DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA , BHOPAL

SCHEME OF STUDIES & EXAMINATIONS (IMPLEMENTED FROM SESSION : JULY 2023)

SCHEME	NAME OF BRANCH	BRANCH CODE	SEMESTER
OCBC JULY 2022/2023	MECHANICAL ENGINEERING	M02	FOURTH (IV)

S.N.	PAPER CODE	SUBJECT CODE	SUBJECT NAME	THEORY COMPONENT								PRACTICAL COMPONENT					TOTAL CREDITS	TOTAL MARKS
				HRS PER WEEK	CREDITS	TERM WORK				THEORY PAPER		HRS PER WEEK	CREDITS	LAB WORK	PRACTICAL EXAM/VIVA			
						QUIZ/ASSIGNMENT	MID TERM TEST*		TOTAL	MARKS	DURATION				MARKS	DURATION		
							I	II										
1	7406	401	MEASUREMENTS AND METROLOGY	4	4	10	10	10	30	70	03 Hrs.	4	2	20	30	03 Hrs.	6	150
2	7407	402	STRENGTH OF MATERIALS	4	4	10	10	10	30	70	03 Hrs.	4	2	20	30	03 Hrs.	6	150
3	7408	403	THERMAL ENGINEERING - II	3	3	10	10	10	30	70	03 Hrs.	4	2	20	30	03 Hrs.	5	150
4	7409	411	MATERIAL HANDLING SYSTEM OR	3	3	10	10	10	30	70	03 Hrs.	0	0	0	0	0	3	100
	7410	412	COMPUTER INTEGERATED MANUFACTURING															
5	7411	421	HEAT TRANSFER OR	3	3	10	10	10	30	70	03 Hrs.	0	0	0	0	0	3	100
	7412	422	REFRIGERATION AND AIR-CONDITIONING															
6			MINOR PROJECT	0	0	0	0	0	0	0	0	4	2	20	30	03 Hrs.	2	50
7			ESSENCE OF INDIAN KNOWLEDGE AND TRADITION	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8			LIBERARY /SEMINAR/VISITS etc.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
TOTAL				19	17				150	350		17	8	80	120		25	700

NOTE - (1)* Two Best,out of Three Mid Term Tests (Progressive Tests) Marks should be entered here.

GRAND TOTAL OF CREDITS	GRAND TOTAL OF MARKS
25	700

DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN MECHANICAL ENGINEERING (M02)

SEMESTER IV

COURSE TITLE	:	MEASUREMENTS AND METROLOGY
PAPER CODE	:	7406
SUBJECT CODE	:	401
TREORY CREDITS	:	04
PRACTICAL CREDITS	:	02

Course Objectives:

- To study advances in technology, measurement techniques, types of instrumentation devices, innovations, refinements.
- To study the principles of instrumentation, transducers & measurement of non-electrical parameters like temperature, pressure, flow, speed, force and stress.

Course Content:

UNIT-I: Introduction to measurements: Definition of measurement; Significance of measurement; Methods of measurements: Direct & Indirect; Generalized measuring system; Standards of measurements: Primary & Secondary; Factors influencing selection of measuring instruments; Terms applicable to measuring instruments: Precision and Accuracy, Sensitivity and Repeatability, Range, Threshold, Hysteresis, calibration; Errors in Measurements: Classification of errors, Systematic and Random error.

Measuring instruments: Introduction; Thread measurements: Thread gauge micrometre; Angle measurements: Bevel protractor, Sine Bar; Gauges: plain plug gauge, ring Gauge, snap gauge, limit gauge; Comparators: Characteristics of comparators, Types of comparators; Surface finish: Definition, Terminology of surface finish, Talysurf surface roughness tester; Co-ordinating measuring machine.

Unit-II: Transducers and Strain gauges: Introduction; Transducers: Characteristics, classification of transducers, two coil self-inductance transducer, Piezoelectric transducer; Strain Measurements: Strain gauge, Classification, mounting of strain gauges, Strain gauge rosettes-two and three elements.

Measurement of force, torque, and pressure: Introduction; Force measurement: Spring Balance, Proving ring, Load cell; Torque measurement: Prony brake, Eddy current, Hydraulic dynamometer; Pressure measurement: Mcloed gauge.

Unit-III: Applied mechanical measurements: Speed measurement: Classification of tachometers, Revolution counters, Eddy current tachometers; Displacement measurement: Linear variable Differential transformers (LVDT); Flow measurement: Rotometers, Turbine meter; Temperature measurement: Resistance thermometers, Optical Pyrometer.

Miscellaneous measurements: Humidity measurement: hair hygrometer; Density measurement: hydrometer; Liquid level measurement: sight glass, Float gauge; Biomedical measurement: Sphygmo monometer.

Unit-IV: Limits, Fits & Tolerances: Concept of Limits, Fits, and Tolerances; Selective Assembly; Interchangeability; Hole And Shaft Basis System; Taylor's Principle; Design of Plug; Ring Gauges; IS 919-1993 (Limits, Fits & Tolerances, Gauges} IS 3477-1973; concept of multi gauging and inspection.

Angular Measurement: Concept; Instruments For Angular Measurements; Working and Use of Universal Bevel Protractor, Sine Bar, Spirit Level; Principle of Working of Clinometers; Angle Gauges (With Numerical on Setting of Angle Gauges).

Screw thread Measurements: ISO grade and fits of thread; Errors in threads; Pitch errors; Measurement of different elements such as major diameter, minor diameter, effective diameter, pitch; Two wire method; Thread gauge micrometer; Working principle of floating carriage dial micrometer.

Unit-V: Gear Measurement and Testing: Analytical and functional inspection; Rolling test; Measurement of tooth thickness (constant chord method); Gear tooth vernier; Errors in gears such as backlash, runout, composite.

Machine tool testing: Parallelism; Straightness; Squareness; Coaxiallity; roundness; run out; alignment testing of machine tools as per IS standard procedure.

Reference Books:

1. Mechanical measurements – Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. Metrology & Measurement – Anand K Bewoor,Vinay kulakarni, Tata McGraw Hill, New Delhi, 2009
3. Principles of Industrial instrumentation and control systems – Channakesava. R. Alavala, DELMAR cenage learning, 2009.
4. Principles of Engineering Metrology – Rega Rajendra, Jaico publishers, 2008
5. Dimensional Metrology – Connie Dotson, DELMAR, Cenage learning, 2007
6. Instrumentation measurement and analysis – B.C. Nakara, K.K. Chaudary, second edition, Tata cgraw Hill, 2005.
7. Engineering Metrology – R.K. Jain, Khanna Publishers, New Delhi, 2005.
8. A text book of Engineering Metrology – I.C. Gupta, Dhanpat Rai and Sons, New Delhi, 2005
9. Metrology for Engineers – J.F.W. Galyer and C. R. Shotbolt, ELBS
10. Engineering Metrology – K. J. Hume, Kalyani publishers

Course outcomes

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

CO1	Define accuracy, precision, calibration, sensitivity, repeatability and such relevant terms in metrology.
CO2	Distinguish between various types of errors.
CO3	Understand the principle of operation of an instrument and select suitable measuring device for a particular application.
CO4	Appreciate the concept of calibration of an instrument.
CO5	Analyze and interpret the data obtained from the different measurements processes and present it in the graphical form, statistical form.

MEASUREMENTS AND METROLOGY LAB

Course Objectives:

- To understand techniques for precise measurement of the dimensions of various objects and shapes.

Course Content:

S.No.	Topics for practice
I	Measure the diameter of a wire using micrometre and compare the result with digital micrometre
II	Measure the angle of the machined surface using sine bar with slip gauges.
III	Measure the angle of a V-block / Taper Shank of Drill / Dovetail using universal bevel protractor.
IV	Measure the dimensions of ground MS flat/cylindrical bush using Vernier Caliper compare with Digital/Dial Vernier Caliper.
V	Measure the geometrical dimensions of V-Thread using thread Vernier gauge.
VI	Measure the thickness of ground MS plates using slip gauges

Reference Books:

1. Engineering Metrology – R. K. Jain
2. Engineering precision metrology – R. C. Gupta
3. A Hand book of Industrial Metrology – ASME

Course outcomes:

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

CO1	Measure various component of linear measurement using Vernier calipers and Micrometre.
CO2	Measure various component of angle measurement using sine bar and bevel Protractor
CO3	Measure the geometrical dimensions of V-thread and spur gear

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DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN MECHANICAL ENGINEERING (M02)

SEMESTER IV

COURSE TITLE	:	STRENGTH OF MATERIALS
PAPER CODE	:	7407
SUBJECT CODE	:	402
TREORY CREDITS	:	04
PRACTICAL CREDITS	:	00

Course Objectives:

- To understand the concept of Simple Stresses and Strains.
- To understand the concept of Strain Energy.
- To understand the concept of Shear Force and Bending Moment Diagrams.
- To understand the concept of Theory of Simple Bending and Deflection of Beams.
- To understand the concept of Torsion in Shafts and Springs.
- To understand the concept of Thin Cylindrical Shells.

Course Content:

UNIT-I: Simple Stresses and Strains: Types of forces; Stress, Strain and their nature; Mechanical properties of common engineering materials; Significance of various points on stress – strain diagram for M.S. and C.I. specimens; Significance of factor of safety; Relation between elastic constants; Stress and strain values in bodies of uniform section and of composite section under the influence of normal forces; Thermal stresses in bodies of uniform section and composite sections; Related numerical problems on the above topics.

Strain Energy: Strain energy or resilience, proof resilience and modulus of resilience; Derivation of strain energy for the following cases: i) Gradually applied load, ii) Suddenly applied load, iii) Impact/ shock load; Related numerical problems.

Unit-II: Shear Force & Bending Moment Diagrams: Types of beams with examples: a) Cantilever beam, b) Simply supported beam, c) Over hanging beam, d) Continuous beam, e) Fixed beam; Types of Loads – Point load, UDL and UVL; Definition and explanation of shear force and bending moment; Calculation of shear force and bending moment and drawing the S.F and B.M. diagrams by the analytical method only for the following cases: a) Cantilever with point loads, b) Cantilever with uniformly distributed load, c) Simply supported beam with point loads, d) Simply supported beam with UDL, e) Over hanging beam with point loads, at the centre and at free ends, f) Over hanging beam with UDL throughout, g) Combination of point and UDL for the above; Related numerical problems.

Unit-III: Theory of Simple Bending and Deflection of Beams: Explanation of terms: Neutral layer, Neutral Axis, Modulus of Section, Moment of Resistance, Bending stress, Radius of curvature; Assumptions in theory of simple bending; Bending Equation $M/I = \sigma/Y = E/R$ with derivation; Problems involving calculations of bending stress, modulus of section and moment of resistance; Calculation of safe loads and safe span and dimensions of cross- section; Definition and explanation of deflection as applied to beams; Deflection formulae without proof for cantilever and simply supported beams with point load and UDL only (Standard cases only); Related numerical problems.

Unit-IV: Torsion in Shafts and Springs: Definition and function of shaft; Calculation of polar M.I. for solid and hollow shafts; Assumptions in simple torsion; Derivation of the equation $T/J=f_s/R=G\theta/L$; Problems on design of shaft based on strength and rigidity; Numerical Problems related to comparison of strength and weight of solid and hollow shafts; Classification of springs; Nomenclature of closed coil helical spring; Deflection formula for closed coil helical spring (without derivation); stiffness of spring; Numerical problems on closed coil helical spring to find safe load, deflection, size of coil and number of coils.

Unit-V: Thin Cylindrical Shells: Explanation of longitudinal and hoop stresses in the light of circumferential and longitudinal failure of shell; Derivation of expressions for the longitudinal and hoop stress for seamless and seam shells; Related numerical Problems for safe thickness and safe working pressure.

Reference Books:

1. Strength of Materials – D.S. Bedi, Khanna Book Publishing Co. (P) Ltd., Delhi, 2017
2. Strength of Materials – B.C.Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publications, New Delhi, 2013
3. Strength of Materials – S. Ramamrutham, Dhanpat Rai & Publication New Delhi
4. Strength of Materials – R.S. Khurmi, S.Chand Company Ltd. Delhi
5. A Text Book strength of Material– R.K. Bansal, Laxmi Publication New Delhi

Course outcomes:

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

CO1	Compute stress and strain values and find the changes in axial, lateral and volumetric dimensions of bodies of uniform section and of composite section under the influence of normal forces.
CO2	Calculate thermal stresses, in bodies of uniform section and composite sections.
CO3	Define resilience, proof – resilience and modulus of resilience and obtain expressions for instantaneous stress developed in bodies subjected to different loads.
CO4	Compute shear force and bending moment at any section of beam and draw the S.F. & B.M diagrams of for UDL and Point loads.
CO5	Calculate the safe load, safe span and dimensions of cross section.
CO6	Compare strength and weight of solid and hollow shafts of the same length and material and compute the stress and deflection of the closed coil helical spring.

STRENGTH OF MATERIALS LAB

Course Objectives:

- To understand the working and applications of Gas turbines & Jet Propulsion.
- To understand the methods of computing various properties of steam.
- To understand the working of various Steam Boilers, functions of various accessories and mountings of boilers.
- To understand the Working of Steam Nozzles and Steam turbines.
- To understand the necessity of compounding and governing of a turbine.

Course Content:

UNIT-I: Gas Turbines: Air-standard Brayton cycle; Description with p-v and T-S diagrams; Gas turbines Classification: open cycle gas turbines and closed cycle gas turbines; comparison of gas turbine with reciprocating I.C. engines and steam turbines. Applications and limitations of gas turbines; General lay-out of Open cycle constant pressure gas turbine; P-V and T-S diagrams and working; General lay-out of Closed cycle gas turbine; P-V and T-S diagrams and working.

Jet Propulsion: Principle of jet propulsion; Fuels used for jet propulsion; Applications of jet propulsion; Working of a turbojet engine; Principle of Ram effect; Working of a Ram jet engine; Principle of Rocket propulsion; Working principle of a rocket engine; Applications of rocket propulsion; Comparison of jet and rocket propulsions.

Unit-II: Properties of Steam: Formation of steam under constant pressure; Industrial uses of steam; Basic definitions: saturated liquid line, saturated vapour line, liquid region, vapour region, wet region, superheat region, critical point, saturated liquid, saturated vapour, saturation temperature, sensible heat, latent heat, wet steam, dryness fraction, wetness fraction, saturated steam, superheated steam, degree of superheat; Determination of enthalpy, internal energy, internal latent heat, entropy of wet, dry and superheated steam at a given pressure using steam tables and Mollier chart for the following processes: Isochoric process, Isobaric process, Hyperbolic process, Isothermal process, Isentropic process, Throttling process, Polytropic process; Simple direct problems on the above using tables and charts; Steam calorimeters: Separating, throttling, Combined Separating and throttling calorimeters – problems.

Unit-III: Steam Generators: Function and use of steam boilers; Classification of steam boilers with examples; Brief explanation with line sketches of Cochran, Babcock and Wilcox Boilers; Comparison of water tube and fire tube boilers; Description with line sketches and working of modern high pressure boilers Lamont and Benson boilers; Boiler mountings: Pressure gauge, water level indicator, fusible plug, blow down cock, stop valve, safety valve, (dead weight type, spring loaded type, high pressure and low water safety alarm); Boiler accessories: feed pump, economiser, super heater and air pre-heater; Study of steam traps & separators; Explanation of the terms: Actual evaporation, equivalent evaporation, factor of evaporation, boiler horse power and boiler efficiency; Formula for the above terms without proof; Simple direct problems on the above; Draught systems (Natural, forced & induced).

Unit-IV: Steam Nozzles: Flow of steam through nozzle; Velocity of steam at the exit of nozzle in terms of heat drop using analytical method and Mollier chart; Discharge of steam through nozzles; Critical pressure ratio; Methods of calculation of cross-sectional areas at throat and exit for maximum discharge; Effect of friction in nozzles and Super saturated flow in nozzles; Working steam jet injector; Simple numerical problems.

Unit-V: Steam Turbines: Classification of steam turbines with examples; Difference between impulse & reaction turbines; Principle of working of a simple De-lavel turbine with line diagrams- Velocity diagrams; Expression for work done, axial thrust, tangential thrust, blade and diagram efficiency, stage efficiency, nozzle efficiency; Methods of reducing rotor speed; compounding for velocity, for pressure or both pressure and velocity; Working principle with line diagram of a Parson's Reaction turbine–velocity diagrams; Simple problems on single stage impulse turbines (without blade friction) and reaction turbine including data on blade height. Bleeding, re-heating and re-heating factors (Problems omitted); Governing of steam turbines: Throttle, By-pass & Nozzle control governing.

Reference Books:

1. A Course in Thermal Engineering – S. Domkundwar & C.P. Kothandaraman, Dhanpat Rai & Publication, New Delhi
2. Thermal Engineering – R.K. Rajput, Laxmi Publication New Delhi
3. Thermal Engineering – P.L. Ballaney, Khanna Publishers, 2002
4. Treatise on Heat Engineering in MKS and SI Units – V.P. Vasandani & D.S. Kumar, Metropolitan Book Co. Pvt. Ltd, New Delhi.

Course outcomes:

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

CO1	Explain the working cycle of gas turbines, and the working of Jet and Rocket Engines apart from identifying the fuels used for Jet and Rocket propulsion.
CO2	Compute the work done, enthalpy, internal energy and entropy of steam at given conditions using steam tables and Mollier chart.
CO3	Distinguish between water tube and fire-tube boilers and explain the function all the mountings and accessories.
CO4	Calculate Velocity of steam at the exit of nozzle in terms of heat drop analytically and by using Mollier chart.
CO5	State the necessity of governing and compounding of a turbine.
CO6	Explain the principle of working of a steam turbine and distinguish between the impulse turbines and reaction turbines.

DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN MECHANICAL ENGINEERING (M02)

SEMESTER IV

COURSE TITLE	:	THERMAL ENGINEERING - II
PAPER CODE	:	7408
SUBJECT CODE	:	403
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	02

Course Objectives:

- To understand the working and applications of Gas turbines & Jet Propulsion.
- To understand the methods of computing various properties of steam.
- To understand the working of various Steam Boilers, functions of various accessories and mountings of boilers.
- To understand the Working of Steam Nozzles and Steam turbines.
- To understand the necessity of compounding and governing of a turbine.

Course Content:

UNIT-I: Gas Turbines: Air-standard Brayton cycle; Description with p-v and T-S diagrams; Gas turbines Classification: open cycle gas turbines and closed cycle gas turbines; comparison of gas turbine with reciprocating I.C. engines and steam turbines. Applications and limitations of gas turbines; General lay-out of Open cycle constant pressure gas turbine; P-V and T-S diagrams and working; General lay-out of Closed cycle gas turbine; P-V and T-S diagrams and working.

Jet Propulsion: Principle of jet propulsion; Fuels used for jet propulsion; Applications of jet propulsion; Working of a turbojet engine; Principle of Ram effect; Working of a Ram jet engine; Principle of Rocket propulsion; Working principle of a rocket engine; Applications of rocket propulsion; Comparison of jet and rocket propulsions.

Unit-II: Properties of Steam: Formation of steam under constant pressure; Industrial uses of steam; Basic definitions: saturated liquid line, saturated vapour line, liquid region, vapour region, wet region, superheat region, critical point, saturated liquid, saturated vapour, saturation temperature, sensible heat, latent heat, wet steam, dryness fraction, wetness fraction, saturated steam, superheated steam, degree of superheat; Determination of enthalpy, internal energy, internal latent heat, entropy of wet, dry and superheated steam at a given pressure using steam tables and Mollier chart for the following processes: Isochoric process, Isobaric process, Hyperbolic process, Isothermal process, Isentropic process, Throttling process, Polytropic process; Simple direct problems on the above using tables and charts; Steam calorimeters: Separating, throttling, Combined Separating and throttling calorimeters – problems.

Unit-III: Steam Generators: Function and use of steam boilers; Classification of steam boilers with examples; Brief explanation with line sketches of Cochran, Babcock and Wilcox Boilers; Comparison of water tube and fire tube boilers; Description with line sketches and working of modern high pressure boilers Lamont and Benson boilers; Boiler mountings: Pressure gauge, water level indicator, fusible plug, blow down cock, stop valve, safety valve, (dead weight type, spring loaded type, high pressure and low water safety alarm); Boiler accessories: feed pump, economiser, super heater and air pre-heater; Study of steam traps & separators; Explanation of the terms: Actual evaporation, equivalent evaporation, factor of evaporation, boiler horse power and boiler efficiency; Formula for the above terms without proof; Simple direct problems on the above; Draught systems (Natural, forced & induced).

Unit-IV: Steam Nozzles: Flow of steam through nozzle; Velocity of steam at the exit of nozzle in terms of heat drop using analytical method and Mollier chart; Discharge of steam through nozzles; Critical pressure ratio; Methods of calculation of cross-sectional areas at throat and exit for maximum discharge; Effect of friction in nozzles and Super saturated flow in nozzles; Working steam jet injector; Simple numerical problems.

Unit-V: Steam Turbines: Classification of steam turbines with examples; Difference between impulse & reaction turbines; Principle of working of a simple De-lavel turbine with line diagrams- Velocity diagrams; Expression for work done, axial thrust, tangential thrust, blade and diagram efficiency, stage efficiency, nozzle efficiency; Methods of reducing rotor speed; compounding for velocity, for pressure or both pressure and velocity; Working principle with line diagram of a Parson's Reaction turbine–velocity diagrams; Simple problems on single stage impulse turbines (without blade friction) and reaction turbine including data on blade height. Bleeding, re-heating and re-heating factors (Problems omitted); Governing of steam turbines: Throttle, By-pass & Nozzle control governing.

Reference Books:

5. A Course in Thermal Engineering – S. Domkundwar & C.P. Kothandaraman, Dhanpat Rai & Publication, New Delhi
6. Thermal Engineering – R.K. Rajput, Laxmi Publication New Delhi
7. Thermal Engineering – P.L. Ballaney, Khanna Publishers, 2002
8. Treatise on Heat Engineering in MKS and SI Units – V.P. Vasandani & D.S. Kumar, Metropolitan Book Co. Pvt. Ltd, New Delhi.

Course outcomes:

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

CO1	Explain the working cycle of gas turbines, and the working of Jet and Rocket Engines apart from identifying the fuels used for Jet and Rocket propulsion.
CO2	Compute the work done, enthalpy, internal energy and entropy of steam at given conditions using steam tables and Mollier chart.
CO3	Distinguish between water tube and fire-tube boilers and explain the function all the mountings and accessories.
CO4	Calculate Velocity of steam at the exit of nozzle in terms of heat drop analytically and by using Mollier chart.
CO5	State the necessity of governing and compounding of a turbine.
CO6	Explain the principle of working of a steam turbine and distinguish between the impulse turbines and reaction turbines.

THERMAL ENGINEERING – II LAB

Course Objectives:

- To understand the working of boilers, compressors and IC engines.
- To observe various parts of engines and understand their functions.
- To perform various tests on IC engines and calculate performance parameters.
- To understand economical and optimum running conditions of the engines.

Course Content:

S.No.	Topics for practice
I	Study of high pressure boiler with model
II	Study of boiler mountings and accessories
III	Conduct performance test on VCR test rig to determine COP of the refrigerator
IV	Conduct performance test on multi stage reciprocating compressor
V	Conduct Morse test to determine the indicated power of individual cylinders
VI	Conduct Performance test on 2-S CI/SI engine.
VII	Conduct Performance test on 4-S CI/SI engine.
VIII	Conduct Heat balance test on CI/SI engine..
IX	Conduct Economical speed test on 4-S CI/SI engine.
X	Thermal conductivity test on 1) Thick slab 2) Composite wall 3) Thick cylinder
XI	Leak detection of refrigeration equipment
XII	Conduct performance test on A/C test rig to determine COP of the refrigerator

Reference Books:

1. Thermal Engineering – P.L. Ballaney, Khanna Publishers, 2002
2. A Course in Thermal Engineering – S. Domkundwar & C.P. Kothandaraman, Dhanpat Rai & Publication New Delhi
3. Thermal Engineering – R.S. Khurmi and J.K. Gupta, 18th Edition, S. Chand & Co, NewDelhi

Course outcomes

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

CO1	Evaluate the performance characteristics of single cylinder diesel/petrol engine at different loads and draw the heat balance sheet.
CO2	Find the indicated power of individual cylinders of an engine by using morse test.
CO3	Evaluate the performance characteristics Multi stage air compressor
CO4	Evaluate the co efficient of performance of refrigerator
CO5	Find the thermal conductivity of material

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DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN MECHANICAL ENGINEERING (M02)

SEMESTER IV

COURSE TITLE	:	MATERIAL HANDLING SYSTEM
PAPER CODE	:	7409
SUBJECT CODE	:	411
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Objectives:

- To know the operational features of the material handling equipment & its practical applications.
- To understand, select, operate and maintain the material handling equipments.
- To understand different material handling processes used in industries.
- To understand & appreciate safety instrumentation for equipment.

Course Content:

UNIT-I: Introduction to Material Handling System: Main types of Material handling equipments & their applications; Types of load to be handled; Types of Movements; Methods of stacking, loading & unloading systems; Principles of Material Handling Systems; Modern trends in Materials handling.

UNIT-II: Hoisting Machinery & Equipments: Construction, Working & Maintenance of different types of hoists such as Lever operated hoist, Portable hand chain hoist, Differential hoists, Worm geared and Spur geared hoists, Electric & Pneumatic hoists, Jumper; Construction, Working & Maintenance of different types of cranes such as Rotary cranes, Trackless cranes, Mobile cranes, Bridge cranes, Cable cranes, Floating cranes & Cranes traveling on guide rails; Construction, Working & Maintenance of Elevating equipments such as Stackers, Industrial lifts, Freight elevators, Passenger lifts, and Mast type's elevators, Vertical skip hoist elevators.

UNIT-III: Conveying Machinery: Construction, Working & Maintenance of Traction type conveyors such as Belt conveyors, Chain conveyors, Bucket elevators, Escalators; Construction, Working & Maintenance of Traction less type conveyors such as Gravity type conveyors, Vibrating & Oscillating conveyors, Screw conveyors, Pneumatic & Hydraulic conveyors, Hoppers gates & Feeders.

Surface Transportation Equipment: Construction, Function, Working of Trackless equipment such as Hand operated trucks, Powered trucks, Tractors, Automatic Guided vehicle, Industrial Trailers; Construction, Function, Working of Cross handling equipment such as Winches, Capstans, Turntables, Transfer tables, Monorail conveyors.

UNIT-IV: Components of Material Handling Systems: Flexible hoisting appliances such as Welded load chains, Roller chains, Hemp ropes, Steel wire ropes, Fastening methods of wire & chains, Eye bolts, Lifting tackles, Lifting & Rigging practices; Load handling attachments: a) Various types of hooks-Forged, Triangular eye hooks, Appliances for suspending hooks b) Crane grab for unit & piece loads c) Electric lifting magnet, vacuum lifter. d) Grabbing attachment for loose materials e) Crane attachment for handling liquids/molten metals; Construction & Working of Arresting gear & Brakes; Construction & use of electromagnetic shoe brakes, Thruster operated shoe brakes, Control brakes.

UNIT-V: Mechanism used in Material Handling Equipment: Steady state motion; Starting & stopping of motion in following mechanisms: Hoisting mechanism, Lifting Mechanism, Traveling Mechanism, Slewing Mechanism, Rope & chain operated Cross- Traverse Mechanism.

Selection of Material Handling Equipment: Factors affecting choice of material handling equipment such as Type of loads, Hourly capacity of the unit, Direction & length of travel, Methods of stocking at initial, final & intermediate points, Nature of production process involved, Specific load conditions & Economics of material handling system.

Reference Books:

1. Material handling (Principles & Practice) – Allegri T. H., CBS Publisher, New Delhi.
2. Plant Layout & Materials Handling – Apple J. M., JohnWiley Publishers.
3. Material Handling Equipment – N. Rundenko, Peace Publisher, Moscow.
4. Material Handling Equipment – M. P. Alexandrov, MIR Publisher, Moscow.
5. Material Handling Equipment – Y. I. Oberman, MIR Publisher, Moscow.

Course outcomes

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

CO1	Understand constructional & operational features of various materials handling systems.
CO2	Identify, compare & select proper material handling equipment for specified applications.
CO3	Know the controls & safety measures incorporated on material handling equipment.
CO4	Appreciate the role of material handling devices in mechanization & automation of industrial process.
CO5	Understand & appreciate safety instrumentation for equipment

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SEMESTER IV

COURSE TITLE	:	COMPUTER INTEGRATED MANUFACTURING
PAPER CODE	:	7410
SUBJECT CODE	:	412
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Learning Objectives:

- To understand different types of manufacturing available today such as the Special manufacturing System, the Manufacturing Cell, and the Flexible Manufacturing System (FMS).
- To learn the fundamentals of computer assisted numerical control programming and programming languages.
- To learn the concepts of Computer Integrated Manufacturing and Management System and automated flow lines.
- To learn the guidelines and criteria for implementing CAD/CAM Systems and associated software for design, Manufacturing, and a common CAD/CAM data base organized to serve both design and manufacturing.

Course Content:

UNIT-I: Concept of Computer Integrated Manufacturing (CIM); Basic components of CIM; Distributed database system; distributed communication system, computer networks for manufacturing; future automated factory; social and economic factors.

Unit-II: Computer Aided Design (CAD): CAD hardware and software; product modelling, automatic drafting; engineering analysis; FEM design review and evaluation; Group Technology Centre.

Unit-III: Computer Aided Manufacturing (CAM), Computer assisted NC part programming; Computer assisted robot programming; computer aided process planning (CAPP); computer aided material requirements planning (MRP)

Unit-IV: Computer aided production scheduling; computer aided inspection planning; computer aided inventory planning, Flexible manufacturing system (FMS); concept of flexible manufacturing.

Unit-V: Integrating NC machines, robots, AGVs, and other NC equipment; Computer aided quality control; business functions, computer aided forecasting; office automation

Reference Books:

1. CAD, CAM, CIM by P. Radhakrishnan and S. Subramanyan, New Age International Publishers.
2. Computer Integrated Manufacturing by Paul G. Rankey, Prentice Hall.
3. Robotics Technology and Flexible Automation – S.R. Deb, TMH

Course outcomes:

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

CO1	Understand basic components and networks involved in CIM.
CO2	Understand hardware, software and product modeling at industry level
CO3	Understand process planning and program coding of task.
CO4	Design a manufacturing cell and cellular manufacturing system.
CO5	Design automated material handling and storage systems for a typical production system.

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DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN MECHANICAL ENGINEERING (M02)

SEMESTER IV

COURSE TITLE	:	HEAT TRANSFER
PAPER CODE	:	7411
SUBJECT CODE	:	421
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Objectives:

- To understand the concepts of conduction.
- To understand the concepts of Fins heat transfer.
- To understand the concepts of radiation.
- To understand the concepts of convection.
- To understand the basics of heat exchangers.

Course Content:

UNIT-I: Conduction: Fourier law of heat conduction for isotropic material; Thermal conductivity; Derivation of the energy equation in three dimensions including transient effect; Nondimensional - thermal diffusivity and Fourier number; Types of boundary conditions (Dirchlet, Neumann, mixed type); One dimensional solution with and without heat generation; Analogy with electrical circuits.

Unit-II: Fins: rectangular and pin fins. Fin effectiveness and efficiency. Critical thickness of insulation. Lumped parameter approach and physical significance of time constant, Biot number, Validity of lumped parameter approach. Introduction to Heissler Chart.

Unit-III: Convection: Introduction, Newton's law of cooling; Momentum and energy equations in two dimensions; nondiemnsionalisation, importance of nondimensional quantities and their physical significance. Velocity and thermal boundary layer thickness by integral method. Analogies between momentum, heat and mass transfer. Natural convection, effect of coupling on the conservation equations.

Unit-IV: Radiation : Physical mechanism of thermal radiation, laws of radiation, dfeinition of black body, emissive power, intensity of radiation, emissivity, reflectivity, transmittivity, irradiation, radiosity. Radiation exchange between black bodies, concept of Gray-Diffuse Isotropic (GDI) surface. Radiation exchange between GDI surfaces by radiation network and radiosity matrix method. Radiation shielding.

Unit-V: Heat exchangers: Types of heat exchangers, parallel and counterflow types, Introduction to LMTD. Correction factors, fouling factor. NTU method for heat exchangers.

Reference Books:

1. Fundamentals of Heat and Mass Transfer by F.P.Incropera and D.P.Dewitt, 4th ed., John Wiley & Sons.
2. Heat Transfer - A Basic Approach by M.N.Ozisik, McGrawhill.
3. Heat Transfer by J.P.Holman, 8th ed., McGrawhill.
4. Elements of Heat & Mass Transfer by Vijay Gupta, 2nd ed., New Age International Publishers.

Course outcomes:

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

CO1	Understand the concepts of conduction
CO2	understand the concepts of fins
CO3	Understand the concepts of radiation.
CO4	Understand the concepts of convection
CO5	Understand the basic concepts of heat exchangers.

DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN MECHANICAL ENGINEERING (M02)

SEMESTER IV

COURSE TITLE	:	REFRIGERATION AND AIR-CONDITIONING
PAPER CODE	:	7412
SUBJECT CODE	:	422
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Objectives:

- To understand the basics of Refrigeration cycles.
- To understand basics of vapour compression and vapour absorbtion systems.
- To identify components and refrigerants and lubricants of a refrigeration system.
- To understand control strategies for refrigeration system.
- To understand the basics about air conditioning systems.

Course Content:

UNIT-I: Introduction to Refrigeration: Definition of Refrigeration; Refrigerating effect-unit of refrigeration- Coefficient of performance; Types of Refrigeration-Ice, dry ice, Steam jet, Throttling, Liquid nitrogen refrigeration; Carnot refrigeration Cycle; Air refrigeration- Bell - Coleman cycle, PV& TS diagram; Advantage and disadvantages in air refrigeration; Simple problems

Unit-II: Refrigeration systems: Basic Components, Flow diagram of working of Vapour compression cycle; Representation of the vapour compression cycle on P-H, T-S & P-V Diagram; Expression for Refrigerating effect, work done and power required; Types of Vapour Compression cycle; Effects of super heating and under cooling, its advantages and disadvantages; Simple Vapour absorptions cycle and its flow diagram; Simple Electrolux system for domestic units; Comparison of Vapour absorption and vapour compression system; Simple problems on vapour compression cycle.

Unit-III: Refrigeration equipments: Compressor - types of compressors; Hermetically sealed and Semi hermetically sealed compressor; Condensers - Air Cooled, water cooled, natural and forced draught cooling system; Advantages and disadvantages of air cooled and water cooled condensers; Evaporators -natural, convection, forced convection types.

Refrigerants and lubricants: Introduction to refrigerants; Properties of good refrigerants; Classification of refrigerants by group number and commonly used refrigerants in practice; Detection of refrigerants leakage; Charging the system with refrigerant; Lubricants used in refrigeration and their properties.

Unit-IV: Refrigerant flow controls: Capillary tube; Automatic Expansion valve; Thermo static expansion valve; High side and low side float valve; Solenoid valve; Evaporator pressure regulator.

Application of refrigeration: Slow and quick freezing; Cold storage and Frozen storage; Dairy refrigeration; Ice making industry; Water coolers.

Unit-V: Air conditioning: Introduction to Air conditioning; Factors affecting Air conditioning; Psychometric chart and its use; Psychometric process-sensible heating and cooling, Humidifying and dehumidifying; Adiabatic saturation process; Equipments used in air conditioning cycle; Air conditioning units and plants.

Refrigeration and Air-conditioning tools: Tools used in refrigeration and Air conditioner installation; Installation procedure; Faults in refrigeration and air conditioning system; Servicing procedure.

Reference Books:

1. Refrigeration and Air Conditioning – Sadhu Singh, Khanna Book Publishing Co., New Delhi
2. Refrigeration and Air Conditioning – S. Domakundawar, Dhanpat Rai publications.
3. Refrigeration and Air Conditioning – A.S.Sarao & G.S. Gabi, 6th edition, Satya Prakashan publications, New Delhi, 2004.
4. Principles of Refrigeration – Roy J.Dossat, 5th edition, Pearson Publications, 2001.
5. Refrigeration and Air Conditioning – M.Zakria Baig, Premier/ Radiant Publishing House.
6. Refrigeration and Air Conditioning – C.P Arora, Tata McGraw Hill Education, 2000.

Course outcomes

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

CO1	Define refrigeration and types of Refrigeration cycles
CO2	Explain Vapour Compression and Vapour Absorbtion System working principles
CO3	Identify the components required for refrigeration system.
CO4	Identify the controlling components for a refrigeration system.
CO5	Explain the working principles of Air-conditioning.

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DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

DIPLOMA IN MECHANICAL ENGINEERING (M02)

SEMESTER IV

COURSE TITLE	:	MINOR PROJECT
PAPER CODE	:	--
SUBJECT CODE	:	--
TREORY CREDITS	:	00
PRACTICAL CREDITS	:	02

MINOR PROJECT –

Evaluation is based on work done, quality of report performance in viva-voce, presentation etc.

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DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA,BHOPAL
DIPLOMA IN MECHANICAL ENGINEERING (M02)

SEMESTER IV

COURSE TITLE	:	ESSENCE OF INDIAN KNOWLEDGE AND TRADITION
PAPER CODE	:	--
COURSE CODE	:	--
TREORY CREDITS	:	00
PRACTICAL CREDITS	:	00

Course Content:

Basic Structure of Indian Knowledge System:

(i) वेद, (ii) उन्नवेद (आयवेद, धनुवेद गन्धवेद स्थान्नत्य आदद) (iii) वेदांग (शिक्षा कल्न ननरूत व्याकरण ज्योनतष छांद),

(iv) उन्नाइग (धर्म रीरांसा, नुराण, तकमिस्त्र)

- Modern Science and Indian Knowledge System
- Yoga and Holistic Health care
- Case Studies.

SUGGESTED TEXT/REFERENCE BOOKS:

S. No.	Title of Book	Author	Publication
1.	Cultural Heritage of India-Course Material	V. Sivaramakrishna	Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2.	Modern Physics and Vedant	Swami Jitatmanand	Bharatiya Vidya Bhavan
3.	The wave of Life	Fritzof Capra	
4.	Tao of Physics	Fritzof Capra	
5.	Tarkasangraha of Annam Bhatta, Inernational	V N Jha	Chinmay Foundation, Velliarnad, Amaku,am
6.	Science of Consciousness Psychotherapy and Yoga Practices	RN Jha	Vidyanidhi Prakasham, Delhi, 2016

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