers, inverting amplifier, differential amplifier, Protection, comparator, filters, multiplexer, Pulse width modulation counters, decoders. Data acquisition – Quantizing theory, Analog to digital conversion, digital to analog conversion.

**Controllers:** Classification of Control systems, Feedback, Closed loop and open loop systems

#### UNIT - V:

**PLC Programming:** PLC Principles of operation, PLC sizes, PLC hardware components, I/O section Analog I/O section, Analog I/O modules, digital I/O modules, CPU processor memory, module programming, Ladder Programming, ladder diagrams, Timers, Internal relays and counters, data handling, analogue input, and output. Application on real time industrial automation systems.


**Advanced Applications in Mechatronics:** Sensors for condition monitoring, mechatronic control in automated manufacturing, Artificial intelligence in Mechatronics, micro sensors in mechatronics, Application of Washing machine as mechatronic device.

#### TEXT BOOKS:


1. W. Bolton, “Mechatronics”, 5th edition, Adison Wesley Longman ltd, 2010.
2. Mechatronics system design by Devdas Shetty and Richard A. Kolk, P.W.S. Publishing company, 2001.
3. Alciatore David G & Histan Michael B, “Introduction to Mechatronics and Measurement systems”, 4th edition, Tata McGraw Hill, 2006

#### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/112/107/112107298/>



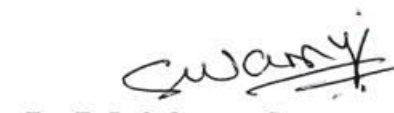
**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



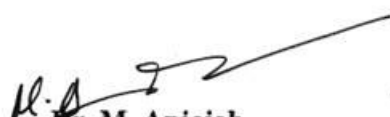
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)



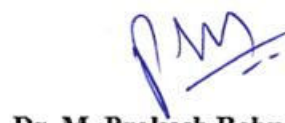
**Dr. J. Chidanandappa**  
(Industry Representative)



**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### POWER PLANT ENGINEERING (22PE0ME3A) (PROFESSIONAL ELECTIVE – III)

B.Tech. IV Year I Sem.

L T P C  
3 0 0 3

**Course Objectives:** The goal of this course is to be aware of the design of conventional and alternative power-generation plants. The learning objectives include

- Analysis and preliminary design of the major systems of conventional fossil-fuel steam-cycle power plants.
- A working knowledge of the basic design principles of nuclear, gas turbine, combined cycle, hydro, wind, geothermal, solar, and alternate power plants.
- Awareness of the economic, environmental, and regulatory issues related to power generation.

**Course Outcomes:** At the end of the course students will be able to:

- Understand the concept of Rankine cycle.
- Understand working of boilers including water tube, fire tube and high-pressure boilers and determine efficiencies.
- Analyze the flow of steam through nozzles.
- Evaluate the performance of condensers and steam turbines.
- Evaluate the performance of gas turbines.

#### UNIT – I:

Introduction to the Sources of Energy – Resources and Development of Power in India.

**Steam Power Plant:** Plant Layout, Working of different Circuits, Fuel and handling equipment, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems.

**Combustion Process:** Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment.

#### UNIT – II:

**Internal Combustion Engine Plant:** Diesel Power Plant: Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, lubrication, and cooling system – super charging.

**Gas Turbine Plant:** Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison.

### UNIT – III:

**Hydro Electric Power Plant:** Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and Pondage – classification of dams and spill ways.

**Hydro Projects and Plant:** Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.

**UNIT – IV:** Nuclear Power Station: Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation.

**Types of Reactors:** Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

### UNIT – V:

**Power Plant Economics and Environmental Considerations:** Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor – related exercises. Effluents from power plants and Impact on environment – pollutants and pollution standards – Methods of Pollution control.

### TEXT BOOKS:

1. Power Plant Engineering/ P. K. Nag / Mc Graw Hill
2. Power Plant Engineering / Hegde / Pearson.

### REFERENCES BOOKS:

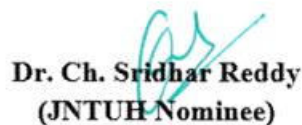
1. Power Plant Engineering / Gupta / PHI
2. Power Plant Engineering / A K Raja / New age

### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/112/107/112107291/>



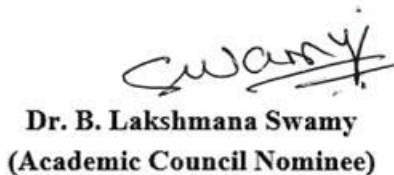
Dr. A. Raj Kumar  
(Chairman, BOS)



Dr. Ch. Sridhar Reddy  
(JNTUH Nominee)



Dr. L. Siva Rama Krishna  
(Academic Council Nominee)



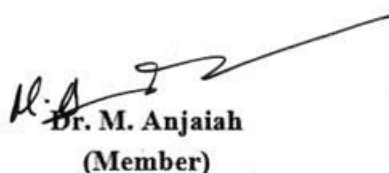
Dr. B. Lakshmana Swamy  
(Academic Council Nominee)



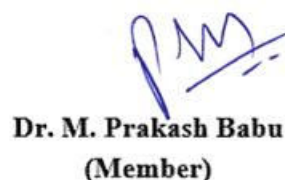
Dr. J. Chidanandappa  
(Industry Representative)



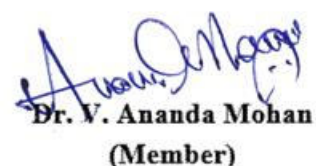
Dr. B. Sai Venkata Krishna  
(Alumni)



Dr. M. Anjaiah  
(Member)



Dr. M. Prakash Babu  
(Member)



Dr. V. Ananda Mohan  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### AUTOMOBILE ENGINEERING (22PE0ME3B) (PROFESSIONAL ELECTIVE – III)

B.Tech. IV Year I Sem.

L T P C  
3 0 0 3

**Course Objectives:** The Objective of this course is to provide the student to

- Elaborate the Systems of Automobile, Components of Engine, fuel & Lubrication system, and its requirements
- Explain the significance and features of Cooling, Ignition and Electrical Systems
- Illustrate the working of transmission system and Suspension systems and its components
- Elaborate the function of each accessory of steering and braking system and their role for effective performance of automobile
- Discuss the particulates of combustion in CI and SI engines, reasons for formation of particulates and methods adopted to control the pollution

**Course Outcomes:** At the end of the course, the student will be able to

- Illustrate the function of each and every system of an automobiles including fuel system and injection approaches
- Explain the Cooling, ignition, and electrical system of the Automobile
- Describe each component of transmission system of an automobile viz clutch, gear box, propeller shaft and differential and suspension system and the effect of the same on tyre performance and other components of an automobile
- Analyze the geometry of the steering mechanism and braking system
- Demonstrate about emission standards, emission control techniques and electrical systems. Student can identify thrust areas for carrying their dissertation in future.

#### UNIT – I:

**Introduction:** Layout of automobile – introduction chassis and body components. Types of Automobile engines. – Power unit – Introduction to engine lubrication – engine servicing

**Fuel System:** S.I. Engine: Fuel supply systems, Mechanical and electrical fuel pump – filters – carburetor – types – air filters – petrol injection. Introduction to MPFI and GDI Systems.

**C.I. Engines:** Requirements of diesel injection systems, types of injection systems, DI Systems IDI systems. Fuel pump, nozzle, spray formation, injection timing, testing of fuel pumps. Introduction to CRDI and TDI Systems.

#### UNIT – II:

**Cooling System:** Cooling Requirements, Air Cooling, Liquid Cooling, Thermo, water and Forced Circulation System – Radiators – Types – Cooling Fan - water pump, thermostat, evaporative cooling – pressure sealed cooling – antifreeze solutions.

**Ignition System:** Function of an ignition system, battery ignition system, constructional features of storage, battery, auto transformer, contact breaker points, condenser, and spark plug – Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

**Electrical System:** Charging circuit, generator, current – voltage regulator – starting system, Bendix drive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.



### UNIT – III:

**Transmission System:** Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear boxes, types, sliding mesh, constant mesh, synchro mesh gear boxes, epicyclic gear box, over drive torque converter. Propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential rear axles – types – wheels and tyres.

**Suspension System:** Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, independent suspension system.

### UNIT – IV:

**Braking System:** Mechanical brake system, Hydraulic brake system, Master cylinder, wheel cylinder tandem master cylinder Requirement of brake fluid, Pneumatic and vacuum brakes.

**Steering System:** Steering geometry – camber, castor, king pin rake, combined angle toein, center point steering. Types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.

### UNIT – V:

**Emissions from Automobiles** – Pollution standards National and international – Pollution Control – Techniques – Multipoint fuel injection for SI Engines. Common rail diesel injection Energy alternatives – Solar, Photo-voltaic, hydrogen, Biomass, alcohols, LPG, CNG, liquid Fuels, and gaseous fuels, Hydrogen as a fuel for IC Engines. - Their merits and demerits. Standard Vehicle maintenance practice.

### TEXT BOOKS:


1. Automobile Engineering / William H Crouse
2. A Text Book Automobile Engineering–Manzoor, Nawazish Mehdi & Yosuf Ali, Frontline Publications.

### REFERENCE BOOKS:

1. A Text Book of Automobile Engineering by R K Rajput. Laxmi Publications.
2. Automotive Mechanics / Heitner.
3. Automotive Engineering / Newton Steeds & Garrett.
4. Automotive Engines / Srinivasan.
5. A Text Book of Automobile Engineering by Khalil U Siddiqui New Age International.


### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/107/106/107106088/>

  
Dr. A. Raj Kumar  
(Chairman, BOS)


  
Dr. Ch. Sridhar Reddy  
(JNTUH Nominee)

  
Dr. L. Siva Rama Krishna  
(Academic Council Nominee)


  
Dr. B. Lakshmana Swamy  
(Academic Council Nominee)

  
Dr. J. Chidanandappa  
(Industry Representative)

  
Dr. B. Sai Venkata Krishna  
(Alumni)

  
Dr. M. Anjaiah  
(Member)

  
Dr. M. Prakash Babu  
(Member)

  
Dr. V. Ananda Mohan  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)  
Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### NON-CONVENTIONAL ENERGY SOURCES (22PE0ME3C) (PROFESSIONAL ELECTIVE – III)

**B.Tech. IV Year I Sem.**

**L T P C**  
**3 0 0 3**

**Course Objectives:** The Objective of this course is to

- Introduce the need of the non-convectional energy sources.
- Differentiate various solar collectors
- Identify the energy resources utilization systems
- Recognize the source and potential of wind energy and understand the classifications of wind mills.
- Summarize the principles of bio-conversion, ocean energy and geo thermal energy.

**Course Outcomes:** At the end of the course students will be able to

- Choose the appropriate renewable energy as an alternate for conventional power in any application.
- Understand principles of various solar collectors and use them in different applications
- Inculcate the knowledge on usage of alternate energy sources in I.C Engines
- Know various energy conversion techniques
- Analyze large scale demand of heat energy for meeting day to day domestic, institutional, and industrial requirements can be met by utilizing solar thermal systems, biogas, PV cells, wind energy, Geothermal, MHD etc.

#### **UNIT-I:**

Principles of Solar Radiation, Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power - Physics of the sun, the solar constant, extra-terrestrial and terrestrial solar radiation, Solar radiation on titled surface, Instruments for measuring solar radiation and sun shine, solar radiation data.

#### **UNIT-II:**

Solar Energy Collection Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors. Solar Energy Storage and Applications: Different methods, sensible, latent heat and stratified storage, solar ponds. Solar applications - solar heating/ cooling techniques, solar distillation and drying, Photovoltaic energy conversion.

#### **UNIT-III:**

Wind Energy Sources and potentials, horizontal and vertical axis windmills, performance characteristics. Bio-Mass: Principles of Bio-Conversion, Anaerobic /aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation, and economic aspects.

#### UNIT-IV:

Geothermal Energy Resources, types of wells, methods of harnessing the energy, potential in India. OTEC: Principles, utilization, setting of OTEC plants, thermodynamic cycles. Tidal and Wave Energy: Potential and conversion techniques, mini-hydel power plants, their economics.

#### UNIT-V:

Direct Energy Conversion Need for DEC, Carnot cycle, limitations, Principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule Thompson effects, figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principle, faraday's laws, thermodynamic aspects, selection of fuels and operating conditions.

#### TEXT BOOKS:

1. Renewable Energy Sources/Twidell & Weir /Taylor and Francis / 2nd Special Indian Edition.
2. Non- conventional Energy Sources / G.D. Rai / Dhanpat Rai and Sons.

#### REFERENCE BOOKS:


1. Energy Resources Utilization and Technologies/Anjaneyulu & Francis/BS Publications/2012.
2. Principles of Solar Energy / Frank Krieth & John F Kreider / Hemisphere Publications.
3. Non-Conventional Energy / Ashok V Desai / Wiley Eastern.
4. Non-Conventional Energy Systems / K Mittal / Wheeler.
5. Renewable Energy Technologies /Ramesh & Kumar /Narosa.
6. Renewable Energy Resources /Tiwari and Ghosal /Narosa.

#### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/121/106/121106014/>



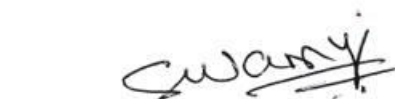
**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



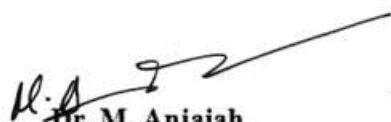
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)



**Dr. J. Chidanandappa**  
(Industry Representative)



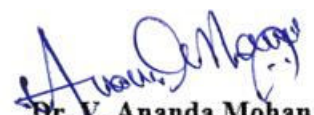
**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### SOLAR ENERGY TECHNOLOGY (22PE0ME3D) (PROFESSIONAL ELECTIVE – III)

B.Tech. IV Year I Sem.

L T P C  
3 0 0 3

#### Course Objectives:

- Focus on solar energy utilization.
- Explain the concepts of solar water heating and its layout.
- Concepts of thermal energy storage.
- Discuss the energy conversion technologies.
- Concentrate the economic aspects of Solar Energy.

#### Course Outcomes:

- Explain the solar energy potential and construction details of collector with performance analysis
- Analyse the concepts of solar water heating technologies and its parameters
- Narrate the methods of solar energy storage and its working
- Infer the direct energy conversion and conversion efficiencies calculations
- Discuss the Principles of Economic Analysis and optimization with respect solar energy

#### UNIT- I:

**Introduction** – Solar energy option, specialty, and potential – Sun – Earth – Solar radiation, beam and diffuse – measurement – estimation of average solar radiation on horizontal and tilted surfaces – problems – applications. Capturing solar radiation – physical principles of collection – types – liquid flat plate collectors – construction details – performance analysis – concentrating collection – flat plate collectors with plane reflectors – cylindrical parabolic collectors – Orientation and tracking – Performance Analysis.

#### UNIT- II:

**Design of Solar Water Heating System and Layout:** Power generation – solar central receiver system – Heliostats and Receiver – Heat transport system – solar distributed receiver system – Power cycles, working fluids and prime movers, concentration ratio.

#### UNIT- III:

**Thermal Energy Storage:** Introduction – Need for – Methods of sensible heat storage using solids and liquids – Packed bed storage – Latent heat storage – working principle – construction – application and limitations. Other solar devices – stills, air heaters, dryers, Solar Ponds & Solar Refrigeration, active and passive heating systems.

#### UNIT- IV:

**Direct Energy Conversion:** solid-state principles – semiconductors – solar cells – performance – modular construction – applications. conversion efficiencies calculations.

#### UNIT- V:

**Economics:** Principles of Economic Analysis – Discounted cash flow – Solar system – life cycle costs – cost benefit analysis and optimization – cost-based analysis of water heating and photo voltaic applications.

#### TEXT BOOKS:

1. Principles of solar engineering/ Kreith and Kerider/Taylor and Franscis/2nd Edition.
2. Solar energy thermal processes/ Duffie and Beckman/John Wiley & Sons.

#### REFERENCE BOOKS:


1. Solar energy: Principles of Thermal Collection and Storage/ Sukhatme/TMH/2nd edition.
2. Solar energy/ Garg/TMH 5. Solar energy/ Magal/Mc Graw Hill.
3. Solar Thermal Engineering Systems / Tiwari and Suneja/Narosa.
4. Power plant Technology/ El Wakil/TMH.

#### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/115/103/115103123/>




Dr. A. Raj Kumar  
(Chairman, BOS)



Dr. Ch. Sridhar Reddy  
(JNTUH-Nominee)



Dr. L. Siva Rama Krishna  
(Academic Council Nominee)



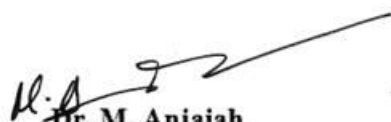
Dr. B. Lakshmana Swamy  
(Academic Council Nominee)



Dr. J. Chidanandappa  
(Industry Representative)



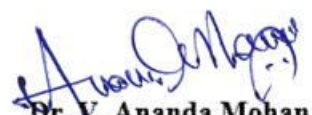
Dr. B. Sai Venkata Krishna  
(Alumni)



Dr. M. Anjaiah  
(Member)



Dr. M. Prakash Babu  
(Member)



Dr. V. Ananda Mohan  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

**RE-ENGINEERING (22PE0ME4A)**

**(PROFESSIONAL ELECTIVE – IV)**

**B.Tech. IV Year I Sem.**

**L T P C**

**3 0 0 3**

**Course objective:** The objective is to understand the terminologies related to forward engineering and reverse engineering and to identify the process of designing, manufacturing, assembling, and maintaining products and systems.

**Course Outcomes:** At the end of the course, the student will be able to:

- Familiarize with the process of reverse engineering and its applications.
- Understand the methodologies and techniques for Reverse Engineering.
- Learn various data collection techniques and the data processing chain.
- Select a proper system to generate geometric representations of physical objects.
- Integrate Reverse Engineering and Rapid Prototyping.

### UNIT - I

**Introduction to Reverse Engineering:** Reverse Engineering –The Generic Process Reverse Engineering in Automotive, Aerospace, Medical sectors: Legal Aspects of Reverse Engineering: Copyright Law, Reverse Engineering, Recent Case Law, Barriers to Adopting Reverse Engineering. A discussion on a few benchmarks case studies.

### UNIT - II

**Methodologies and Techniques for Reverse Engineering:** The Potential for Automation with 3-D Laser Scanners, What Is Not Reverse Engineering, what is Computer-aided (Forward) Engineering, What Is Computer-aided Reverse Engineering, Computer Vision, and Reverse Engineering, Structuredlight Range Imaging, Scanner Pipeline

### UNIT - III

**Reverse Engineering–Hardware and Software:** Contact Methods Noncontact Methods, Destructive Method. Reverse Engineering Software Classification, Fundamental Reverse Engineering Operations, Reverse Engineering Phases

### UNIT - IV

**Selecting a Reverse Engineering System:** The Selection Process, Some Additional Complexities, Point Capture Devices, Triangulation Approaches, “Time-of-flight” or Ranging Systems, Structured-light and Stereoscopic Imaging Systems, issues with Light-based Approaches, Tracking Systems, Internal Measurement Systems, X-ray Tomography, Destructive Systems, Some Comments on Accuracy, Positioning the Probe, Post processing the Captured Data, Handling Data Points, Curve and Surface Creation, Inspection Applications, Manufacturing Approaches.



## UNIT - V:

**Integration between Reverse Engineering and Rapid Prototyping:** Modeling Cloud Data in Reverse Engineering, Data Processing for Rapid Prototyping, Integration of RE and RP for Layer-based Model Generation, Adaptive Slicing Approach for Cloud Data Modeling, Planar Polygon Curve Construction for a Layer, Determination of Adaptive Layer Thickness.

### TEXT BOOK:


1. Reverse Engineering: An Industrial Perspective by Vinesh Raja and Kiran J. Fernandes, Springer-Verlag London Limited 2008

### REFERENCE BOOKS:


1. K. Otto and K. Wood, Product Design: Techniques in Reverse Engineering and New Product Development, Prentice Hall, 2001.
2. Anupam Saxena, Birendra Sahay, Computer Aided Engineering Design, Springer, 2005.
3. Ali K. Kamrani and Emad Abouel Nasr, Engineering Design and Rapid Prototyping, Springer, 2010.

### WEB SOURCE REFERENCE:

1. <http://www.digimat.in/nptel/courses/video/112102101/L52.html>




**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)




**Dr. J. Chidanandappa**  
(Industry Representative)



**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)  
Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### COMPUTATIONAL FLUID DYNAMICS (22PE0ME4B) (PROFESSIONAL ELECTIVE – IV)

**B.Tech. IV Year I Sem.**

**L T P C**  
**3 0 0 3**

**Pre-requisite:** Heat Transfer and Fluid Mechanics

**Course Objective:** To apply the principles of Heat Transfer and Fluid Mechanics to formulate governing equations for physical problems and to solve those using different numerical techniques.

**Course Outcomes:** At the end of the course, the student should be able to:

- Differentiate between different types of Partial Differential Equations and to know and understand appropriate numerical techniques.
- Solve the simple heat transfer and fluid flow problems using different numerical techniques, viz., FDM.
- Understand and to appreciate the need for validation of numerical solution.

#### UNIT - I:

**Basic Aspects of the Governing Equations** – Physical Boundary Conditions – Methods of solutions of Physical Problems – Need for Computational Fluid Dynamics – Different numerical/CFD techniques – FDM, FEM, FVM etc., - Main working principle - CFD as a research and design tool – Applications in various branches of Engineering Mathematical behavior of Partial Differential Equations (Governing Equations): Classification of linear/ quasi linear PDE – Examples - Physical Processes: Wave Equations and Equations of Heat Transfer and Fluid Flow – Mathematical Behavior - General characteristics – Its significance in understanding the physical and numerical aspects of the PDE – One way and Two Way variables – Well posed problems – Initial and Boundary Conditions Solution of Simultaneous Algebraic Equations: Direct Method – Gauss Elimination – LU Decomposition – Pivoting – Treatment of Banded Matrices – Thomas Algorithm Iterative Method: Gauss Seidel and Jordan Methods - Stability Criterion.

#### UNIT - II:

**Finite Difference Method:** Basic aspects of Discretization – Finite Difference formulae for first order and second order terms – Solution of physical problems with Elliptic type of Governing Equations for different boundary conditions - Numerical treatment of 1D and 2D problems in heat conduction, beams etc., - Solutions –Treatment of Curvilinear coordinates – Singularities – Finite Difference Discretization – Solution of 1D heat conduction problems in Heat conduction in curve linear coordinates

### UNIT - III:

**FDM:** Solution of physical problems with Parabolic type of Governing Equations – Initial Condition – Explicit, implicit and semi implicit methods – Types of errors – Stability and Consistency – Von Neumann Stability criterion– Solution of simple physical problems in 1D and 2D – Transient Heat conduction problems- ADI scheme - Simple Hyperbolic type PDE - First order and Second order wave equations – Discretization using Explicit method - Stability criterion – Courant Number – CFL Condition - Its significance - Treatment of simple problems

### UNIT - IV:

**Finite Difference Solution of Unsteady Inviscid Flows:** Lax – Wendroff Technique – Disadvantages – Maccormack’s Technique Fluid Flow Equations – Finite Difference Solutions of 2D Viscous Incompressible flow problems – Vorticity and Stream Function Formulation – Finite Difference treatment of Lid Driven Cavity Problem - Application to Cylindrical Coordinates with example of flow over infinitely long cylinder and sphere – Obtaining Elliptic Equations.

### UNIT - V:

**Finite Difference Applications in Fluid flow problems:** Fundamentals of fluid Flow modeling using Burger’s Equation – Discretization using FTCS method with respect to Upwind Scheme and Transport Property – Upwind Scheme and Artificial Viscosity Solutions of Navier Stokes Equations for Incompressible Fluid Flows: Staggered Grid – Marker and Cell (MAC) Formulation – Numerical Stability Considerations – Pressure correction method - SIMPLE Algorithm.

### TEXT BOOKS:

1. Computational Fluid Dynamics: The basics with applications/ John D Anderson/McGraw Hill Publications
2. Numerical Heat Transfer and Fluid Flow/ S.V. Patankar/ Mc Graw Hill.

### REFERENCE BOOKS:


1. Computational Fluid Flow and Heat Transfer / K Muralidharan and T Sudarajan/ Narosa Publishers.
2. Computational Methods for Fluid Dynamics / Firziger & Peric/ Springer.

### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/112/105/112105254/>



**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



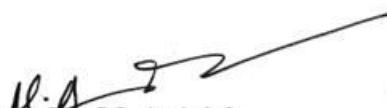
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)




**Dr. J. Chidanandappa**  
(Industry Representative)



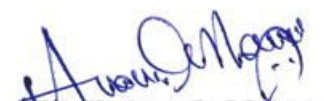
**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)  
Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### TURBO MACHINERY (22PE0ME4C) (PROFESSIONAL ELECTIVE – IV)

B.Tech. IV Year I Sem.

L T P C  
3 0 0 3

**Pre-requisites:** Thermal Engineering, Heat Transfer.

#### Course Objectives:

- To provide the knowledge of basic principles, governing equations, and applications of turbo machinery.
- To explain construction and working principle and evaluate the performance characteristics of Turbo Machines.

**Course Outcomes:** At the end of the course, student will be able to:

- Apply thermodynamics and kinematics principles to turbo machines
- Understand mechanisms behind working of Turbines, compressors.
- Understand the thermodynamic and flow analysis for turbines and compressors
- Analyze the performance of turbo machines.

#### UNIT – I:

**Introduction to Turbomachinery:** Classification of turbo-machines, second law of thermodynamics applied to turbine and compressors work, nozzle, diffuser work, fluid equation, continuity, Euler's, Bernoulli's, equation and its applications, expansion, and compression process, reheat factor, preheat factor

#### UNIT – II:

**Fundamental Concepts of Axial and Radial Machines:** Euler's equation of energy transfer, vane congruent flow, influence of relative circulation, thickness of vanes, number of vanes on velocity triangles, slip factor, Stodola, Stanitz and Balje's slip factor, suction pressure and net positive suction head, phenomena of cavitation in pumps, concept of specific speed, shape number, axial, radial and mixed flow machines, similarity laws.

#### UNIT – III:

**Gas Dynamics:** Fundamental thermodynamic concepts, isentropic conditions, Mach numbers, and area, Velocity relations, Dynamic Pressure, Normal shock relation for perfect gas. Supersonic flow, oblique shock waves. Normal shock recoveries, detached shocks, Aerofoil theory. Centrifugal compressor: Types, Velocity triangles and efficiencies, Blade passage design, Diffuser, and pressure recovery. Slip factor, Stanitz and Stodolas formula's, Effect of inlet mach numbers, Pre whirl, Performance

#### UNIT – IV:

**Axial Flow Compressors:** Flow Analysis, Work, and velocity triangles, Efficiencies, Thermodynamic analysis. Stage pressure rise, Degree of reaction, Stage Loading, General design, Effect of velocity, Incidence, Performance Cascade Analysis: Geometrical and terminology. Blade force, Efficiencies, Losses, Free end force, Vortex Blades.

#### UNIT – V:

**Axial Flow Gas Turbines:** Work done. Velocity triangle and efficiencies, Thermodynamic flow analysis, Degree of reaction, Zweifel's relation, Design cascade analysis, Soderberg, Hawthorne, Ainley, Correlations, Secondary flow, Free vortex blade, Blade angles for variable degree of reaction. Actuator disc, Theory, Stress in blades, Blade assembling, Material and cooling of blades, Performances, Matching of compressors and turbines, off design performance.

#### TEXT BOOKS:

1. Principles of Turbo Machines/DG Shepherd / Macmillan
2. Turbines, Pumps, Compressors/Yahya/ Mc Graw Hill

#### REFERENCE BOOKS:

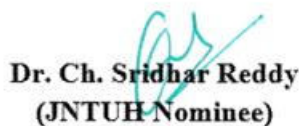
1. A Treatise on Turbo machines / G. Gopal Krishnan and D. Prithviraj/ SciTech
2. Gas Turbine Theory/ Saravanamuttoo/ Pearson.
3. Turbo Machines/ A Valan Arasu/ Vikas Publishing House Pvt. Ltd.

#### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/112/104/112104305/>



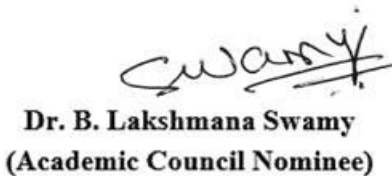
**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



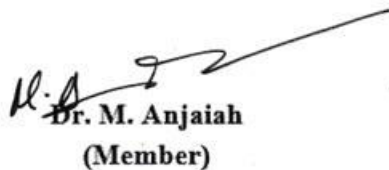
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)



**Dr. J. Chidanandappa**  
(Industry Representative)



**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# **GURU NANAK INSTITUTIONS TECHNICAL CAMPUS**

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## **R22 B.Tech. Mechanical Engineering**

### **FLUID POWER SYSTEM (22PE0ME4D) (PROFESSIONAL ELECTIVE – IV)**

**B.Tech. IV Year I Sem.**

**L T P C  
3 0 0 3**

**Pre-requisites:** Fluid Mechanics and Hydraulics Machinery

**Course outcomes:** At the end of the course, student will be able to:

- Understand the basic types of pumps and motors
- Analyse different types of valves
- Design and analysis of hydraulic circuits
- Visualize how a hydraulic/pneumatic circuit works to accomplish the function.
- Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro-pneumatics for a given application.

#### **UNIT- I:**

Introduction to oil hydraulics and pneumatics, their structure, advantages and limitations. ISO symbols, energy losses in hydraulic systems. Applications, Basic types and constructions of Hydraulic pumps and motors. Pump and motor analysis. Performance curves and parameters.

#### **UNIT- II:**

Hydraulic actuators, types and constructional details, lever systems, control elements – direction, pressure, and flow control valves. Valve configurations, General valve analysis, valve lap, flow forces and lateral forces on spool valves. Series and parallel pressure compensation flow control valves. Flapper valve Analysis and Design.

#### **UNIT- III:**

Proportional control valves and servo valves. Nonlinearities in control systems (backlash, hysteresis, dead band, and friction nonlinearities). Design and analysis of typical hydraulic circuits. Regenerative circuits, high low circuits, Synchronization circuits, and accumulator sizing.



#### UNIT- IV:

Intensifier circuits Meter-in, Meter-out and Bleed-off circuits; Fail Safe and Counter balancing circuits, accessories used in fluid power system, Filtration systems and maintenance of system. Components of pneumatic systems; Direction, flow and pressure control valves in pneumatic systems. Development of single and multiple actuator circuits. Valves for logic functions; Time delay valve; Exhaust and supply air throttling.

#### UNIT- V:

Examples of typical circuits using Displacement – Time and Travel-Step diagrams. Will-dependent control, Travel-dependent control and Time dependent control, combined control, Program Control, Electropneumatic control and air-hydraulic control, Ladder diagrams. Applications in Assembly, Feeding, Metal working, materials handling and plastics working.

#### TEXT BOOKS:

1. Fluid Power Control systems/ Pippenger, J.J., and R. M. Koff/ New York: McGraw Hill.
2. Fluid Power Systems: modeling, simulation, and microcomputer control"/ John Watton/ Prentice Hall International.

#### REFERENCE BOOKS:

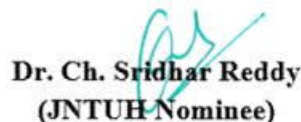
1. Fundamentals of Fluid Power Control. / John Watton/ 1st Ed. Cambridge University Press, 2009.
2. Fluid Power with applications"/ Anthony Esposito / Pearson Education.

#### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/112/106/112106175/>



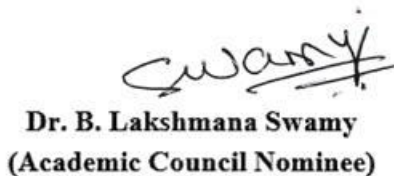
**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



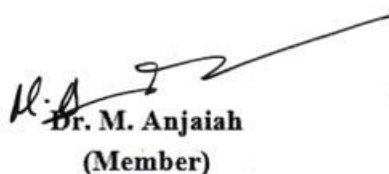
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)



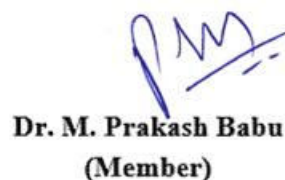
**Dr. J. Chidanandappa**  
(Industry Representative)



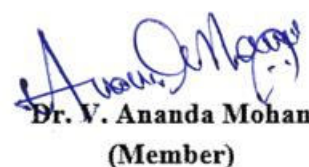
**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)  
Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### QUANTITATIVE ANALYSIS FOR BUSINESS DECISIONS (22OE0ME2A) (OPEN ELECTIVE – II)

B.Tech. IV Year I Sem.

L T P C  
3 0 0 3

#### Course Objectives:

- To impart knowledge of basic tools of Operations research in solving the management problems using mathematical approaches for decision making.
- To teach the methods of solving Linear Programming Problems.
- To impart knowledge on assignment model and transportation problem.
- To impart knowledge on the significance of decision tree and Network analysis.
- To highlight the importance of Queuing Theory.

#### Course Outcomes: At the end of the course, students will be able to:

- Understand the origin and application of operations research.
- Learn about the Formulation of Linear Programming Problem for different areas.
- appreciate the significance of variations of assignment problem, methods for finding Initial feasible solution.
- Learn the aspects of Decision Theory and Network Analysis
- Gain insights of the theoretical principles and practical applications of different queuing models.

#### UNIT – I:

**Introduction to Operations Research:** Nature and Scope of Operations Research: Origins of OR, Applications of OR in different Managerial Areas, Problem Solving and Decisionmaking, Quantitative and Qualitative Analysis. Defining a Model, Types of Models, Process for Developing an Operations Research Model, Practices, Opportunities and Shortcomings of using an OR Model.

#### UNIT – II:

**Linear Programming Method:** Structure of LPP, Assumptions of LPP, Application Areas of LPP, Guidelines for Formulation of LPP, Formulation of LPP for Different Areas, Solving of LPP by Graphical Method: Extreme Point Method, Simplex Method, Converting Primal LPP to Dual LPP, Limitations of LPP.

#### UNIT – III:

**Assignment Model:** Algorithm for Solving Assignment Model, Hungarians Method for Solving Assignment Problem, Variations of Assignment Problem: Multiple Optimal Solutions, Maximization Case in Assignment Problem, Unbalanced Assignment Problem, Travelling Salesman Problem, Simplex Method for Solving Assignment Problem.

**Transportation Problem:** Mathematical Model of Transportation Problem, Methods for Finding Initial Feasible Solution: Northwest Corner Method, Least Cost Method, Vogels Approximation Method, Test of Optimality by Modi Method, Unbalanced Supply and Demand, Degeneracy, and its Resolution.

**UNIT – IV:**

**Decision Theory:** Introduction, Ingredients of Decision Problems. Decision-making under Uncertainty, Cost of Uncertainty Under Risk, Under Perfect Information, Decision Tree, Construction of Decision Tree. Network Analysis: Network Diagram, PERT, CPM, Critical Path Determination, Project Completion Time, Project Crashing.

**UNIT – V:**

**Queuing Theory:** Queuing Structure and Basic Component of a Queuing Model, Distributions in Queuing Model, Different Queuing Models with FCFS, Queue Discipline, Single and Multiple Service Station with Finite and Infinite Population. Game Theory, Saddle Point, Value of the Game.

**TEXT BOOKS:**

1. Mik Wisniewski, Dr Farhad Shafti, Quantitative Analysis for Decision Makers, Pearson, 7e, 2019.
2. Miguel Ángel Canela, Inés Alegre, Alberto Ibarra, Quantitative Methods for Management: A Practical Approach, Springer International Publishing, 1e, 2019.

**REFERENCE BOOKS:**


1. James E. Sallis, Geir Gripsrud, Ulf Henning Olsson, Ragnhild Silkoset, Research Methods and Data Analysis for Business Decisions: A Primer Using SPSS, Springer International Publishing, 1e, 2021.
2. R. Pannerselvam, Operations Research, Prentice Hall International, 3e, 2015.
3. N.V.S. Raju, Operations Research: Theory and Practice, CRC Press, 2020.
4. R. Pannerselvam, Operations Research, Prentice Hall International, 3e, 2015
5. J.K. Sharma, Operations Research: Theory Dand applications, MacMillian, 5e, 2013.

**WEB SOURCE REFERENCE:**

1. <https://nptel.ac.in/courses/110105089>




**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



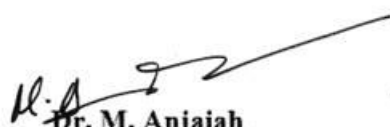
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)




**Dr. J. Chidanandappa**  
(Industry Representative)



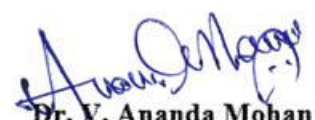
**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### INDUSTRIAL ENGINEERING & MANAGEMENT (22OE0ME2B) (OPEN ELECTIVE – II)

**B.Tech. IV Year I Sem.**

**L T P C**  
**3 0 0 3**

**Prerequisites:** None

**Course objectives:** The main objectives of this course are the following to Learn:

- Philosophies of various management gurus & characteristics of various organization structures.
- Various Industrial Engineering practices.
- Human resource management practices.
- Network analysis through PERT and CPM techniques.

**Course outcomes:** At the end of course, students will be able to

- Practice the management theories proposed by Taylor, Fayol etc.
- Consider various factors and identify plant location for given industry.
- Determine EOQ, classify items and implement P-system and Q-system.
- Conduct work study (method study+ Work measurement: a) Time study & Work sampling).
- Practice HRM principles.
- Analyze the networks by using PERT & CPM.

#### **UNIT - I:**

**Management and Organization** – Functions of Management - Contributions of Taylor, Fayol, Douglas Mc-Gregor, Mayo Hertzberg and Maslow. – Systems Approach to Management - Organizational Structures: Basic concepts related to Organization - Departmentation and Decentralization, Types of mechanistic and organic structures of organization and their merits, demerits, and suitability.

#### **UNIT- II:**

**Operations Management-I:** Plant location, definition, factors affecting the plant location, comparison of rural and urban sites-methods for selection of plant- Matrix approach. Types of plant layout – various data analyzing forms-travel chart - Work study: Method study and Work measurement. Inventory – functions, types, Determination of Economic Order Quantity (EOQ), ABC and VED analysis. Inventory Control Systems-Continuous review system-periodical review system. Stores Management and Stores Records. Purchase management, duties of purchase of manager, JIT System.

#### **UNIT - III:**

**Operations Management-II:** Inspection and quality control, types of inspections - Statistical Quality Control-techniques- Charts for variables and attributes. Acceptance sampling plan- single sampling and double sampling plans-OC curves. Introduction to TQM-Quality Circles, ISO 9000 series procedures. Functions of Marketing, Marketing vs Selling, Marketing mix, Product Life Cycle.

#### UNIT - IV:

**Human Resources Management (HRM):** Concepts of HRM, HRD and Personnel Management and Industrial Relations (PMIR), HRM vs PMIR, Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating – Capability Maturity Model (CMM) Levels – Performance Management System.

#### UNIT- V:

**PERT/CPM:** Project management, network modelling-probabilistic model, various types of activity time's estimation-programme evaluation review techniques- Critical Path-probability of completing the project, Critical Path Method (CPM) - Project crashing. Simple problems.

#### TEXT BOOKS:


1. Aryasri, Management Science, McGraw hill, 2012
2. Kumar, Rao and Chhalill: Introduction to Management Science, Cengage 2012.

#### REFERENCE BOOKS:


1. Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi, 2012.
2. Amrine, Manufacturing Organization and Management, Pearson, 2012.
3. Chase, Jacobs, Aquilano, Operations Management, McGraw Hill, 2012.
4. Panner Selvam, Production and Operations Management, PHI, 2012.
5. Nadha Muni Reddy & Vijaya Kumar Reddy, Reliability Engineering & Quality Engineering, Galgotia, 2012.
6. Ralph M Barnes, Motion and Time Studies, John Wiley and Sons, 2012.
7. L. S. Srinath, PERT / CPM, Affiliate East-West Press, New Delhi, 2012.
8. Gary Dessler, Human Resource Management, Pearson Education Asia, 2012.
9. Phillip Kotler, Marketing Management, Pearson, 2012.
10. S. K. Basu, K. C. Sahu, B. Rajiv: Industrial Organization and Management, PHI, 2012.
11. Dipak Kumar Bhattacharyya: Industrial Management, Vikas publishing house 2013.

#### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/112/107/112107292/>




**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)




**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)




**Dr. J. Chidanandappa**  
(Industry Representative)



**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)





# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### INDUSTRIAL ROBOTICS (22PE0ME5A) (PROFESSIONAL ELECTIVE – V)

B.Tech. IV Year II Sem.

L T P C  
3 0 0 3

**Pre-requisites:** Basic principles of Kinematics and mechanics.

**Course Objectives:** The goal of the course is to familiarize the students with the concepts and techniques in robotic engineering, manipulator kinematics, dynamics, and control, choose, and incorporate robotic technology in engineering systems.

- Make the students acquainted with the theoretical aspects of Robotics
- Enable the students to acquire practical experience in the field of Robotics through design projects and case studies.
- Make the students to understand the importance of robots in various fields of engineering.
- Expose the students to various robots and their operational details.

**Course Outcomes:** At the end of the course, the student will be able to:

- understand the basic components of robots.
- Differentiate types of robots and robot grippers.
- Model forward and inverse kinematics of robot manipulators.
- Analyze forces in links and joints of a robot.
- Programme a robot to perform tasks in industrial applications.
- Design intelligent robots using sensors.

#### UNIT – I:

**Introduction:** Automation and Robotics – An over view of Robotics – present and future applications.

**Components of the Industrial Robotics:** common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, Design of end effectors, Precision of Movement: Resolution, Accuracy and Repeatability, Speed of Response and Load Carrying Capacity.

#### UNIT – II:

**Motion Analysis:** Basic Rotation Matrices, Equivalent Axis and Angle, Euler Angles, Composite Rotation Matrices. Homogeneous transformations as applicable to rotation and translation – problems.

**Manipulator Kinematics-H** notation-H method of Assignment of frames-H Transformation Matrix, joint coordinates, and world coordinates, Forward and inverse kinematics – problems on Industrial Robotic Manipulators.

#### UNIT – III:

Differential transformation of manipulators, Jacobians – problems. Dynamics: Lagrange – Euler and Newton – Euler formations – Problems. Trajectory planning and avoidance of obstacles, path planning, Slew motion, joint interpolated motion – straight line motion.



#### UNIT – IV:

**Robot actuators and Feedback components:** Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison of Actuators, Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors, Tactile and Range sensors, Force and Torque sensors – End Effectors and Tools

#### UNIT V:

**Robot Application in Manufacturing:** Material Transfer - Material handling, loading, and unloading-Processing - spot and continuous arc welding & spray painting - Assembly and Inspection. Robotic Programming Methods – Languages: Lead Through Programming, Textual Robotic Languages such as APT, MCL.

#### TEXT BOOKS:


1. Industrial Robotics / Groover M P /Mc Graw Hill
2. Introduction to Industrial Robotics / Ramachandran Nagarajan / Pearson

#### REFERENCE BOOKS:


1. Robot Dynamics and Controls / Spony and Vidyasagar / John Wiley
2. Robot Analysis and control / Asada, Slotine / Wiley Inter-Science.
3. Robotics – Fu et al / TMH Publications.

#### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/112/105/112105249/>



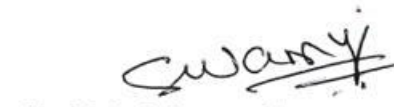
**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



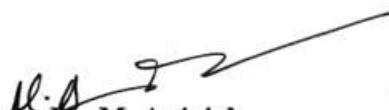
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)



**Dr. J. Chidanandappa**  
(Industry Representative)



**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### MECHANICAL VIBRATIONS (22PE0ME5B) (PROFESSIONAL ELECTIVE – V)

B.Tech. IV Year II Sem.

L T P C  
3 0 0 3

**Pre-requisites:** Engineering Mechanics.

**Course objectives:** To Understand various types of vibrations.

**Course Outcomes:** At the end of the course, the student will be able to,

- Understand the causes and effects of vibration in mechanical systems.
- Develop schematic models for physical systems and formulate governing equations of motion
- Understand the role of damping, stiffness, and inertia in mechanical systems
- Analyze rotating and reciprocating systems and compute critical speeds.
- Analyze and design machine supporting structures, vibration isolators and absorbers.

#### UNIT – I:

**Single degree of Freedom systems - I:** Undamped and damped free vibrations; forced vibrations coulomb damping; Response to excitation; rotating unbalance and support excitation; vibration isolation and transmissibility.

#### UNIT – II:

**Single degree of Freedom systems - II:** Response to Non-Periodic Excitations: unit impulse, unit step and unit Ramp functions; response to arbitrary excitations, The Convolution Integral; shock spectrum; System response by the Laplace Transformation method.

#### UNIT – III:

**Two-degree freedom systems:** Principal modes- undamped and damped free and forced vibrations; undamped vibration absorbers.

**Multi degree freedom systems:** Matrix formulation, stiffness, and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis; Method of matrix inversion; Torsional vibrations of multi-rotor systems and geared systems; Discrete- Time systems.

#### UNIT – IV:

**Continuous system:** Free vibration of strings – longitudinal oscillations of bars-traverse vibrations of beams- Torsional vibrations of shafts.

**Critical speeds of shafts:** Critical speeds without and with damping, secondary critical speed.

**Numerical Methods:** Rayleigh's stodola's, Matrix iteration, Rayleigh- Ritz Method and Holzer's methods. Vibration measuring instruments: Vibrometers, velocity meters & accelerometers

## UNIT – V:

**Sound level and subjective response to sound:** Subjective response to sound, frequency dependent human response to sound, sound-pressure dependent human response, the decibel scale, relationship among sound power, sound intensity and sound pressure level, relationship between sound power level and sound intensity, relationship between sound intensity level and sound pressure level, sound measuring instruments.

### TEXT BOOKS:

1. Elements of Vibration Analysis / Meirovitch/ Mc Graw Hill.
2. Principles of Vibration / Benson H. Tongue/Oxford.

### REFERENCE BOOKS:

1. Mechanical Vibrations / SS Rao / Pearson
2. Mechanical Vibration /Rao V. Dukkipati, J Srinivas/ PHI.
3. Mechanical Vibrations/ G.K. Grover/ Nemchand & Brothers.

### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/112/103/112103111/>



**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)




**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)



**Dr. J. Chidanandappa**  
(Industry Representative)



**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### COMPOSITE MATERIALS (22PE0ME5C) (PROFESSIONAL ELECTIVE – V)

B.Tech. IV Year II Sem.

L T P C  
3 0 0 3

#### Course objectives:

- Develop understanding of the structure of ceramic materials on multiple length scales.
- Develop knowledge of point defect generation in ceramic materials, and their impact on transport properties.
- To describe key processing techniques for producing metal, ceramic-, and polymer-matrix composites.
- To demonstrate the relationship among synthesis, processing, and properties in composite materials.

#### Course Outcomes: At the end of the course student will be able to

- Understand the crystal structures of a wide range of ceramic materials and glasses.
- explain how common fibers are produced and how the properties of the fibers are related to the internal structure.
- select matrices for composite materials in different applications.
- describe key processing methods for fabricating composites.

#### UNIT – I:

**Introduction:** Definition, Classification of Composite materials based on structure, based on matrix, Advantages of composites, Applications of composites, Functional requirements of reinforcement and matrix.

#### UNIT – II:

**Types of reinforcements and their properties:** Fibers: Carbon, Boron, Glass, Aramid, Al<sub>2</sub>O<sub>3</sub>, SiC, Nature and manufacture of glass, carbon and aramid fibres, Comparison of fibres. Role of interfaces: Wettability and Bonding, the interface in Composites, Interactions and Types of bonding at the Interface, Tests for measuring Interfacial strength.

#### UNIT – III:

Fabrication of Polymeric Matrix Composites, Structure and properties of Polymeric Matrix Composites, Interface in Polymeric Matrix Composites, Applications; Fabrication of Ceramic Matrix Composites, Properties of Ceramic Matrix Composites, Interface in Ceramic Matrix Composites, Toughness of Ceramic Matrix Composites Applications of Ceramic Matrix Composites.

#### UNIT – IV:

**Fabrication of Metal Matrix Composites:** Solid state fabrication, Liquid state fabrication and In-situ fabrication techniques; Interface in Metal Matrix Composites: Mechanical bonding, Chemical bonding, and Interfaces in In-situ Composites; Discontinuously reinforced Metal Matrix Composites, Properties and Applications. Fabrication of Carbon fiber composites, properties, interface, and applications.

#### UNIT – V:

**Micromechanics of Composites:** Density, Mechanical Properties: Prediction of Elastic constants, Micro mechanical approach, Halpin-Tsai equations, Transverse stresses; Thermal properties: Hydrothermal stresses and Mechanics of Load transfer from matrix to fiber.

#### TEXTS BOOKS:


1. Composite Materials – Science & Engineering, K.K. Chawla, Springer-Verlag, New York, 1987.
2. An Introduction to Composite Materials, Hull, Cambridge, 2nd Edition. 1997.

#### REFERENCE BOOKS:

1. Composites, Engineered Materials Handbook, Vol. 1, ASM International, Ohio, 1988.
2. Structure and Properties of Composites, Materials Science and Technology, Vol. 13, VCH, Weinheim, Germany, 1993.
3. Composite Materials: Engineering and Science, F.L. Matthews and R.D. Rawlings, Chapman & Hall, London, 1994.

#### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/112/104/112104229/>




**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)




**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)




**Dr. J. Chidanandappa**  
(Industry Representative)



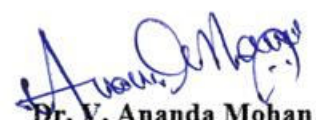
**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### ENERGY CONSERVATION AND MANAGEMENT (22PE0ME5D) (PROFESSIONAL ELECTIVE – V)

B.Tech. IV Year II Sem.

L T P C  
3 0 0 3

#### Course Objectives:

- To understand the principles of energy conservation
- To understand thermal insulation & refractors.
- To know waste heat recovery systems.
- To gain knowledge about engineering economics.
- To impart knowledge Energy management programs.

**Course Outcomes:** At the end of the course, student will be able to

- Understand the basic concept of energy conservation and its role in energy management.
- Focus on thermal Insulation & refractors, classification, and applications.
- Discuss the energy conservation opportunities in the energy intensive industries by waste heat recovery system.
- Analyze the quantum of electrical energy that can be saved using energy efficient lighting systems and energy audit parameters.
- Understand concept of Project management and energy management Programs.

#### UNIT-I:

**Energy Conservation:** Rules for efficient energy conservation – technologies for energy conservation – outline of waste heat and material reclamation, load management, alternate energy sources, and energy storage.

#### UNIT-II:

**Thermal Insulation & Refractors:** Heat loss through un-insulated surfaces, effects of insulation on current carrying wires – economic thickness of insulation – critical radius of insulation – properties of thermal insulators – classification of insulation materials – classification of refractors – properties of refractors – criteria for good refractory material – applications of insulating & refractory materials.

#### UNIT-III:

**Waste Heat Recovery Systems:** Guideline to identify waste heat – feasibility study of waste heat – shell and tube heat exchanger – thermal wheel – heat pipe heat exchanger – heat pump – waste heat boilers – incinerators.

**Heat Recovery Systems & Heat Exchanger Networks:** Liquid to liquid heat exchangers – gas to liquid heat recovery systems, regenerators, recuperators, rotating regenerators – miscellaneous heat recovery methods – selection of materials for heat exchangers – combined radiation and convective heat exchanger, U tube heat exchanger, tube heat exchanger, fluidized bed heat exchanger – economizer.



#### UNIT-IV:

**Engineering Economics:** Managerial objectives, steps in planning – efficiency of organization- capital budgeting – classification of costs – interest – types – nominal and effective interest rates – discrete and continuous compounding – discounting - time value of money – cash flow diagrams – present worth factor, capital recovery factor, equal annual payments – equivalent between cash flows.

**Energy auditing:** A definition – objectives – level of responsibility – control of energy – uses of energy – check lists – energy conservation schemes – energy index – cost index – pie charts – sankey diagrams – load profiles – types of energy audits – questionnaire – energy audit of industries – general energy audit – detailed energy audit – energy saving potential.

#### UNIT-V:

**Project Management:** Method of investment appraisal – rate of return method, pay back method, net present value method (NPV) – adoption of the methods in energy conservation campaign – types of projects – propose of project management – classification – role and qualities of project manager – types of budgets - budget committee – budgeting.

**Energy Management Programs:** Necessary steps of energy management programme – concepts of energy management – general principles of energy management – energy management in manufacturing and process industries – qualities and functions of energy managers – duties of energy manager - language of energy manager – checklist for top management.

#### TEXT BOOKS:


1. Waste heat recovery systems -D.A. Reay/Pergamon Press.
2. Energy Management -W.R. Murphy & G. McKay, Butterworths

#### REFERENCE BOOKS:

1. Energy Conservation -P.W. O'Callaghan, Pergamon Press 1981.
2. Engineering Heat Audits -C.P. Gupta & Rajendra Prakash, Nem Chand & Bros.
3. Hand book of energy audits -Albert Thumann, The Fairmont Press Inc., Atlanta Georgia, 1979.
4. Energy Management Principles -Craig B. Smith, Pergamon Press.

#### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/112/105/112105221/>




**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



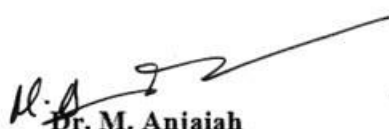
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)




**Dr. J. Chidanandappa**  
(Industry Representative)



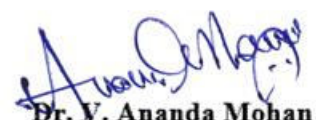
**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### INDUSTRY 4.0 (22PE0ME6A) (PROFESSIONAL ELECTIVE – VI)

B.Tech. IV Year II Sem.

L T P C  
3 0 0 3

**Course Objectives:** The objectives of this course are

- To understand the basics of Industry 4.0
- To understand the Business model and impact of IIoT
- To understand the concepts of virtual reality, lean manufacturing
- To gain knowledge of various sensors and actuators.
- To understand various data transmission technologies.

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

- Explain Smart Business Perspective, Cyber security, Impacts of Industry 4.0.
- Understand the basics of the Industrial Internet of Things.
- Understand various key technologies.
- Implement various sensors and actuators.
- Understand different industrial transmission technologies and IIOT applications in real life.

#### UNIT – I:

**Industry 4.0 Basics:** Industrial revolution: Phases, Evolution of Industry4.0, Environmental impacts of industrial revolution, Applications, Design requirements, Drivers of Industry4.0, Sustainability Assessment of industries, Smart Business Perspective, Cyber security, Impacts of Industry 4.0.

#### UNIT – II:

**Industrial Internet of Things- Basics:** IIoT and Industry 4.0, IIC, Industrial Internet Systems, Design of industrial internet systems, Impact of industrial internet, Benefits of industrial internet, Industrial sensing, Industrial Processes, Features of IIoT for industrial processes, Industrial plant–The future architecture, Digital Enterprise.

**Business Models and Reference Architecture of IIoT:** Definition of a business model, Business models of IIoT, Industrial Internet Reference Architecture

#### UNIT –III:

**Key Technologies:** Off-site Technologies, Cloud Computing.

**Fog Computing Key Technologies:** On-site Technologies, Augmented Reality, Virtual Reality, Smart factories, Lean manufacturing system, Big Data and Advanced Analytics.

#### UNIT –IV:

**Sensors:** Various sensor types and their underlying working principles, Characteristics of Sensors – Resolution, calibration, accuracy and others, Sensor Categories – Thermal, Mechanical, Electrical, Optical and Acoustic sensors.

**Actuators:** Thermal, Hydraulic, Pneumatic, Electro mechanical Actuator

## UNIT – V:

**Industrial Data Transmission and Acquisition:** Architecture of various data transmission technologies like Foundation Fieldbus, Profibus, Highway Addressable Remote Transducer (HART), Interbus, Bitbus, Digital STROM, Controller Area Network, and other recent and upcoming Technologies. Distributed Control System, SCADA and PLC System.

**IIOT Applications:** IoT Applications on Industrial automation, Factories and Assembly line, Plant Security and Safety, Transportation, Agriculture, Healthcare, Home Automation, Oil, Chemical and Pharmaceutical Industry and others.

### TEXT BOOKS:

1. Introduction to Industrial Internet of Things and Industry 4.0 by Sudip Misra, Chandana Roy, Anandarup Mukherjee, CRC Press.
2. Vijay Madiseti, Arshdeep Bahga, Internet of Things, “A Hands-on Approach”, University Press.

### REFERENCE BOOKS:

1. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, “Introduction to Internet of Things: A practical Approach”, ETI Labs.
2. Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”, CRC Press.
3. Adrian McEwen, “Designing the Internet of Things”, Wiley.
4. Raj Kamal, “Internet of Things: Architecture and Design”, McGraw Hill.
5. Cuno Pfister, “Getting Started with the Internet of Things”, O Reilly Media.

### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/106/105/106105195/>



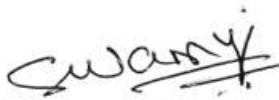
**Dr. A. Raj Kumar**  
(Chairman, BOS)




**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



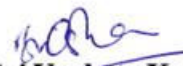
**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



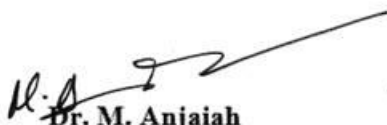
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)



**Dr. J. Chidanandappa**  
(Industry Representative)



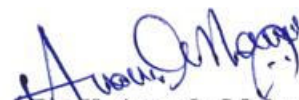
**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### FUZZY LOGIC AND ANN (22PE0ME6B) (PROFESSIONAL ELECTIVE – VI)

**B.Tech. IV Year II Sem.**

**L T P C**  
**3 0 0 3**

**Prerequisite:** Operations research, Optimization Techniques, Control Systems.

**Course Objectives:** The goal of this course is to give a good basic understanding of Neural Networks and Fuzzy Logic. This course is mainly intended for engineers who desire to learn more about these techniques.

**Course outcomes:** After completion of this course, the student will be able to

- Understand the concepts of neural networks and fuzzy logics
- Understand the topology of multi-layer perceptron, recurrent neural networks and
- Fuzzification & Defuzzification.
- Understand the basic structure and operation of Fuzzy logic control systems

#### UNIT-I:

**Evolution of neural networks:** Artificial Neural Network: Basic model, Classification, Feed forward and Recurrent topologies, Activation functions; Learning algorithms: Supervised, Un-supervised and Reinforcement; Fundamentals of connectionist modeling: McCulloch – Pits model, Perceptron, Adaline, Madaline.

#### UNIT-II:

**Topology of Multilayer perceptron,** Back propagation learning algorithm, limitations of Multilayer perceptron. Radial Basis Function networks: Topology, learning algorithm; Kohonen's self-organising network: Topology, learning algorithm; Bidirectional associative memory Topology, learning algorithm, Applications.

#### UNIT-III:

**Recurrent neural networks:** Basic concepts, Dynamics, Architecture and training algorithms, Applications;

Hopfield network: Topology, learning algorithm, Applications; Industrial and commercial applications of Neural networks: Semiconductor manufacturing processes, Communication, Process monitoring and optimal control, Robotics, Decision fusion and pattern recognition.

#### UNIT-IV:

**Classical and fuzzy sets:** Introduction, Operations and Properties, Fuzzy Relations: Cardinality, Operations and Properties, Equivalence and tolerance relation, Value assignment: cosine amplitude and max-min method; Fuzzification: Membership value assignment- Inference, rank ordering, angular fuzzy sets. Defuzzification methods, Fuzzy measures, Fuzzy integrals, Fuzziness and fuzzy resolution; possibility theory and Fuzzy arithmetic; composition and inference; Considerations of fuzzy decision-making.

#### UNIT-V:

**Basic structure and operation of Fuzzy logic control systems:** Design methodology and stability analysis of fuzzy control systems; Applications of Fuzzy controllers. Applications of fuzzy theory.

#### TEXT BOOKS:

1. Neural Networks in Computer Intelligence by Limin Fu, McGraw Hill, 2003.
2. Soft Computing and Intelligent Systems Design, Theory, Tools, and Applications by Fakhreddine O. Karray and Clarence De Silva., Pearson Education, India, 2009.

#### REFERENCE BOOKS:

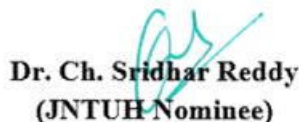
1. Fuzzy Logic with Engineering Applications by Timothy J. Ross, McGraw Hill, 1995.
2. Artificial Neural Networks by B. Yegnanarayana, PHI, India, 2006.

#### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/127/105/127105006/>



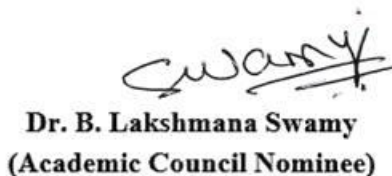
Dr. A. Raj Kumar  
(Chairman, BOS)



Dr. Ch. Sridhar Reddy  
(JNTUH-Nominee)



Dr. L. Siva Rama Krishna  
(Academic Council Nominee)



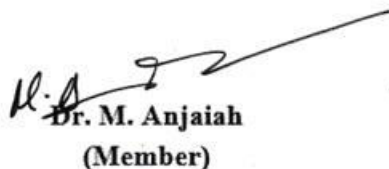
Dr. B. Lakshmana Swamy  
(Academic Council Nominee)



Dr. J. Chidanandappa  
(Industry Representative)



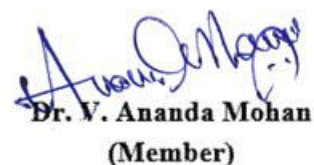
Dr. B. Sai Venkata Krishna  
(Alumni)



Dr. M. Anjaiah  
(Member)



Dr. M. Prakash Babu  
(Member)



Dr. V. Ananda Mohan  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)  
Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### ELECTRIC AND HYBRID VEHICLES (22PE0ME6C) (PROFESSIONAL ELECTIVE – VI)

B.Tech. IV Year II Sem.

L T P C  
3 0 0 3

#### Course Objectives:

- Explain the history of Electric vehicles and development
- Discuss the Social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies
- Explore to basic concept of electric traction, Configuration and control of DC Motor drives, Configuration, and control of Induction Motor drives etc.
- Analyse the Fuel Cell based energy storage and Super Capacitor based energy storage etc.
- Explore to types of Driving Cycles, Range modelling for Battery Electric Vehicle, Hybrid (ICE & others) etc.

#### Course Outcomes: At the end of the course student will be able to

- Choose the appropriate source of energy for the hybrid electric vehicle based on driving cycle.
- Analyze the power and energy need of the various hybrid electric vehicle and Measure and Estimate the energy consumption of the Hybrid Vehicles.
- Evaluate energy efficiency of the vehicle for its drive trains.
- Elaborate the types of storage systems such as battery based, fuel cell based etc.
- Explain the types of Driving Cycles, Fuel Cell EV, Solar Powered Vehicles.

#### UNIT- I:

**Introduction to Electric Vehicle:** History of Electric Vehicles, Development towards 21st Century, Types of Electric Vehicles in use today – Battery Electric Vehicle, Hybrid (ICE & others), Fuel Cell EV, Solar Powered Vehicles. Motion and Dynamic Equations of the Electric Vehicles: various forces acting on the Vehicle in static and dynamic conditions.

#### UNIT- II:

**Introduction to Hybrid and Electric Vehicles:** Social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid Drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis



### UNIT- III:

**Electric Drive Trains:** Basic concept of electric traction, introduction to various electric drivetrain topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency

### UNIT- IV:

**Types of Storage Systems:** Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Calculation for the rating.

### UNIT- V:

**Modelling of Hybrid Electric Vehicle Range:** Driving Cycles, Types of Driving Cycles, Range modelling for Battery Electric Vehicle, Hybrid (ICE & others), Fuel Cell EV, Solar Powered Vehicles. Case study of 2-wheeler, 3-wheeler, and 4-wheeler vehicles.

### TEXT BOOKS:

1. James Larminie, J. Lowry, "Electric Vehicle Technology Explained", John Wiley & Sons Ltd. 2003.
2. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.

### REFERENCE BOOKS:

1. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2016.
2. Iqbal Hussein, "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2010.

### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/108/103/108103009/>



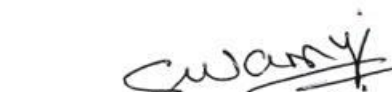
**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)




**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)



**Dr. J. Chidanandappa**  
(Industry Representative)




**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### TOTAL QUALITY MANAGEMENT (22PE0ME6D) (PROFESSIONAL ELECTIVE – VI)

B.Tech. IV Year II Sem.

L T P C  
3 0 0 3

#### Course Objectives:

- Develop an understanding of the necessary information and skills needed to manage, control, and improve quality practices in the organizations through TQM philosophy.
- To understand customer and supplier relationship and Bench marketing.
- Apply TQM in traditional organizations.
- Analysis of quality in cost and management.
- To understand various ISO around the world.

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

- Understand the concept of TQM and various control charts.
- To analyze the relationship between customer and supplier.
- Implement TQM in an organization.
- To evaluate the cost of quality.
- Understand the third-party audit and documentation of various ISO audits.

#### UNIT – I:

**Introduction:** The concept of TQM, Quality and Business performance, attitude and involvement of top management, communication, culture, and management systems. Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs, Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

#### UNIT – II:

**Customer Focus and Satisfaction:** Process Vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer – Supplier relationships. Bench Marketing: Evolution of Bench Marketing, meaning of Bench marketing, benefits of bench marketing, the bench marketing process, pitfalls of bench marketing.

#### UNIT – III:

**Organizing for TQM:** The systems approach, organizing for quality implementation, making the transition from a traditional to a TQM organizing, Quality Circles. Productivity, Quality and Reengineering: The leverage of Productivity and Quality, Management systems Vs. Technology, Measuring Productivity, Improving Productivity Re-engineering.

#### UNIT – IV:

**The Cost of Quality:** Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost Information, Accounting Systems and Quality Management.

#### UNIT – V:

**ISO9000:** Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQCQ-90. Series Standards, benefits of ISO9000 certification, the third-party audit, Documentation ISO9000 and services, the cost of certification implementing the system.

#### TEXT BOOKS:


1. Total Quality Management: Text, cases and Readings, Third Edition - Joel E. Ross.
2. Beyond TQM - Robert L. Flood.

#### REFERENCE BOOKS:

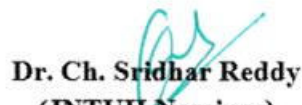
1. Statistical Quality Control – Eugene Grant, Richard McGraw-Hill, 2017.
2. Total Quality Management, Besterfiled D. H., Pearson Education Asia – 2015-4th Edition
3. The Management and Control of Quality, Evans J. R, and Lindsay W. M., Southwestern (Thomson Learning), Fifth Edition.

#### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/110/104/110104080/>



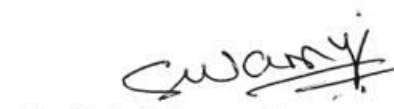
**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



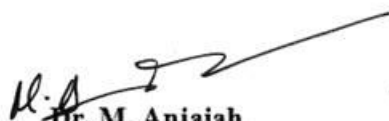
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)



**Dr. J. Chidanandappa**  
(Industry Representative)



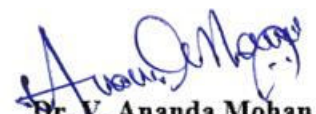
**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)  
Ibrahimpatnam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### ENTREPRENEURSHIP DEVELOPMENT (22OE0ME3A) (OPEN ELECTIVE – III)

B.Tech. IV Year II Sem.

L T P C  
3 0 0 3

#### Course objectives:

Study of this subject provides an understanding of the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc.

**Course Outcomes:** Upon completion of the course, students will be able to

- Identify the factors affecting entrepreneurial growth.
- Understand various programs supporting entrepreneurship.
- Write preliminary project report.
- Estimate the finances for the project.
- Appraise and avail support rendered by the Government and other Appropriate Agencies.

#### UNIT I:

**Entrepreneurship:** Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

#### UNIT II:

**Motivation:** Major Motives Influencing an entrepreneur – Achievement Motivation Training, Self-Rating, Business Game, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

#### UNIT III:

**Business:** Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – Identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

#### UNIT IV:

**Financing and Accounting:** Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT / CPM – Taxation – Income Tax, Excise Duty – Sales Tax.

## UNIT V:

**Support to Entrepreneurs:** Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

### TEXT BOOKS:


1. S.S. Khanka, “Entrepreneurial Development” S. Chand & Co. Ltd., 2020.
2. Kuratko & Hodgetts, “Entrepreneurship – Theory, process and practice”, Thomson learning 6th edition.

### REFERENCE BOOKS:


1. Hisrich R D, Peters M P, Dean Shepherd, “Entrepreneurship” 12th Edition McGraw-Hill.
2. Mathew J Manimala,” Entrepreneurship theory at cross roads: paradigms and praxis” Dream tech, 2nd edition 2006.
3. Rabindra N. Kanungo, “Entrepreneurship and innovation: Models for Development”, Sage Publications, 1998.
4. EDII “Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development”, Institute of India.

### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/110/106/110106141/>




**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)




**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)



**Dr. J. Chidanandappa**  
(Industry Representative)




**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)



# GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(An UGC Autonomous Institution - Affiliated to JNTUH)

Ibrahimpattanam, Ranga Reddy (District), Hyderabad - 501 506.



## R22 B.Tech. Mechanical Engineering

### ELEMENTS OF ELECTRIC AND HYBRID VEHICLES (22OE0ME3B) (OPEN ELECTIVE – III)

B.Tech. IV Year II Sem.

L T P C  
3 0 0 3

#### Course Objectives:

- Explain the history of Electric vehicles and development.
- Discuss the Social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.
- Explore to basic concept of electric traction, Configuration and control of DC Motor drives, Configuration, and control of Induction Motor drives etc.
- Analyse the Fuel Cell based energy storage and Super Capacitor based energy storage etc.
- Explore to types of Driving Cycles, Range modelling for Battery Electric Vehicle, Hybrid (ICE & others) etc.

#### Course Outcomes: At the end of the course student will be able to

- Choose the appropriate source of energy for the hybrid electric vehicle based on driving cycle.
- Analyze the power and energy need of the various hybrid electric vehicle and Measure and Estimate the energy consumption of the Hybrid Vehicles.
- Evaluate energy efficiency of the vehicle for its drive trains.
- Elaborate the types of storage systems such as battery based, fuel cell based etc.
- Explain the types of Driving Cycles, Fuel Cell EV, Solar Powered Vehicles.

#### UNIT- I:

**Introduction to Electric Vehicle:** History of Electric Vehicles, Development towards 21st Century, Types of Electric Vehicles in use today – Battery Electric Vehicle, Hybrid (ICE & others), Fuel Cell EV, Solar Powered Vehicles. Motion and Dynamic Equations of the Electric Vehicles: various forces acting on the Vehicle in static and dynamic conditions.

#### UNIT- II:

**Introduction to Hybrid and Electric Vehicles:** Social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid Drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis



### UNIT- III:

**Introduction to Electric Drive Trains:** Basic concept of electric traction, introduction to various electric drive train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency

### UNIT- IV:

**Types of Storage Systems:** Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Calculation for the rating.

### UNIT- V:

**Modelling of Hybrid Electric Vehicle Range:** Driving Cycles, Types of Driving Cycles, Range modelling for Battery Electric Vehicle, Hybrid (ICE & others), Fuel Cell EV, Solar Powered Vehicles. Case study of 2-wheeler, 3-wheeler, and 4-wheeler vehicles.

### TEXT BOOKS:


1. James Larminie, J. Lowry, "Electric Vehicle Technology Explained", John Wiley & Sons Ltd. 2003.
2. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.

### REFERENCE BOOKS:


1. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2016.
2. Iqbal Hussein, "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2010.

### WEB SOURCE REFERENCE:

1. <https://archive.nptel.ac.in/courses/108/103/108103009/>




**Dr. A. Raj Kumar**  
(Chairman, BOS)



**Dr. Ch. Sridhar Reddy**  
(JNTUH Nominee)



**Dr. L. Siva Rama Krishna**  
(Academic Council Nominee)



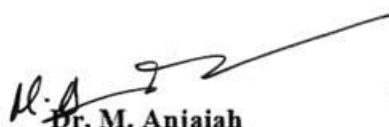
**Dr. B. Lakshmana Swamy**  
(Academic Council Nominee)




**Dr. J. Chidanandappa**  
(Industry Representative)



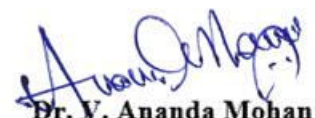
**Dr. B. Sai Venkata Krishna**  
(Alumni)



**Dr. M. Anjaiah**  
(Member)



**Dr. M. Prakash Babu**  
(Member)



**Dr. V. Ananda Mohan**  
(Member)