



MATS UNIVERSITY

Raipur (C.G.)

Syllabus Scheme

(8th Semester)

For

Bachelor of Engineering

In

MECHANICAL



MATS School of Engineering & Technology

ARANG , RAIPUR (C.G.)



MATS UNIVERSITY

ARANG, RAIPUR



Subject Code For School of Engineering & Tech. Deptt.

8th Semester (MECHANICAL)

S.No.	Subject Code	Subject Name
1	BE810	Refrigeration and air conditioning
2	BE811	Production Management
3	BE812	Robotics
4	BE813	Finite Elements Method
5	Refer Table	Elective – III
6	BE815	Refrigeration and air conditioning Lab
7	BE816	Robotics Lab
8	BE817	Major Project

Table – 3

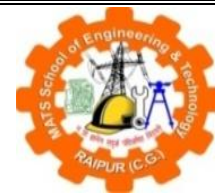
Elective – III

S.N.	Subject Code	Subject Name
1	BE8140	Engineering Economics
2	BE8141	Fire and safety Engineering
3	BE8142	Cryogenic Engineering
4	BE8143	Environmental/ Pollution Control
5	BE8144	Numerical Control of Machine Tool



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Scheme of Teaching & Examination B.E. VIII SEMESTER MECHANICAL ENGINEERING

S.N.	code	Subject	Periods per week			Scheme of marks		Total Marks
			L	T	P	ESE	IM	
1.	BE810	Refrigeration and air conditioning	4	1	-	70	30	100
2.	BE811	Production Management	4	1	-	70	30	100
3.	BE812	Robotics	4	1	-	70	30	100
4.	BE813	Finite Elements Method	4	1	-	70	30	100
5.	Refer Table	Elective -III	4	1	-	70	30	100
6.	BE815	Refrigeration and air conditioning Lab	-	-	3	20	30	50
7.	BE816	Robotics Lab	-	-	3	20	30	50
8.	BE817	Major Project	-	-	3	100	100	200
		Total	20	5	9	490	310	800

L – Lecture, T – Tutorial, ESE – End Semester Examination,

P – Practical, IM – Internal Marks (Include Class Test & Teacher's Assessments)

Table - 3
Elective - III

S.N.	Subject Code	Subject
1	BE8140	Engineering Economics
2	BE8141	Fire and Safety Engineering
3	BE8142	Cryogenic engineering
4	BE8143	Environmental Pollution and Control
5	BE8144	Numerical control of machine Tool

Note (1) – $\frac{1}{4}$ of total strength of students subject to minimum of twenty students is required to offer an elective in the college in a particular academic session

Note (2) – Choice of elective course once made for an examination cannot be changed in future examinations.

MATS UNIVERSITY
SEMESTER - 8TH
BRANCH - MECHANICAL
SUBJECT - REFRIGERATION AND AIRCONDITIONING
CODE - BE810

Note : Refrigerant and Psychrometric Properties (Tables and Charts) by Jain Brothers Publications are Permitted in the examination.

UNIT – I

Introduction

Refrigeration and second law of Thermodynamics, Refrigeration effect and unit of Refrigeration, Heat pump, reversed Carnot cycle.

Vapour Compression Refrigeration System

Analysis of simple vapour compression Refrigeration cycle by p-h and T-S diagram. Effect of operating conditions, liquid vapour heat exchangers, actual refrigeration cycle.

Multiple Evaporator and compressor system.

Application, air compressor system, Individual compressor, compound compression, cascade system. Application, air compressor systems, individual compressor, compound compression, cascade system.

UNIT – II

Gas cycle Refrigeration

Limitation of Carnot cycle with gas, reversed Brayton cycle, Brayton cycle with regenerative H.E.

Air cycle for air craft

Necessity of cooling of air craft, Basic cycle, boot strap, regenerative type air craft refrigeration cycle.

UNIT – III

Vapour Absorption System

Simple Vapour absorption system, Electrolux Refrigerator, Analysis of Ammonia absorption refrigeration system, Lithium Bromide Absorption Refrigeration System.

Refrigerants

Properties of refrigerants, Classification, Nomenclature, selection of Refrigerants, global warming potential of CFC Refrigerants.

Refrigeration Equipments

Compressor, condenser, evaporator, expansion devices – types & working.

UNIT – IV

Psychrometry

Psychrometric properties, psychrometric relations, psychrometric charts, psychrometric processes, cooling coils, By-pass factor and air washers.

Human Comfort

Mechanism of body heat losses, factors affecting human comfort, effective temperature, comfort chart.

UNIT – V

Cooling load calculations

Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychrometric calculation for cooling, selection of air conditioning, apparatus for cooling and dehumidification, Air conditioning system for summer and winter (with sketches), main parts of air conditioning ,duct flow and materials .

TEXT BOOKS

1. Refrigeration & Air Conditioning – Ahmadid, Amean - PHI
2. Refrigeration and Air Conditioning –C. P. Arora - TMH.

REFERENCE BOOKS

1. Refrigeration and Air Conditioning – Manohar Prasad – Newage International Pub
2. Refrigeration and Air Conditioning – Arora&Domkundwar – DhanpatRai& Sons
3. Refrigeration and Air Conditioning – P.L. Ballaney – Khanna Pub.
4. Refrigeration and Air Conditioning – W.F. Stooker

MATS UNIVERSITY
SEMESTER - 8TH
BRANCH - MECHANICAL
SUBJECT - PRODUCTION MANAGEMENT
CODE - BE811

UNIT-I

Production Management

Definition, objectives, scope, benefits, functions of production management, place of production management in an organization, types of production system, Product life cycle, product design and development, production cycle.

Costing and Cost Analysis

Elements of costs, Break even analysis, Incremental costs, make or buy decision.

UNIT-II

Sales Forecasting

Purposes, methods – Delphi, linear regression, economic indicators, time-series analysis, adjustment for seasonal variations, moving average, exponential smoothing.

UNIT-III

Production Planning and Control

Functions, Organization, Master Scheduling, Aggregate planning and strategies, Materials requirement planning, product structure tree, Routing, Loading Scheduling – forward and backward, Dispatching – priority rules, Sequencing, Johnson's algorithm for n jobs and two machines, Gantt's chart, Bar chart, Flow process chart.

Materials Handling

Principles of materials handling, unit load, Types of materials handling equipment, Relation between materials handling and plant layout.

UNIT - IV

Material Management

Objectives and functions of materials management, Organization of materials management.

Procurement

Objectives of purchase deptt. purchase responsibilities and organization, types of purchasing, purchase procedures, Import and Export.

Stores Keeping

Stores management, functions of stores, classification of materials, standardization of materials, identification and maintenance of layout of stores, physical control of materials, pricing of stores, issuing of stores.

Inventory Control

Objective, scope and functions of inventory control, inventory control techniques, economic ordering quantity, periodic ordering quantity, A.B.C. analysis, General idea regarding inventory control under risk and uncertainty.

UNIT - V

Quality Control

Difference between inspection and quality control, acceptance sampling, procedure's risk and consumer's risk, operating characteristic curve for single sampling plan, AOQL

Quality of conformance, quality of design, economics of quality, SQC charts for variables and attributes.

Introduction to JIT manufacturing, kanban system.

TEXT BOOKS

1. Production and operation Management – By P. Ramamurty – New Age International Pub., 2005
2. Production and operation Management – By R. Mayer – TMH
3. Quality Planning and Analysis, Juran and Gryna

REFERENCE BOOKS

1. Industrial Engineering & Production Management – MartandTelsang – S. Chand & Co., 2004
2. Production and operations Management by – Adam and Ebert – PHI – 6th Edn., 2003
3. Production planning and Control – By Samuel Eilon, NavneetPrakashan Ltd., Bombay

MATS UNIVERSITY
SEMESTER - 8TH
BRANCH - MECHANICAL
SUBJECT - ROBOTICS
CODE-BE812

UNIT-I

Introduction to Robotics

Evolution of Robots and Robotics, Laws of Robotics, What is and What is not a Robot, Progressive Advancement in Robots, Robot Anatomy, Human Arm Characteristics, Design and Control Issues, Manipulation and Control, Sensors and Vision, Programming Robots, The Future Prospects, Notations.

UNIT – II

Coordinate Frames, Mapping and Transforms

Coordinate Frames, Description of Objects in Space, Transformation of Vectors, Inverting a Homogeneous Transform, Fundamental Rotation Matrices

UNIT – III

Symbolic Modeling of Robots – Direct Kinematic Model

Mechanical Structure and Notations, Description of Links and Joints, Kinematic Modeling of the Manipulator, Denavit – Hartenberg Notation, Kinematic Relationship between Adjacent Links, Manipulator Transformation Matrix. Introduction to Inverse Kinematic model

UNIT – IV

Robotic Sensors and Vision

The Meaning of Sensing, Sensors in Robotics, Kinds of Sensors used in Robotics, Robotic vision, Industrial Applications of Vision-Controlled Robotic Systems, Process of Imaging, Architecture of Robotic Vision Systems, Image Acquisition, Description of Other components of Vision System, Image Representation, Image Processing.

UNIT – V

Robot Applications

Industrial Applications, Material Handling, Processing Applications, Assembly Applications, Inspection Application, Principles for Robot Application and Application Planning, Justification of Robots, Robot Safety, Non-Industrial Applications, Robotic application for sustainable Development.

TEXT BOOKS

1. Robotics & Control – R.K. Mittal & I.J. Nagrath – TMH Publications
2. Robotics for engineers - Yoram Korean- McGrew Hill Co.
3. Industrial Robotics Technology programming and Applications - M.P.Groover, M.Weiss, R.N.Nagel, N.G.Odrey

REFERENCE BOOKS

1. Robotics Control Sensing, Vision and Intelligence - K.S.Fu, R.C.Gonzalex, C.S.G.Lee- McGrew hill Book co.
2. Kinematics and Synthesis of linkages - Hartenberg and Denavit - McGrew Hill Book Co
3. Kinematics and Linkage Design - A.S. Hall - Prentice Hall
4. Kinematics and Dynamics of Machinery - J.Hirschhorn - McGrew HillBook

MATS UNIVERSITY
SEMESTER - 8TH
BRANCH - MECHANICAL
SUBJECT - FINITE ELEMENT METHODS
CODE - BE813

UNIT - I

Introduction:

Over view of the method, range of applications, energy methods to solve problems in mechanics of solids, virtual work principle, Rayleigh-Ritz method

UNIT - II

Basic Equations:

Basic equations from fluid mechanics, heat transfer, and solid mechanics, functional and it's minima, variational approach, FEM and Ritz method, element equations from variational principle, finding variational principles for the problem, methods of weighted Gelarkin collocation techniques

UNIT - III

Formulation of FEM equations:

Elements and interpolation functions, stiffness, matrix and the equilibrium equations, formulation based on generalised co-ordinates, convergence requirements, natural co-ordinates, numerical integration, Newton-Cotes and Gauss-Legendre quadrature

UNIT - IV

Solving FEM equations:

Assembly of global stiffness matrix and inserting boundary conditions, solution of linear system of equation, Gauss elimination, Gauss-Siedel, Cholesky's decomposition, nature of the stiffness matrix

UNIT - V

FEM software and applications:

Exposure to FEM software, standard components of FEM software and their roles, application of FEM

TEXT BOOKS

1. An Introduction to the Finite Element Method - Reddy J.N. - McGraw-Hill Company
2. Introduction to Finite Element, in Engineering - Belegundu Chandraupatla - Prentice Hall of India Pvt. Ltd New- Delhi

REFERENCE BOOKS

1. FEM - Desai and Abel
2. Finite Element Procedure - K.J. Bathe - Prentice-Hall of India Pvt. New-Delhi
3. Finite Element Analysis - Krishnamoorthy

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SEMESTER - 8TH
BRANCH - MECHANICAL
SUBJECT - ENGINEERING ECONOMICS
CODE - BE8140

Unit-I

Utility, value, wealth, consumption, wants, necessities, comforts and luxuries. laws of demand, elasticity of demand.

Unit-II

Production, agents of production, laws of returns. Forms of business organization. Single trader, partnership and public limited company.

Unit-III

Price determination in perfect competition, monopoly and imperfect competition. Rent, interest, money, cheques, bills of exchange.

Unit-IV

Costing- Cost concepts, Elements of cost, Methods of distribution of overhead costs. Unit costing, Job costing and process costing.

Unit- V

Break- Even analysis, Depreciation methods, Preparation of profit and loss account and balance sheet (Outlines only).

Text Book:

1. Engineering Economics, Vol.1, Tara Chand.

References:

1. A Text book of Economic Theory by Dhingra and Garg.
2. Cost Accounts by Shukla and Grewal.

MATS UNIVERSITY
SEMESTER- 8TH
BRANCH- MECHANICAL
SUBJECT- FIRE AND SAFETY ENGINEERING
CODE-BE8141

Unit-I General Principles of Fire Prevention and Protection Measures

Planning and Construction of the Building:

Site Planning considering the nature of the plant, building, equipment and processes from the stand point of safety and fire protection, where corrosive, poisonous, explosive and easily combustible materials are handled and processed. Type of construction fire walls, barricades etc. Fire separation, fire steps, segregation, isolation.

Unit II Fire Protection Arrangement:

Fire appliances; Fire Warning system (Manual and Automatic) fixed fire-fighting installations: I. Foam System; II. Gas/Vapour System; III. Dry Powder System; IV. Special Safety Protection Equipment- Explosion detection, venting and suppression system, Inergen clean agent system and F.M. 200.

Unit-III Water Supply and System:

Installations using water:

1. Sprinklers
2. Drenchers,
3. Water spray projector systems
4. Rising mains-wet and dry.

Unit IV

Safety in industries involving hazardous processes, safety in industries involving highly

flammable liquids & flammable compressed gases, safety in chemical works, application of safety in handling corrosive substances, safety audit in various types of factories, types of safety audit, its methodology and reporting

Unit-V Safety and Fire Protection Organization:

- (a) House-Keeping and management;
- (b) Plant Fire Brigade and fire-fighting facilities, petrol, systems.

1. General Fire Hazards and Fire Protection by J.J. Williams.
2. Fire Prevention Notes for Industrial Premises by F.P.A.
3. Fire Prevention Hand Book by Kesteren Fire Brigade
4. Fire Prevention Standard Recommendations by Earnest Beam Ltd.

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SEMESTER- 8TH
BRANCH- MECHANICAL
SUBJECT - CRYOGENIC ENGINEERING
CODE - BE8142

UNIT-I

Introduction to Cryogenic Systems

Properties of materials at low temperature, Properties of Cryogenic Fluids.

Air and Gas Liquefaction Systems:

Thermodynamically ideal system, Production of low temperatures

Liquefaction systems for gases other than Neon, Hydrogen and Helium, liquefaction systems for Neon, Hydrogen and Helium. Cryogenic Refrigeration System

UNIT – II

Gas Separation and Gas Purification Systems

The thermodynamically ideal separation system properties of mixtures, Principles of gas separation, air separation systems, Hydrogen, Argon, Helium air separation systems, Gas purification methods.

UNIT – III

Vacuum Techniques

System for production of high vacuum such as mechanical, diffusion, ion and cryopumps.

Cryogenics measurement systems

Temperature pressure, flow rate, liquid level measurement, Introduction to Cryocoolers.

UNIT – IV

Cryogenic Fluid Storage Systems

Introduction, Basic Storage vessels, inner vessel, outer vessel design, piping, access manways, safety device.

Cryogenic insulations

Vacuum insulation, gas filled powders and fibrous materials, solid foam, selection and comparison of insulations. Cryogenic fluid transfer systems. Transfer through uninsulated lines, vacuum insulated lines, porous insulated lines etc.

UNIT – V

Advances in Cryogenics

Vortex tube and applications, Pulse tube refrigerator, Cryogenic Engine for space vehicles.

Cryogenic Applications

Applications in gas industry, cryogenic fluids, space research, Cryobiology, food processing, electronics, nuclear and high energy physics, chemical processing, metal manufacturing, cryogenic power generation, medicine, analytical physics and chemistry.

TEXT BOOKS

1. Cryogenic Systems – R.F. Barron
2. Cryogenic Engineering – R.B. Scott – D.VanNostrand Company, 1959

REFERENCE BOOKS

1. Cryogenic Process Engineering – K.D. Timmerhaus and T.M. Flynn, Plenum Press, New York, 1989
2. High Vacuum Technology – A. Guthrie – New Age International Publication
3. Experimental Techniques in Low Temperature Physics – G.K. White – Oxford University Press, England, 1959

MATS UNIVERSITY
SEMESTER - 8TH
BRANCH - MECHANICAL
SUBJECT - ENVIRONMENTAL POLLUTION AND CONTROL
CODE - BE8143

UNIT- I

Environmental Pollution – Introduction & Classification

Sources and classification of air pollutants, aerosols, primary and secondary air pollutants, effect of air pollution on human health, effect of SO₂, CO₂, NO₂ H₂S and lead, economic effect of air pollution, mechanism of deterioration in polluted atmosphere. Factors influencing atmospheric deterioration, effect of air pollution on building materials, paints, textiles, rubber, leather, paper and electronic industry.

UNIT – II

Environmental Pollution - Sources

Air pollution due to automobiles, exhaust, Crankcase and evaporative emissions and their control, effect of various parameters of I.C. engines on air pollution, photochemical air pollution, air pollution from ferrous metallurgical operations and thermal power plants.

UNIT – III

Chemistry of Pollution

Definition of pollutant concentrations, mass concentration, volume concentration, mass-volume concentration and relationship between these concentrations, smoke and its control. Ningalmam smoke chart, smoke prevention and control of air pollution by process change, elementary ideas of control of gaseous contaminants for combustion and absorption.

UNIT – IV

Pollution Control

Control of air pollution by equipment, objectives of using control equipment, objectives of using control equipment, settling chambers, inertial separators, cyclones, principle of electroscopic precipitators, descriptive study of the above equipment only, merits and demerits of the equipment, choice of equipment.

UNIT – V

Environmental Laws & Acts

Air pollution indices, definition of air pollution index, type and use of air pollution indices, criteria for a standardized index, acid rain, causes of acid rain and its remedy, green house and its effect, air pollution legislation and regulations, constitution of the Board, functions of the central board and state boards, classification of pollution sources under Air Act 1981 and 1986.

TEXT BOOKS

1. Air Pollution - M.N. Rao and H.V.N. Rao
2. Air Pollution Central Theory - Martin Crawford.

REFERENCE BOOKS

1. Air Pollution Central Technology - R.W. Bethewaven Van Nostrans.
2. Air Pollution & Control – KVSG Murali Krishnan – Kaushal& Company
3. Air Pollution & Control Technologies – Y. Anjaneyulu – Allied Publishers
4. Water & Air Pollution & Environmental Protection Laws, Vol. - II – M.C. Mehta – Delhi Law House

MATS UNIVERSITY
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BRANCH- MECHANICAL
SUBJECT- NUMERICAL CONTROL OF MACHINE TOOLS
CODE- BE8144

UNIT - I

Introduction

Fundamentals of numerical control, advantages limitations of N.C systems -classification of N.C systems.

Computer Numerical Control

Nomenclature, types and features of CNC machine tools. . Machine control unit. Position control and its significance. Engineering analysis of NC positioning systems. Open loop and closed loop systems. Precision in NC positioning systems: control resolution, accuracy and repeatability. Actuators: servomotors, stepper motors, transducers and feedback elements.

UNIT - II

Features of N.C. Machine tools

Design consideration of N.C machine tools - increasing productivity with N.C machines, tooling for CNC machine.

System Device

Feed back system-counting devices digital analog converters

Interpolations

DDA integrators, simple and symmetrical DD reference word CNC interpolators.

UNIT - III

Part Programming

Process planning and flow chart for part programming.systems, nomenclature and tool geometries. Tool presetting&Modular Tooling. Selection of tools based on machining capacity, accuracy and surface finish. Elements of programming for turning and milling. part programming. Preparatory codes G, Miscellaneous functions M. Interpolation, Tool compensations, cycles for simplifying programming. Typical part programming

Control Loops for N C Systems

Introduction-control loops for point and counting systems.

UNIT - IV

Computerized Numerical Control

CNC concepts-advantage of CNC reference planes, sampled data techniques, microcomputers in CNC.

Adaptive Control Systems

Adaptive control with optimization, and constraints-variable gains AC systems.

UNIT - V

Modern CNC machines

CNC lathes. Turning centers. Machining centres.Automatic pallet changers.Automatic tool changers. Direct numerical control and applications. CNC machine design features.

TEXT BOOKS

1. Automation, Production Systems and Computer Integrated Manufacturing - Mikell P. Groover - PHI, 2001.
2. CNC Programming - S.K. Sinha - Galgotia Publications 2003.

REFERENCE BOOKS

1. HMT Mechatronics - Tata McGraw Hill
2. numerical control of machine tool by urie and koren

MATS UNIVERSITY
SEMESTER - 8TH
BRANCH - MECHANICAL
SUBJECT- REFRIGERATION AND AIR CONDITIONING LAB
CODE - BE815

EXPERIMENTS TO BE PERFORMED

1. To study Domestic Refrigerator.
2. To study the Hermetically Sealed Compressor.
3. To study Refrigeration Tutor and to determine the following:-
 - a. Theoretical coefficient of Performance
 - b. Actual Coefficient of Performance.
 - c. Theoretical capacity of the plant
 - d. Actual capacity of the plant.
4. To Study the Mechanical Heat Pump and to determine the following:-
 - a. Theoretical coefficient of Performance
 - b. Actual Coefficient of Performance.
 - c. Theoretical capacity of the plant
 - d. Actual capacity of the plant
5. To study the Air and Water Heat Pump and to determine the following:-
 - a. Theoretical coefficient of Performance of the system as a refrigerator and as a heat pump.
 - b. Actual Coefficient of Performance of the system as a refrigerator and as a heat pump.
 - c. Capacity of the system in tons as a refrigerator.
 - d. Capacity of the system in kW as a heat pump under the following conditions of operation:-
 - i. Water cooled condenser and water-cooled evaporator.
 - ii. Water-cooled condenser and air-cooled evaporator.
 - iii. Air-cooled condenser and air-cooled evaporator.
 - iv. Air-cooled condenser and water-cooled evaporator.
6. To study the following processes on the Air Conditioning Test Rig.
 - a. Sensible Heating
 - b. Sensible Cooling
 - c. Sensible Cooling/cooling dehumidification
 - d. Humidification and cooling
7. To Find the Efficiency of Cooling Tower Test Rig.
8. To Study the Simple vapor Absorption System.
9. To study the AC Simulator and to determine the following:-
 - a. Sensible Heating
 - b. Sensible Cooling
 - c. COP of R-22
 - d. Air Washer Efficiency
 - e. Sensible heat load applied
 - f. Latent heat load applied
 - g. RSHF
 - h. ESHF

LIST OF EQUIPMENTS/MACHINES REQUIRED

1. Domestic Refrigerator
2. Cut Section of Hermitically Sealed Compressor
3. Refrigeration Tutor Test Rig
4. Mechanical Heat Pump Test Rig
5. Air & Water Heat Pump Test Rig
6. Air Conditioning Test Rig
7. Simple Absorption System Test Rig
8. Cooling Tower Test Rig
9. Air Conditioning Simulator Test Rig

MATS UNIVERSITY
SEMESTER - 8TH
BRANCH - MECHANICAL
SUBJECT - ROBOTICS LAB
CODE - BE816

EXPERIMENTS TO BE PERFORMED

1. To detect the sensor scanning system to overcome limitation of fixed sensors on various robotic applications, ultrasonic sensor, laser range finders, infrared detectors and miniature.
2. To find the horizontal and vertical movement up to 180o in either direction.
3. To detect objects with infrared ray detector.
4. To determine object distance (3cm – 300cm).
5. To detect distance (10cm to 80 cm) with infrared object detector.
6. To determine 5 Axis Robotic Arm movement and its degree of rotation.
7. To lift the object and place 100m away in various directions.
8. To find the gripper movement (0 to 50mm).
9. To study various Robotic Arm Configurations.
10. To study Pick and Place Robot

LIST OF EQUIPMENTS/MACHINES REQUIRED

1. 5 Axis Robotic Arm System
2. Hex Crawler Robot. The Mechatronics Robot
3. Ultrasonic Range Finder
4. Servo Power Supply
5. Infrared Object/Distance Detector
6. A 7.2V Battery Charger
7. Blue Tooth Transducer
8. Blue Tooth Pc Adaptor
9. Various Wooden Models to study Robotic Arm Configuration
10. Working model of Pick and Place Robot

**MATS UNIVERSITY
SEMESTER - 8TH
BRANCH - MECHANICAL
SUBJECT - MAJOR PROJECT
CODE - BE817**

Students should submit their major projects and perform their presentation on concerned project.