Name of program- **B.Tech** Semester: **VII**
Subject: **Automobile Engineering** Code: **BT710**
Branch: **Mechanical Engineering**

UNIT-I

Chassis & Frame - Layout of chassis & its main components, types of frames, conventional frames & unitized chassis.

Suspension system &Springs -Objects & principles of suspension, system, types, rigid axle suspension & Independent suspension for front & rear ends, simple & double arm parallel & perpendicular type of suspension system. Gas filled suspension system.

Springs - Purpose, types viz. leaf, coiled, rubber, air, suspension system, torsion bar, stabilizer, Telescopic damper.

UNIT – II

Clutches

Characteristics, functions, principles of operation of clutch, friction clutch, single plate, multi plate, centrifugal clutch, positive clutch, friction plate clutch lining materials. Torque transmitted and related problems.

Fluid flywheel

Construction, principles of working & characteristics.

UNIT – III

Gear Box: Object of Gear Box, Air, rolling & gradient resistance, tractive effort variation with speed, performance curve.

Types of Gear Boxes:- Sliding mesh, constant mesh, synchromesh device, automatic transmission, overdrive, lubrication of gear box.

Torque converter: Principles of working, characteristics, Torque converter with direct drive.

Testing of automobiles

UNIT – IV

Universal Joint-: Types, propeller shaft, slip joint.

Differential – Functions, single & double reduction differential, limited slip differential.

Front Axle: Live & dead axle, stub axle.

Back Axle: Hotch kiss drive, torque tube drive.

Brakes & Braking system: Purpose, principles, layout of braking system. Classification, mechanical, hydraulic,
master cylinder, Tandoma master cylinder wheel cylinder, self energizing & self adjusting brakes, disc brakes,
antiskidbrakes.power operated brakes:

UNIT – V

Steering system:- Gear & links, types of steering gears, reversibility of steering, center point steering, steering geometryviz castor, camber, king pin inclination toe in, toe out, cornering power, under-over steer; power steering, effect of shimmy, condition of true rolling, calculation of turning radius. Correct steering equation and related problems.

TEXT BOOKS

1. Automobile Engineering – Kripal Singh – Standard Publications
2. Automobile Engineering – G.B.S. Narang – Khanna Publishers

REFERENCE BOOKS

1. Automobile Engineering - Dr. N. K. Giri – Khanna Publishers
2. Automobile Engineering – K. R. Govindan – Anuradha Agencies
3. Automotive Mechanics – Heitner
4. Motor Vehicle – Newton & Steeds – Life & Sons Limited.

Name of program- **B.Tech** Semester: **VII**
Subject: **Refrigeration & Air-conditioning** Code: **BT711**
Branch: **Mechanical Engineering**

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, psychometric relations, pyschrormetric 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

Name of program- **B.Tech** Semester: **VII**
Subject: **Robotics** Code: **BT712**
Branch: **Mechanical Engineering**

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 Transormation 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 Machinary - J.Hirchhorn - McGrew HillBook

Name of program- **B.Tech** Semester: **VII**
Subject: **Operation Research** Code: **BT713**
Branch: **Mechanical Engineering**

UNIT I

Introduction

Various stages of O.R., Fields of application, optimization and its classification. General Linear Programming Problems- Introduction, maximization and minimization of function with or without constraints, formulation of a linear programming problem, graphical method and simplex method, Big M method degeneracy, application of L.P.P. in Mechanical Engineering.

UNIT – II

The Transportation Problems

Mathematical formulation computational procedures, Stepping stone method, Modified Distribution Method, Vogels Approximation Method, Solution of balanced and unbalanced transportation problems and case of Degeneracy.

The Assignment Problems

Mathematical formulation of assignment problems, solution of assignment problems, traveling salesman problems, Air crew Assignment problems.

UNIT - III

Waiting Line Theory

Basic queuing process, basic structure of queuing models, some commonly known queuing situations Kendall's service time, solution to M/M/1: ∞□/FCFS models.

Network Analysis

CPM/PERT, Network Representation, Techniques for drawing network. Resource smoothing and leveling, project cost, Optimum project duration, project crashing, updating, Time estimation in PERT.

UNIT – IV

Game Theory

Introduction, two person zero sum game, methods for solving two person zero sum game: when saddle point exists, when no saddle point exists, solution of 2xn and mx2 game.

UNIT – V

Simulation

Basic concept of simulation, applications of simulation, merits and demerits of simulation, Monte Carlo simulation, simulation of Inventory system, simulation of Queuing system.

Note: Four questions to be set, one from each unit.

TEXT BOOKS

1. Operation Research ,SasienYaspan
2**.** Operation Research – N. D. Vohra – TMH
3. Operation Research– Hira& Gupta – S. Chand & Co.

REFERENCES

1. Operation Research – H. Gillette – TMH, New Delhi
2. Operations Research – M. Taha – TMH, New Delhi
3. Fundamentals of Operation Research – AckofSasieni – DhanpatRai& Sons
4. Quantitative Approach to Management – Lovin and Krit Patrick – TMH
5. Operation Research– S.D. Sharma – S. Chand & Com. New Delhi

Name of program- **B.Tech** Semester: **VII**
Subject: **Automobile Engineering Lab** Code: **BT715**

Branch: **Mechanical Engineering**

EXPERIMENTS TO BE PERFORMED

1. Study of Frame and Chassis.
2. Study of Clutches – Single Plate, Multi Plate and Centrifugal
3. Study of Gear Boxes – Sliding mesh, Constant mesh, Synchro mesh.
4. Study of Differential, Universal joints, Axles and Slip Joints.
5. Study of Brakes – Mechanical, Hydraulic, Air Brake and Disc Brake.
6. Study of Steering System used with Rigid Axle suspension and independent suspension system, Power Steering
7. Study of different types of springs used in Automobiles.
8. Study of Rigid Axle suspension system.
9. Study of Front Independent Suspension System.
10. Study of Read Independent Suspension System.
11. Study of Battery, Staring and Generating System and Battery Charging System.
12. Study of Automotive Electrical System.
13. Study of Educational Car Model.

LIST OF EQUIPMENTS/MACHINES REQUIRED

1. Working model of Single plate, Multi-plate & Centrifugal Clutch
2. Working model of Actual Differential System
3. Working model of Universal Joint, Axles & Slip Joints
4. Working model of Mechanical, Hydraulic and Air Brake
5. Working model of Steering System used with Rigid Axle suspension System
6. Working model of Steering System used with Independent Suspension System
7. Different types of Springs used in Automobiles
8. Working model of Rigid Axle Suspension System
9. Working model of Front Independent Suspension System
10. Working model of Rear Independent Suspension System
11. Working model of Battery, Staring and Generating System along with charging unit
12. Working model of Electrical System
13. Cut section of Actual Master Cylinder of Hydraulic Brake System
14. Educational Car Model

Name of program- **B.Tech** Semester: **VII**
Subject: **Refrigeration & Air-conditioning Lab** Code: **BT716**

Branch: **Mechanical Engineering**

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

Name of program- **B.Tech** Semester: **VII**
Subject: **Robotics Laboratory** Code: **BT717**

Branch: **Mechanical Engineering**

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

Name of program- **B.Tech** Semester: **VII**
Subject: **Quality Control Laboratory** Code: **BT718**

Branch: **Mechanical Engineering**

EXPERIMENTS TO BE PERFORMED

Each student shall submit report for Quality Testing and how it control of real mechanical component that's made on workshop at least five different- different jobs to be chosen by student in group. At least one industrial visit must to observe the Quality management in it.

Name of program- **B.Tech** Semester: **VII**
Subject: **Power Plant Engineering** Code: **BT7141**

Branch: **Mechanical Engineering**

UNIT-I
Elements of Power Plant
General Sources of power, renewable and non renewable concepts of public and private power stations, Distribution of power generation, transmission, and utilizations, Importance of Central Power Stations, types of power stations – steam, nuclear, diesel and hydro – Elements of modern power stations (Steams only) brief layout and arrangement of elements and complements, sitting of different power stations, foundation. Elements of Electric power systems primary and secondary distribution substations (in brief).

UNIT – II
Steam Power Plant
Steam power plants selection of working medium, Heat Balance in stem cycles, Heat rates, comparison of efficiencies gas loop, fuels and fuel handling. Equipments, fuel gas cleaning and ash handling. Air pre-heater, feed water pre-heaters, steam re-heaters, deaerators, feed water treatment, pumping and regulation water walls, modern developments in steam boilers, Important instrumentation and piping of gas and water loop. Factors to be
controlled from maximum efficiency and variable output. Pollution generated by thermal power plants, pollution abatement, clearance from pollution boards, equipments used for reducing pollution – ESP, bag filter and chimney.

UNIT – III
Hydro Electric power station – Potential power with reference to rainfall and catchments area, Water storage,
equipment used in hydro electric power stations. Characteristics of hydraulic turbines. Comparison of the factors
governing the cost of hydro steam and diesel power stations.
Diesel power station – Suitability of diesel engines for bulk power, advantages and limitations of diesel, power stations, efficiency and heat balance.
UNIT – IV
Nuclear Power Station
Evolution of nuclear energy from atoms by fission and fusion. Chain reactions, fission materials, types of reactors ,gas cooled, boiling water liquid, metal cooled and fast reactor, arrangements of various elements in a nuclear power station, stem cycles and boilers coolant heat exchangers, Reactor control, Reactor shielding and safety methods.

UNIT – V
Variable load problems – Idealized and realized load curves, effect of variable load on plant design and operation
variable load operation and load dispatch.
Power station Economics – Source of income, cost of plant and production, elements of cost, depreciation and replacement theory of rates.

Pollution-Board:-concept of state and central pollution Board , power board.

TEXT BOOKS

1. A Text Book of Power Plant Engineering – R.K. Rajput – Laxmi Publications
2. A Course in Power Plant Engineering – Arora, Domkundwar – Dhanpat Rai & Co., 2005

REFERENCE BOOKS

1. Power Plant Engineering, 2nd Edn. – P.K. Nag – Tata McGraw-Hill Pub. Com., New Delhi, 2004
2. Power Plant Engineering – P.C. Sharma – S.K. Kataria & Sons, 2003

Name of program- **B.Tech** Semester: **VII**
Subject: **Total Quality Management** Code: **BT7142**

Branch: **Mechanical Engineering**

UNIT-I

Basic Concept of Quality

Quality and quality control, concept of quality, quality characteristics, Quality of design and quality of conformance, History of quality control, Quality policy and objectives, Economics of quality.

Statistical Concept of Variation

Concept of variation frequency distribution, continuous and discrete, probability distributions viz. Normal, Exponential and weibull distribution, pattern of variation, significance tests, Analysis of variance, statistical aids in limits and tolerances.

UNIT-II

Quality Assurance

Concept, advantages, field complaints, quality rating, quality audit, inspection planning, quality mindness, quality budget, vendor quality rating (VQR), vendor rating (VR), manufacturing planning for quality, Quality function deployment (QFD).

Statistical Quality Control

Objectives, Growth and applications of S.Q.C.,S.O.C, Techniques in manufacturing planning. Process capability analysis, Control charts for variables and attributes and their analysis, process capability, concept of six sigma.

UNIT III

ACCEPTANCE SAMPLING

Fundamental concept in acceptance sampling, operating characteristics curve. Acceptance plans, single, double and introduction of multiple plans, LTPD, AOQL, AOQ.

UNIT -I V

Total Quality Management

Total Quality Control (TQC), Concept of Total Quality Management (TQM), TQM philosophies, Deming approach to TQM, Juran ten steps to Quality Management, Taguchi Philosophy, Crosby fourteen steps, TQM models, Tools and techniques of TQM,

UNIT V

Quality system

Quality system, need for quality system, ISO 9000 Quality Managmeent Standards, ISO 9000:2000 requirement, Quality Auditing, ISO 14000, Benefits of ISO 14000.

TEXT BOOKS

1. Quality Planning and Analysis by Juran J.M. and Gryana FM. – McGraw Hill, New York
2. Statistical Quality Cntrol – R.C. Gupta – Khanna Publishers, Delhi
3. Statistical quality control – E. L. Grant and R. S. Leavenworth – Mc. Graw Hill, New York

REFERENCE BOOKS

4. Engineering Statistics and quality control – I. W. Burr, Mc. Graw Hill, New York
5. Managing for Total quality from Deming to Tguchi and SPC. - Logothetis – Prentice Hall of India
6. Statistical Quality Control – M. Mahajan – DhanpatRai& Company – New Delhi

Name of program- **B.Tech** Semester: **VII**
Subject: **Welding Technology** Code: **BT7143**

Branch: **Mechanical Engineering**

Unit 1: Introduction- Welding as a production process – its advantages and limitations. Gas welding process, Types of fuels, Acetylene, Indane, Butane etc. Gas welding equipment, Gas welding technique. Electric arc welding – Manual metal arc welding – Power supplies, cables and other accessories for arc welding, Welding technique - atomic, hydrogen welding, Thermit welding, soldering, brazing and braze welding.

Unit 2: Special Welding Processes- Power sources, equipments and accessories, application ,limitation and other characteristics of: (a) Gas tungsten arc (TIG) welding (b) Gas metal arc (MIG) welding (c) Submerged arc welding (d) Electro slag welding processes. Resistance welding processes- principle-Types (spot, seam, projection, percussion, flash), Equipment required for each application.

Unit 3: Modern Welding Processes-Electron beam welding, Laser beam welding, Plasma arc welding, Friction welding, Explosive welding, Ultrasonic welding, Stud welding, Under water welding, Diffusion bonding, Cold welding, Welding of dissimilar metals.

Unit 4: Weldment Testing- Defects in welding in various processes-Causes and remedies; Destructive testing of weldments - Strength, hardness, ductility, fatigue, creep properties etc. Non-destructive testing of weldments; Ultrasonic dye penetrant, magnetic particle inspection. X ray testing procedures and identification of defects – case studies. Weld thermal cycle – Residual stressed distortion in welding stress relieving techniques.

Unit 5: Weldability, Automation And Design In Welding-Weldability –definition. Temperature distribution in welding –heat affected zone weldability of steel, cast iron. Aluminum, Pre heating and post heating of weldments. Estimation of transition temperature. Automation in welding – Seam tracking vision and arc sensing welding robots. Design of weldments-Welding symbols positions of welding joint and groove design. Weld stress –Calculations – Design of weld size.

Text/Reference Books:

1. Abbott, J., & Smith, K. M.Welding Technology: Texas State Technical College Publishing.
2. Radhakrishnan.V.M. Welding Technology and Design, New Age International Pub. Ltd.,
3. Little R.L.,Welding Technology Tata McGraw-Hill
4. Partner R.S.Welding Process and Technology, Khanna Publishers

Name of program- **B.Tech** Semester: **VII**
Subject: **Mechanical Handling Systems & Equipment** Code: **BT7144**

Branch: **Mechanical Engineering**

UNIT – I
Types of intraplant transporting facility, principal groups of material handling equipments, choice of material handling equipment, hoisting equipment, screw type, hydraulic and pneumatic conveyors, general characteristics of hoisting machines, surface and overhead equipments, general characteristics of surface and overhead equipments and their applications. Introduction to control of hoisting equipments.

UNIT – II
Belt conveyors, constructional details, toughing angle, idlers, belt specifications, chutes, skirt boards, ploughs, belt conveyor layouts, belt trippers, and typical examples, roller conveyors, overhead conveyors, apron conveyors, component parts and operational details and applications with typical layouts.

UNIT – III
Bucket elevators, screw conveyors, flight conveyors, component parts, operational details and applications with typical layouts. Hoists, EOT cranes, specifications, component parts, ropes, pulley layouts, hoisting drums, arrangement of drive. Wire rope specifications and selection, simple calculation of bridge girder, types of crane hooks.

UNIT – IV
Jib cranes, like wallmounted and travelling type, stability criteria, wheel loads, wheel trucks and bogeys, number of mechanisms in jib cranes, jib construction. Harbour cranes, luffing and levelluffing cranes, shipyard gantry cranes, portal frames and slewing rings and bearings typical stability calculations of portal cranes.

UNIT – V
Special materials handling equipment, wagon tipplers, stackers, reclaimers, their constructional details, pneumatic conveyers, typical materials handling layouts and applications.

TEXT BOOK
1. Materials Handling Equipment – N. Rudenko , Envee Publishers, New Delhi

2. Materials Handling Equipment – M.P. Alexandrov. Mie publications, Maskow

Name of program- **B.Tech** Semester: **VII**
Subject: **Applied Elasticity and Plasticity** Code: **BT7145**

Branch: **Mechanical Engineering**

Unit 1: Theory of Elasticity- Analysis of stress and strain, equilibrium, Compatibility and constitutive equations, Plane stress and plane strain problems, General equation in Polar co-ordinates, Rotating discs and stresses in circular discs, Stress function in terms of harmonic and complex functions, Equation of equilibrium of a deformed body in curvilinear coordinates, Principle of superposition and principle of virtual work, Torsion of thin tubes,

Unit 2:Bending of cantilevers, Uniformly and continuous loaded beams, Bending of circular, elliptical and rectangular cross-section bars, Axi-symmetric formulation and deformation of solids of revolution.

Unit 3: Theory of Plasticity-Nature of engineering plasticity, Differential equations of equilibrium, 3D stress analysis, infinitesimal deformation, finite deformation, Von Mises', Tresca's and anisotropic yield criteria, Halgh-Westergard stress space representation of yield criteria, experimental verification of yield criteria, Subsequent yield surfaces.

Unit 4: Elastic and plastic stress-strain relations and stress strain rate equations, Prandtle-Reuaa equations, Generalized plastic stress strain relations, Anisotropy and instability.Plane plastic flow, Slip-line field theory

Unit 5: Application of slip line field theory to plane strain metal forming processes Plane plastic stress and pseudo plane stress analysis and its applications, Extremum principle for rigid perfectly plastic material, surfaces of stress and velocity discontinuity. Upper bound and lower bound theorems and applications.

Text/Reference Books:

1. A I Lurie ; Theory of Elasticity (Foundations of Engineering Mechanics)
2. Gladwell G M Kluwer ; Contact Problems in the Classical Theory of Elasticity; Aca
3. Chakrabarty J.,Applied Plasticity; Springer-Verlag
4. R. Hill ;The Mathematical Theory of Plasticity, Oxford University.