B. TECH 7TH SEMESTER (MECHANICAL ENGINEERING)

MEASUREMENT AND CONTROL

ME- 471

L	T	P	Cr		
3	1	-	4	**On Semester Evaluation**	**100**
				End Semesters Evaluation	**100**
				Maximum Time	**3 hrs**

Note: -

1. **There will be NINE questions in the question-paper. All questions carry equal marks.**
2. **First question covers the whole syllabus. It is objective/ short answer type (at least ten questions). Two questions will be taken from each of the four units.**
3. **Attempt five questions in all. FIRST question is compulsory. Attempt ONE question from each of the other four Units**

UNIT-I

Introduction: Definition, application of measurement instrumentation, functional elements of a generalized measuring system, measuring standards, types of measurement, types of input to measuring instruments and instrument system, classification of measuring instruments, merits and demerits of mechanical measuring systems, comparison of mechanical measuring system with electrical measuring systems, calibration.

Errors: Introduction to error, types of error, types of uncertainties, propagation of uncertainties in compound quantity, Static performance parameters: accuracy, precision, resolution, static sensitivity, linearity, hysteresis, dead band, backlash, and drift, Sources of error, Selection of measuring instruments, Mechanical and Electrical loading,

UNIT-II

Fundamentals of dynamic characteristics: Generalized mathematical model of measuring systems, types of input, dynamic performance parameters: dynamic error, speed of response, etc, dynamic response of a first order mechanical systems with different inputs e.g. step, ramp, sinusoidal and impulse input.

Introduction to measuring data: types of measuring data, statistical attributes, various methods of presentation, estimation of presentation and uncertainties, confidence level, precision and statistical treatments of single and multi-sample type experimental data, Chauvent's criteria of rejecting a dubious data, curve fitting, best linear calibration and its precision, significant figures and rounding off. Overall uncertainty in estimation of measuring systems, common-sense approach and engineering applications.

UNIT-III

Transducers: Introduction, primary function, classification, electrostatic transducers: principle theory, types, advantages and limitations, Fixed contact mechano-resistive transducers: classification, and uses, Metallic resistance strain gauge: types, construction theory of operation, Adhesive: property, selection criteria, mounting of strain gauges, Mathematical analysis of ballast and DC-Wheatstone bridge circuits, Characteristic and comparison of ballast and DC-Wheatstone bridge circuits, temperature effects and their compensation.

Measurement of load, force, and thrust using resistant strain gauges, Elastic load cells, proving rings, fluid pressure measurement in pipe and containers, using strain gauges, measuring of torque in transmission shaft under axial and bending loads in varying ambient conditions.

UNIT-IV

Introduction, classification of control systems: control system terminology, servo mechanism, process control and regulators, Manual and automatic control systems, physical systems and mathematical models, linear control systems, Lap lace transform, transfer function, block diagram, signal flow graphs, system stability, Time and frequency domain.

Introduction, functional operation, desirable characteristics of hydraulic fluids, hydraulic control systems: hydraulic pump, hydraulic control valve, Pneumatic control systems: pneumatic nozzle, relay, advantages and limitation of such control systems.

Reference and Text Books:

1. Mechanical Measurements & Control: D.S. Kumar, Metropolitan book
2. Instrumentation & Mechanical Measurements: A.K. Tayal, Galgotia Publ.
3. Measurements Systems Application & Design: Ernest Doebelin, McGraw-Hill

B. TECH 7TH SEMESTER (MECHANICAL ENGINEERING)

AUTOMOBILE ENGINEERING

ME- 472

L	T	P	Cr		
3	0	-	3	**On Semester Evaluation**	**100**
				End Semesters Evaluation	**100**
				Maximum Time	**3 hrs**

Note: -

1. **There will be NINE questions in the question-paper. All questions carry equal marks.**
2. **First question covers the whole syllabus. It is objective/ short answer type (at least ten questions). Two questions will be taken from each of the four units.**
3. **Attempt five questions in all. FIRST question is compulsory. Attempt ONE question from each of the other four Units**

UNIT-I

Introduction: Brief history of automobiles, Main components of an automobile, Brief description of each component. Brief description of constructional details and working of a four stroke I.C. Engine (S.I. Engines and C.I. Engines) including lately developed overhead earn shad, Modern Automotive Vehicles Mechanical balancing, Firing Order, Power balancing, Power overlap, Power flow charts. Introduction, Brief description of different components of Transmission System.

Clutch: Introduction to Clutch and its different types, Principle of Friction Clutch, Clutch Lining and friction materials used in Friction Clutches, Torque transmitted, Brief description of Cone Clutch, Single Plate and Multi-plate Clutches, Dry and wet clutches, Automatic clutch action, Centrifugal clutches, Electromagnetic clutches, Fluid Flywheel.

UNIT-II

Gear Box: Air resistance, gradient resistance and rolling resistance coming across a moving automobile, Tractive effort, Variation of tractive effort with speed, Performance curves (object and need of a gear box), Sliding mesh gear box, Control mechanism, Sliding type selector mechanism, Ball type selector mechanism, Steering column gear shift control, Constant mesh gear box, Synchromesh device, Automatic transmission in general, Torque converter, Torque converter with direct drive, Lubrication of Gear Box.

Propeller Shaft: Functions and requirements of a propeller shaft, Universal joints, Constructional forms of universal joints, Flexible-ring joints, Rubber-bushed flexible joints. Constant-velocity joints.

Differential: Principle of operation, Constructional details of a typical Differential unit.

The back axle: Live back axles, The final drive, Single reduction live axles Torque reaction, Driving thrust, Torque and thrust member arrangements Springs serving as torque and thrust member, Hotchkiss Drive with torque reaction member.

UNIT III

Running System: Wheels and rims, Tyre: its function and constructional details.

Brakes: Functions and methods of operation, Brake efficiency. Elementary theory of shoe brake, brake shoe adjustments, A modem i ear-wheel brake, Disc brakes, Brake linkages, Leverage and adjustment of the brake linkage, Servo- and power-operated brakes, Vacuum brake operation,' Hydraulic Brakes-constructional details and working, Power-operated brakes, A dual power air brake system, Compressed air systems, Actuating cylinders for air brakes.

Suspension System: Suspension principles, Road irregularities and human susceptibility, Suspension system, Damping, Double lube damper, Single tube damper, Lever arm type damper, Springs-Leaf springs, Coil and torsion springs, variable rate springs, Composite leaf springs, Rubber springs, Air springs, Adjustable and self-adjusting suspensions, Interconnected suspension system, Interconnected air and liquid suspensions, Independent suspension system, Different independent suspension layouts, McPherson strut type, Wall's linkage, Rear suspension-dead axles, Rear suspension-independent, McPherson strut rear suspension.

UNIT IV

Steering Mechanism: Steering geometry, Castor, Camber, Kingpin inclination, Combined angle, Toe-in, Steering system-basic aims, Ackerman linkage, Center point steering, Costarring or trailing action, Cornering power, Self-righting torque, Steering characteristics-over steer and under steer, Axle beam, Stub-axle construction, Steering column, Reversible and irreversible steering, Rack-and-pinion steering mechanism, Effect of toe-in on steering, Power steering, Numerical Problems.

Recent trends in Automobile engineering: Multi fuel automobiles, Automobiles running on alternate sources of energy, Emission control through catalytic converter, Double catalytic converter, Aspects of pollution control in Automobiles.

B. TECH 7TH SEMESTER (MECHANICAL ENGINEERING)

Reference and Text Books:

1. The Motor Vehicle - By Newton, Steeds and Garrete Basic
2. Automobile Engineering - By Kirpal Singh
3. Automobile Engineering - By K.M. Gupta, Umesh Publications
4. Automotive Mechanics - By Crouse & Anglin
5. Automobile Engineering - By R.K. Rajput, Luxmi Pub.

B. TECH 7TH SEMESTER (MECHANICAL ENGINEERING)

MECHATRONICS AND MANUFACTURING AUTOMATION

ME-473

L	T	P	Cr		
3	0	-	3	On Semester Evaluation	100
				End Semester Evaluation	100
				Maximum Time	3 hrs

Note: -

1. **There will be NINE questions in the question-paper. All questions carry equal marks.**
2. **First question covers the whole syllabus. It is objective/ short answer type (at least ten questions). Two questions will be taken from each of the four units.**
3. **Attempt five questions in all. FIRST question is compulsory. Attempt ONE question from each of the other four Units**

UNIT 1

Introduction: Definition of mechatronics. Mechatronics in manufacturing, products and design. Review of fundamentals of electronics.

Mechatronics Elements (Introductory Part): Data conversion devices, sensors, micro sensors, transducers, signal processing devices, relays, contactors and timers.

UNIT 2

Drives & Mechanisms of An Automated System: Drives: stepper motors, servo drives. Ball, screws, linear motion bearings, cams, system controlled by camshafts, electronic cams, indexing mechanisms, tool magazines, and transfer systems.

Processors /Controllers (Brief Introduction): Microprocessors, microcontrollers, PID controllers and PLCs.

UNIT 3

Pneumatic System: Pneumatics: production, distribution and conditioning of compressed air, system components and graphic representations, design of systems.

Hydraulic System: flow, pressure and direction control valves, actuators, and supporting elements, hydraulic power packs, pumps. Design of hydraulic circuits.

UNIT 4

CNC technology and Robotics: CNC machines and part programming. Industrial Robotics. Stages in designing Mechatronics Systems, Possible Design Solutions. Case studies of Mechatronics systems- Pick and place Robot.

Text Book:

K.P Ramachandran, G.K Vijyaraghvan, M.S Balasundram, "Mechatronics Integrated Mechanical Electronics System", John Wiley India.

M. Groover, "Automation, Production Systems, and CIM", PHI.

Reference:

W. Bolton, "Mechatronics Electronics Control System in Mechanical and Electrical Engineering", Pearson Publication.

S.R Deb, "Robotics technology & Flexible Automation", TMH.

E-Learning Resource: ***http://nptel.ac.in/syllabus/112103174/***

B. TECH 7TH SEMESTER (MECHANICAL ENGINEERING)

STATISTICAL QUALITY CONTROL AND RELIABILITY
ME- 474

L	T	P	Cr		
3	1	-	4	On Semester Evaluation	100
				End Semesters Evaluation	100
				Maximum Time	3 hrs

Note: -

1. **There will be NINE questions in the question-paper. All questions carry equal marks.**
2. **First question covers the whole syllabus. It is objective/ short answer type (at least ten questions). Two questions will be taken from each of the four units.**
3. **Attempt five questions in all. FIRST question is compulsory. Attempt ONE question from each of the other four Units**

UNIT-I

Quality: Definition, Issues in Quality, Factors affecting quality, creating quality by design, product development cycle, Quality Control, economics of quality,
Total Quality Management: its scope, application and implementation.
Quality Circle: Objectives, structure and techniques.
Basic Problem solving techniques: Brain storming, Pareto Diagram, Cause & Defect Diagram, Data collection & Analysis

UNIT-II

Basic statistical concepts, various types of distributions, General theory X and R chart. Decision preparatory to the control charts. Trial control limits. Selection of subgroups, Charts with variable subgroups, Reject and Revoke, limits for average on X charts, modified control limits, specification limits, and practical limitations. Control charts for fraction defectives, calculation and plotting of control limits, sensitivity of p chart, applications. Control charts for Defects, difference between defect and defective, calculation and plotting of control limits, applications, p charts and u charts, plotting of charts. Tests for various control charts. Process capability- inherent and potential capability.

UNIT-III

Purpose of Acceptance by Attributes, Single sampling plans. O.C. curve, selection of sampling plans, Acceptance number, Type A and Type B, O.C. curves, Double sampling plan and its analysis, Multiple and sequential sampling, A.O.Q.L, Acceptance sampling plans under risk. Design of various sampling plans, Dodge-Roming type system for acceptance sampling by attributes (use of various tables). Determination of process average, Acceptance sampling by variables.

UNIT-IV

Reliability: Introduction, Quality control and reliability, Definition, factors affecting reliability, pattern of failure, Design for reliability, Measurement of reliability, Mean time between failure MTBF, Mean time to failure MTTF, Availability, Quality and reliability, System reliability in series and parallel system and related numerical

Reference and Text Books:

1. Statistical Quality Control - By Grant and Leaven, TMH
2. Quality Control and Reliability - By Mahajan, Dhanpat Rai.
3. Quality Control - By Hansen, Prentice- Hall

B. TECH 7TH SEMESTER (MECHANICAL ENGINEERING)

MEASUREMENT AND CONTROL PRACTICAL

ME-47P1

L	T	P	Cr		
-	-	2	1	**On Semester Evaluation**	**120**
				End Semesters Evaluation	**80**
				Maximum Time	**2 hrs**

LIST OF EXPERIMENTS

1. Study of a strain gage based cantilever beam and measurement of strain on the beam.
2. Study of a LVDT and measurement of linear displacement
3. Study of an inductive pick up and measurement of linear displacement
4. Study of a LDR and measurement of linear displacement
5. Study of capacitive pick up and measurement of angular displacement.
6. Study of temperature transducers and measurement of temperature of fluid
7. Study of a LVDT (strain gage based) and measurement of linear displacement.
8. Study of a torque pick up and measurement of torque
9. Study of a pressure pick up and measurement of pressure of fluid
10. Study of load cell and measurement of load with load cell.
11. Study of non-contact type speed pick up and measurement of rotational speed.
12. Comparison of sensitivity of thermocouple, thermister and RTD.

Note: The students must perform at least eight experiments.

B. TECH 7TH SEMESTER (MECHANICAL ENGINEERING)

MECHATRONICS AND MANUFACTURING AUTOMATION

ME-47P

L	T	P	Cr		
				On Semester Evaluation	**120**
-	**-**	**2**	**1**	**End Semester Evaluation**	**80**

1. Design of Hydraulic Systems.
2. Design of Pneumatic System.
3. Design of Electro-Pneumatic System.
4. Interface of Electro-Pneumatic System with PLC.
5. Case Study

Note:

- There are 13 exercises for serial number 1.
- There are 5 exercises for serial number 2.
- There are 3 exercises for serial number 2.

B. TECH 7TH SEMESTER (MECHANICAL ENGINEERING)

SEMINAR
ME-47P3

L	T	P	Cr	On Semester Evaluation	200
-	-	2	1		

Students will give a presentation on emerging technical topics.

B. TECH 7TH SEMESTER (MECHANICAL ENGINEERING)

MINOR PROJECT
ME-47P4

L	T	P	Cr		
-	-	4	4	**On Semester Evaluation**	**120**
				End Semesters Evaluation	**80**

The Students are expected to take up a project under the guidance of a teacher from the college. The project must be based on the mechanical engineering problems. The student may be asked to work individually or in-group with not more than four students. Viva-voce must be based on the preliminary report submitted my student(s) related to project.

B. TECH 7TH SEMESTER (MECHANICAL ENGINEERING)

Industrial Training

ME-47P5

L	T	P	Cr
0	0	0	3

The students are required to undergo Industrial Training of duration not less than six weeks in a reputed organization. The industry chosen for undergoing the training should be at least a private limited company. The students shall present and submit the report at the Institute at the end of training. The presentation will be evaluated by a committee appointed by Head of Department. Assessment of Industrial Training will be based on seminar, viva-voce, report and certificate of Industrial Training obtained by the student from the industry

B. TECH 7TH SEMESTER (MECHANICAL ENGINEERING)

ELECTIVES
ADVANCED MANUFACTURING SYSTEMS
ME- 47E1

L	T	P	Cr		
3	1	-	4	**On Semester Evaluation**	**100**
				End Semesters Evaluation	**100**
				Maximum Time	**3 hrs**

Note: -

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2. **First question covers the whole syllabus. It is objective/ short answer type (at least ten questions). Two questions will be taken from each of the four units.**
3. **Attempt five questions in all. FIRST question is compulsory. Attempt ONE question from each of the other four Units**

UNIT-I

Fundamental of manufacturing and automation: Manufacturing operations and automation strategies; Hard and soft automation. Transfer systems, automated flow lines, feeders, assembly and line balancing. Automated materials handling (including AGV), storage and retrieval systems; Robots and its applications in manufacturing

Computer aided manufacturing: Introduction to CAD/CAM, N.C. Machine Tools; CNC, DNC, Adaptive control. Manual part programming through simple examples; computer assisted part programming. .

UNIT-II

Process planning & group technology (GT): Introduction to process planning (PP), Computer aided process planning (CAPP); scheduling; sequencing of manufacturing operations. Introduction to coding and classification; Benefits of GT.

FMS and CIMS: Flexible manufacturing systems (FMS); FMS work stations; FMS planning and applications. Computer integrated manufacturing systems (CIMS); net work and data bases for manufacturing system. Simulation of Manufacturing systems.

UNIT-III

Production economics & materials management: Kinds of costs, evaluation of capital investments, capital budgeting, break-even-analysis, make-buy decisions, evaluation of alternatives, discounted cash flow, equivalent comparison methods, depreciation.

Purchasing, distribution and inventory control, Inventory concepts; Material requirement planning; Just in time.

UNIT-IV

Introduction to Concurrent Engineering, Agile Manufacturing, Lean Manufacturing.

Economics of quality assurance; Quality control; Process control, Control charts and acceptance sampling, concept of total quality management.

Reference and Text Books:

1. Automation and CIM - By: Zimmer and Groover
2. Agile Manufacturing - By: A. Gunasekaran
3. Concurrent Engineering - By: Hartley J. R.; Cambridge M.A.
4. Modern Production/ Operations Management-By: E. S. Bugga & R. K. Sarin, John-Wiley International
5. Theory and Problems in Production & Operations Management- By: S. N. Chang; TMH

B. TECH 7TH SEMESTER (MECHANICAL ENGINEERING)

FINITE ELEMET METHODS

ME- 47E2

L	T	P	Cr		
3	1	-	4	On Semester Evaluation	100
				End Semesters Evaluation	100
				Maximum Time	3 hrs

Note: -

1. **There will be NINE questions in the question-paper. All questions carry equal marks.**
2. **First question covers the whole syllabus. It is objective/ short answer type (at least ten questions). Two questions will be taken from each of the four units.**
3. **Attempt five questions in all. FIRST question is compulsory. Attempt ONE question from each of the other four Units**

UNIT 1

Basic concepts, historical background, engineering applications, general description, comparison with other methods.

Need for weighted-integral forms, relevant mathematical concepts and formulae, weak formulation of boundary value problems, variation methods, Rayleigh-Ritz method and weighted residual approach.

UNIT- II

Model boundary value problem, finite element discretization, element shapes, sizes and node locations, interpolation functions, derivation of element equations, connectivity, boundary conditions, FEM solution, post-processing, compatibility and completeness requirements, convergence criteria, higher order and iso-parametric elements, natural coordinates, Lagrange and Hermite polynomial.

UNIT-III

External and internal equilibrium equations, one-dimensional stress-strain relations, plane stress and strain problems, axis-symmetric and three dimensional stress-strain problems, strain displacement relations, boundary conditions compatibility equations, computer programs.

UNIT IV

Variational approach, Galerkin approach, one-dimensional and two-dimensional steady-state problems for conductions, convection and radiation, transient problems. Inviscid-incompressible flow, potential function and stream function formulation, incompressible viscous flow, stream function, velocity-pressure and steam function- vorticity formulation, solution of incompressible and compressible fluid film lubrication problems.

Reference and text books:

1. The finite element methods- by Zienkiewicz,m TMH
2. The finite element methods for engineers- by Huebner, John Wiley
3. An introduction to the finite element method- by J. N. Reddy, TMH

B. TECH 7TH SEMESTER (MECHANICAL ENGINEERING)

RENEWABLE ENERGY RESOURCES

ME- 47E3

L	T	P	Cr		
3	1	-	4	On Semester Evaluation	100
				End Semesters Evaluation	100
				Maximum Time	3 hrs

Note: -

1. **There will be NINE questions in the question-paper. All questions carry equal marks.**
2. **First question covers the whole syllabus. It is objective/ short answer type (at least ten questions). Two questions will be taken from each of the four units.**
3. **Attempt five questions in all. FIRST question is compulsory. Attempt ONE question from each of the other four Units**

UNIT-I

Introduction and Essential of Fluid Mechanics and Heat Transfer Fundamentals and scientific principles of renewable energy resources, technical and social implications, Bernoulli's, equation, conservation of momentum, viscosity, turbulence, frication, and pipe flow, heat circuit analysis and terminology, conductive, convective and radiative heat transfers, properties of transparent materials, heat transfer by mass transport, multimode heat transfer and circuit analysis, problems.

UNIT-II

Extraterrestrial solar radiation, components of radiation, geometry of earth and sun, geometry of collector arid the solar beam, effects of earth's atmosphere, measurements of solar radiation, calculation of heat balance for a solar collector, type of water heaters, selective surfaces, crop heaters, space heating, space cooling, water desalination, solar ponds, solar concentrators, electric power system, problems.

Introduction, the silicon p-n junction, photon absorption solar radiation input, photovoltaic circuit properties and loads, limits to cell efficiency, solar cell construction type and adaptations of photovoltaic, other types of photoelectric and thermo electric generation, problems.

UNIT-III

Principles of hydro power, assessing the resource for small installations, an impulse turbine, reaction turbines, hydro electric systems, the hydraulic rain pump, wind turbine type and terms, linear momentum and basic theory, dynamic matching, steam tube theory, characteristics of the wind, power extraction by a turbine, electricity generation, mechanical power, problems.

Introduction, tropic level photosynthesis, photosynthesis a the plant level, thermodynamic considerations, photosynthesis molecular level photosynthesis, synthetic photosynthesis, bio fuel classification, bio-mass production for energy farming, direct combustion for heat, pyrolysis (destructive distillation), alcoholic fermentation, anaerobic digestion for bio-gas, agrochemical fuel extractions, problems.

UNIT-IV

Introduction, wave motion, wave energy and power, wave patterns, devices, the causes of tides, enhancement of tides flow power, tidal range power, world range power sites, problems.

Principles of Ocean Thermal Energy Conversion (OTEC), heal exchangers, pumping requirements, other practical considerations, Introduction to geothermal energy, geophysics, dry rock and hot aquifer analysis, harnessing geothermal resources, problems.

Reference and Text Books:

Renewable energy resources by John W. Twindell and Anthony D. Weir, Published by E & F. N. Spon Ltd. London

B. TECH 7TH SEMESTER (MECHANICAL ENGINEERING)
COMPUTATIONAL FLUID DYNAMICS

ME- 47E4

L	T	P	Cr		
3	1	-	4	**On Semester Evaluation**	**100**
				End Semesters Evaluation	**100**
				Maximum Time	**3 hrs**

Note: -

1. **There will be NINE questions in the question-paper. All questions carry equal marks.**
2. **First question covers the whole syllabus. It is objective/ short answer type (at least ten questions). Two questions will be taken from each of the four units.**
3. **Attempt five questions in all. FIRST question is compulsory. Attempt ONE question from each of the other four Units**

UNIT-I

Methods of prediction: Comparison of experimental investigation Vs theoretical calculation; Mathematical description of physical phenomena; significance of governing differential equations; the general form of governing differential equation.

Classification of problems: Physical classification: Equilibrium problems and Marching problems; Mathematical classification: Elliptic, parabolic and hyperbolic partial differential equations; Nature of co-ordinates; one-way and two-way co-ordinates; Proper choice of co-ordinates.

UNIT-II

The concept of discretisation: Finite differences; Taylor series formulation: Finite difference discretisation of ordinary and partial derivatives: Truncation error, round-off error, discretisation error; Consistency and stability of numerical schemes; Variation formulation; Method of weighted Residuals, control volume formulation.

UNIT-III

Steady one–dimensional Conduction, The inter-face conductivity, Non linearity, Source Term Linearizsation, Types of Boundary Conditions. Unsteady One-dimensional Conduction: Explicit, Crank-Nicolson and Fully Implicit scheme's Discretisation of two and three-dimensional problems, Stability analysis.

UNIT-IV

Steady one-dimensional convection and diffusion, the up wind scheme Generalized Formulation, Discretisation equation for two and three-dimensional problems, the outflow Boundary Condition, false Diffusion.

Basic difficulty, Vorticity Based Methods, Representations of the continue equation the staggered grid: the momentum equations, the pressure velocity corrections, and SIMPLE algorithm.

Reference and Text Books:

1. Computational Fluid Dynamics:
   - By Anderson, McGraw-Hill
2. Numerical Heat Transfer and Fluid Flow
   - By Patankar, McGraw-Hill

B. TECH 7TH SEMESTER (MECHANICAL ENGINEERING)

MAINTENANCE ENGINEERING

ME- 47E5

L	T	P	Cr		
3	1	-	4	On Semester Evaluation	100
				End Semesters Evaluation	100
				Maximum Time	3 hrs

Note: -

1. **There will be NINE questions in the question-paper. All questions carry equal marks.**
2. **First question covers the whole syllabus. It is objective/ short answer type (at least ten questions). Two questions will be taken from each of the four units.**
3. **Attempt five questions in all. FIRST question is compulsory. Attempt ONE question from each of the other four Units**

UNIT-I

Evolution of maintenance, objective of maintenance, maintenance policies and philosophies, maintenance concept, maintenance management & terotechnology, relationship with other functional areas, importance of maintenance, elements of good maintenance, economics of maintenance, training and safety aspects in maintenance.

Classification of maintenance programs, corrective preventive and predictive maintenance, comparison of maintenance programs, preventive maintenance concept, functions, benefits, limitations.

UNIT-II

Objectives, what to monitor, when to monitor, principles of CBM, condition based maintenance techniques, manual inspections, performance monitoring, vibration monitoring, current monitoring, coil debris/spectroscopy, thermograph and corrosion monitoring, steps in implementation of CBM.

RCM logic, maintenance and RCM benefits of RCM total productive maintenance (TPM) introduction, key-supporting elements of TPM, methodology, evaluation and benefits.

UNIT-III

Purpose and challenges: Techniques, visual aids-boroscopes, endoscopes, and fiber optics scanners.

Magnetic particles inspection, liquid pentrants, eddy current, ultrasonic radiography, selection of NDT technique, metrits/demerits and applications of various techniques.

UNIT-IV

Techniques for improvement of operations reliability, safety and availability of machines and production systems, maintainability criteria, fault diagnosis, pareto principle, Ishikawa diagram.

Basic ingredients, basic steps in maintenance management, maintenance planning and control system, documentation, maintenance-productivity areas for improvement.

Text and Reference Books:

1. Maintenance planning and control by Higgin L.R.,McGiaw Hill Book Co.,1900.
2. Maintenance Planning and control by Kelly Anthony, East West Press Private Ltd, New Delhi,1991.
3. Maintainability principle and practices by Blanchard B.S.and Lowey E.E.McGraw Hill Book co.
4. Practical NOT by Raj B. Jaya Kumar T and Thavasimulyi k. Narora Publishing House, New Delhi,1996.
5. Engineering maintenance management by Bieble Benjamin W.Marcel Dekher,1994

B. TECH 7TH SEMESTER (MECHANICAL ENGINEERING)
AIRCRAFT ENGINEERING
ME-47E6

L	T	P	Cr		
3	1	-	4	**On Semester Evaluation**	100
				End Semester Evaluation	100
				Maximum Time	3 hrs

Note: -

1. **There will be NINE questions in the question-paper. All questions carry equal marks.**
2. **First question covers the whole syllabus. It is objective/ short answer type (at least ten questions). Two questions will be taken from each of the four units.**
3. **Attempt five questions in all. FIRST question is compulsory. Attempt ONE question from each of the other four Units.**

UNIT I

Aircraft industry overview

Evolution and History of Flight, Types of Aerospace Industry, Aerospace Manufacturing, Global and Indian Aircraft Scenario.

Introduction to Aircrafts

Basic components of an Aircraft, Aircraft Axis System, Aircraft Motions, Control surfaces and High lift Devices. Types of Aircrafts; Aircrafts Conventional Design Configurations and Unconventional Configurations.

UNIT II

Introduction to Aircraft Systems

Types of Aircraft Systems - Mechanical Systems, Electrical and Electronic Systems, Auxiliary systems.
Mechanical Systems - Environmental control systems (ECS), Pneumatic and Hydraulic systems, Fuel systems, Landing gear systems, Engine Control Systems, Ice and rain protection systems, Cabin Pressurization and Air Conditioning Systems, Steering and Brakes Systems. Propulsion Systems.
Auxiliary Power Unit, Electrical systems- Avionics, Flight controls, Autopilot and Flight Management Systems, Navigation Systems, Communication, Information systems, Radar System.

UNIT III

Basic Principles of Flight

Significance of speed of Sound, Air speed and Ground Speed, Properties of Atmosphere, Bernoulli's Equation, Forces on the airplane, Airflow over wing section, Pressure Distribution over a wing section, Generation of Lift, Drag, Pitching moments, Types of Drag, Lift curve, Drag Curve, Lift/Drag Ratio Curve, Factors affecting Lift and Drag, Center of Pressure and its effects.
Aerofoil Nomenclature, Types of Aerofoil, Aspect Ratio, Effects of lift, Drag, speed, Air density on drag,

UNIT IV

Basics of Flight Mechanics

Mach Waves, Mach Angles, Sonic and Supersonic Flight and its effects.

Stability and Control

Degree of Stability- Lateral, Longitudinal and Directional Stability and controls of Aircraft. Effects of Flaps and Slats on Lift Coefficients, Control Tabs, Stalling, Landing, Gliding Turning, Speed of Sound, Mach Numbers, Shock Waves.

Aircraft Performance

Power Curves, Maximum and minimum speeds of horizontal flight, Effects of Changes of Engine Power, Effects of Altitude, Forces acting on Aeroplane during a Turn, Loads during a Turn, Correct and incorrect Angles of Bank,

Text Books:

1. Flight Mechanics II By Nelson, R.C TMG

Reference Books:

1. Fundamental of Airplane Flight Mechanism by Hull, David G. Springer
2. Infosys Resource Material

B. TECH 7TH SEMESTER (MECHANICAL ENGINEERING)

CRYOGENICS
ME-47E7

L	T	P	Cr		
3	1	0	4	**On Semester Evaluation**	100
				End Semester Evaluation	100
				Maximum Time	3 hrs

Note: -

1. **There will be NINE questions in the question-paper. All questions carry equal marks.**
2. **First question covers the whole syllabus. It is objective/ short answer type (at least ten questions). Two questions will be taken from each of the four units.**
3. **Attempt five questions in all. FIRST question is compulsory. Attempt ONE question from each of the other four Units**

UNIT-I

Introduction & Low Temperature properties of Engineering Materials: Historical background, Present area involving cryogenics, Mechanical properties; Thermal properties; Electrical and Magnetic properties; properties of Cryogenic fluids.

UNIT-II

Gas Liquefaction System: Joule Thompson effect; Adiabatic expansion; Simple Linde-Hampson, Precooled Linde-Hampson system; Liquid dual pressure system; Cascaded system; Claude system, Kapitza system, Collins helium liquefaction system.

Critical Component of Liquefaction System: Effect of heat exchanger; Effectiveness of system performance, Effect of compressor and expander efficiency on system performance; effect of heat transfer to the system.

UNIT-III

Cryogenic Refrigeration System: Phillips refrigerator, Importance refrigerator, effectiveness for Phillips refrigerator, Gifford-McMohan refrigerator.

Measurement System of Low Temperature: Temperature measurement, Flow rate measurement, Liquid level measurement.

UNIT-IV

Cryogenic Storage & Transfer System: Cryogenic fluid storage vessels, Insulation, Cryogenic transfer system.

Vacuum Technology: Importance of Vacuum technology in cryogenics, Flow regimes in vacuum systems; Conductance in vacuum systems, Calculation of pump down time for a vacuum system, Components of vacuum systems, Mechanical vacuum pumps, Diffusion pumps, Ion pumps, Cryopumping, Vacuum gauges & valves.

Text & Reference Books:

1. Cryogenic Systems Barron Randall F Oxford University
2. V Kostiouk, "A Text Book of Cryogenics" Valery Discovery Publishing House
3. Thermodynamic Properties of Cryogenic Fluids R T Jacobsen Plenum Publishing Corpn

B. TECH 7TH SEMESTER (MECHANICAL ENGINEERING)
MACHINE TOOL ENGINEERING
ME-47E8

L	T	P	Cr		
3	1	0	4	**On Semester Evaluation**	100
				End Semester Evaluation	100
				Maximum Time	3 hrs

Note: -

1. **There will be NINE questions in the question-paper. All questions carry equal marks.**
2. **First question covers the whole syllabus. It is objective/ short answer type (at least ten questions). Two questions will be taken from each of the four units.**
3. **Attempt five questions in all. FIRST question is compulsory. Attempt ONE question from each of the other four Units.**

UNIT I

Materials & Classification of Machine Tool

Introduction and desirable Properties, Carbon and Medium –Alloy Steels, High Speed Steel, Cast- Cobalt Alloy, Coated Tools, Alumina Based Ceramics, Cubic Boron Nitrides, and Silicon- Nitride based Ceramics, Diamond, Reinforced Tool Materials, and Cutting-Tool Reconditioning.

Classification of Machine Tools: General purpose, Special purpose, Automatic, Semi Automatic machine tools, Transfer lines. Evolution of machine tool with regard to accuracy.

UNIT II

Kinematics of Machine Tools:

Basic Requirements, Mechanics and Geometry of Chip Formation ,General Considerations for Metal Cutting, Design of single point Cutting Tools, Design of Milling Cutters, Design of Drills and Drilling.

Design of Reamers, Design of Taps, Design of Inserts, Determining Shank Size for Single-point Carbide Tools, Determining the Insert Thickness for Carbide Tools, Chip Breakers, Design of form tools.

UNIT III

Tool Vibration & Reliability of Machine Tool

Machine Tool Vibrations: Effect of vibration on machine tool; Forced vibrations. Machine tool chatter. Self excited vibration and dynamic stability single and two degree freedom analysis. Elimination of vibration. Vibration analysis of machine tool structures. Cutting Tool Manufacturing Machines,

Cutting Oil/Coolant Type and Selection. Control in conventional and NC CNC machines, installations and maintenance of machine tool, reliability of machine tool and its components, analysis of reliability, availability and maintainability of cutting tool.

UNIT IV

Hydraulic Controls & Machine Tool Testing

Various controls used in machine tools, hydraulic and pneumatic system in machine tools, positive displacement pumps. Power packs, relief valve, check valve, multi position direction control valve, and Hydro copying system.

Machine tool testing introduction, various instruments used for tool testing-test mandrels, spirit level, dial indicator, Machine Tool test procedure, Acceptance test on lathe machine, milling machine and radial drill machine

Books Recommended:

1. Sen and Bhattacharya, Principles of Machine Tools, New Central Book Agency, Calcutta,
2. S.K. Basu, Design of Machine Tools, Allied Publishers, India, 1961. Acharkan,
3. Machine Tool Design (vol. 1,2 & 3), MIR Publishers, Moscow, 1973.
4. Machine Tool Technology by K.S.Yadav
5. HMT, "Production Technology"
6. Chapman; "Workshop Technology", Edward Arnold Publishers.
7. P. N. Rao, "Manufacturing Technology, Foundry, Forming and Welding", Tata McGraw Hill,
8. PC Sharma; "Production Technology" (Manufacturing Processes),S Chand &Co.

B. TECH 7TH SEMESTER (MECHANICAL ENGINEERING)