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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
DTME601	DS	Industrial Engineering	60	20	20	0	0	2	1	0	3

Legends: L - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):

To introduction with (A) Industrial Engineering, (B) Production Planning and Inventory Control, Plant Layout and Material Handling, (C) Work Study.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Students will be able to understand basic concept of Industrial Engineering.
2. Students will be able to understand concept of Production Planning and Control and its importance.
3. Students will be able to understand concept of Inventory and solve basic problem related to Inventory control.
4. Students will be able to understand concept of Plant Layout & Material Handling system.
5. Students will be able to understand concept of Work Study and its importance.

Syllabus

Unit - I

Introduction to Industrial Engineering – Evolution of modern concepts in Industrial Engineering, historical development of concepts in Industrial Engineering, application of Industrial Engineering, Product Development, design function, objectives of design, manufacturing vs purchase, development of designs- prototype, production and testing, selection of materials and processes, human factors in design, value engineering, job plan. Preventive and break- down maintenance, replacement of equipments.

Unit - II

Production Planning and Control- Importance of planning, job, batch and mass production, determination of economic lot size in batch production, functions of production control, routing, scheduling, dispatching and follow up, Gantt charts. Quality control and inspection, life testing-

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bath tub curve. Introduction to concepts of bench marking, TQM, ISO, Six Sigma and quality circles (brief description only).

Unit - III

Inventory Control: Types of inventories, ABC analysis, concepts of Economic Order Quantity (EOQ), inventory control with deterministic demand, instantaneous and gradual replenishment, quantity discount, shortages. Problems on Simple inventory control model without shortages.

Unit - IV

Plant Layout & Material Handling: Introduction, Relationship between material handling and plant lay out, functions of material handling systems, objective of material handling system, study of plant layout, flow systems, types of layout, requirements of good plant layout, different material handling equipments.

Unit -V

Work Study: Introduction to Work Study, Productivity, Definition, benefits, measures of effectiveness, Productivity improvement techniques. Method study ; Definition, need, method study procedures; Flow Diagrams, String Diagrams, Process charts: Outline process chart; Flow Process Chart , Multiple activity chart, Travel chart, Workplace layout design, Principles of Motion Economy, Two handed process chart. Motion study, Work measurement;Work Sampling, Time study – procedures & equipments.

Reference:

1. *O. P. Khanna, Industrial Engineering and Management, Dhanpat Rai Publications (P) Ltd.*
2. *T. R. Banga & S. C. Sharma, Engineering Economics and Management, published by McGraw Hill, New Delhi.*
3. *Praveen Kumar, Industrial Engineering and Management, Pearson India Education Pvt. Ltd.*
4. *M Mahajan, Industrial Engineering & Production Management, Dhanpat Rai Pub.*
5. *Heinz Weihrich, Harold Koontz, Management, A global perspective, McGraw Hill international edition.*
6. *Joseph L. Massie, Essentials of Management, 4th Edition, Prentice-Hall of India, New Delhi.*

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT *	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT *				
DTME602	DS	Refrigeration and Air Conditioning	60	20	20	30	20	3	1	2	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):

To introduction with (A) Refrigeration, (B) Vapour Compression Refrigeration, (C) Refrigerants and Absorption Refrigeration (D) Psychrometric and Air conditioning loads calculation.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes -

1. Students would be able to understand the Refrigeration system, and its importance, need and applications.
2. Students would be able to analyses basics of vapour compression refrigeration.
3. Students would be able to understand desirable properties of refrigerants.
4. Students will be able to understand absorption refrigeration system.
5. Students would be able to calculation of psychrometric properties of air by tables and charts.
6. Students would be able to calculation of summer & winter air conditioning load.

Syllabus

Unit - I

Introduction to Refrigeration

Necessity and applications, Principles and methods of refrigeration, unit of refrigeration and C.O.P., Joule Thomson effect and reverse Carnot cycle; types of air-refrigeration, Joule's cycle Boot-strap cycle, Applications and limitations, advantages and disadvantages of air refrigeration cycle.

Unit - II

Vapour Compression Refrigeration

Working principle and essential components of the plant, simple vapour compression refrigeration cycle - COP, Representation of cycle on T-S and p-h charts - effects of sub cooling

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and super heating - cycle analysis - Actual cycle, Influence of various parameters on system performance – necessity of multi-staging, necessity and working of cascading system.

Unit – III

Refrigerants and Absorption Refrigeration

Desirable properties of refrigerants, classification of refrigerants used, nomenclature, environment friendly refrigerants and refrigerant mixtures, ozone depletion, global warming, vapor absorption system, calculation of max COP, description and working of NH3 - water system and Li Br –water, three fluid absorption system and its salient features.

Unit – IV

Psychrometric

Calculation of psychrometric properties of air by table and charts; psychrometric processes: sensible heating and cooling, evaporative cooling, cooling and dehumidification, heating and humidification, sensible heat factor; principle of air conditioning, requirements of comfort air conditioning, ventilation standards, infiltrated air load, fresh air load human comfort, effective temperature & chart, heat production & regulation of human body,

Unit-V

Air conditioning Loads

Calculation of summer & winter air conditioning load, bypass factor of coil, calculation of supply air rate & its condition, room sensible heat factor, grand sensible heat factor, effective sensible heat factor, dehumidified air quantity. Problems on cooling load calculation. Air distribution and ventilation systems

References

1. *Refrigeration and Air Conditioning by C. P. Arora, Tata McGraw Hill,*
2. *Refrigeration and Air Conditioning by A. R .Trott and T. C. Welch, Butterworth-Heinemann.*
3. *Refrigeration and Air Conditioning Technology by Whitman, Johnson and Tomczyk, Thomson Delmer Learning,*
4. *Refrigeration and Air Conditioning by Abdul Ameen, Prentice Hall of India Ltd, 5. Basic Refrigeration and Air Conditioning by P. N. Ananthanarayan, Tata McGraw Hill,*
5. *Refrigeration and Air Conditioning by Wilbert F. Stoecker and Jerold W. Jones, Tata McGraw Hill.*
6. *Refrigeration & Air Conditioning by Domkundwar.*
7. *Refrigeration & Air Conditioning by Manohar Prasad*
8. *ASHRAE Handbook – Refrigeration 2010, ISBN- 9781933742922.*

List of Experiments

1. General Study of vapor compression refrigeration system.
2. General Study of Ice Plant.
3. General Study of Electrolux Refrigeration.

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4. General Study of Water cooler.
5. General Study of Psychrometry (Absorption type)
6. General Study and working of Gas charging Rig.
7. General Study of window Air Conditioner.
8. General Study and working of Vapor compression Air conditioning Test rig.
9. Experimentation on Vapor compression Air Conditioning test rig.
10. General Study and working of Vapor absorption refrigeration system.

Further Necessities: Cold storage visit give greater clarity about important refrigeration concepts and functioning of all components of refrigeration system, as students practically experience how these fundamental concepts are put into action.

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
DTME603	DS	Fabrication Technology	60	20	20	30	20	2	1	2	4

Legends: L - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):

To introduction with (A) Fabrication, (B) Various welding technology, (C) Inspection, errors and testing of welding joints.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Students would be able to understand the need and importance of fabrication technology in industries.
2. Students would be able to inspect drawing of various welding joints.
3. Students would be able to perform test on welded joint to check their strength.
4. Students will be able to proposed safety guideline for welding operation.
5. Students would be able to recognize production methodology and their need.
6. Students would be able to perform different thermal sheet metal joining operations

Syllabus

Unit - I

Introduction : Need and scope of fabrication technology in industries , Weldability-concept, meaning, definition and factors affecting it and its importance , Power source-classification, advantages, limitations, features, applications and selection criteria.

Unit - II

Drawing Interpretation: Welding location of elements, welding general nomenclature, welding symbols as per IS: 696-1972, welding supplementary symbols, abbreviations used for welding processes and welding position , Interpretation and method to work out bill of material for following types of drawings: i. Welding / fabrication. ii. Process and instrumentation. iii. Piping isometric , Welding documents - Weld Test Plan (WTP) and Shop Weld Plan (SWP) , Need and

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application areas of different codes used in fabrication industries remaining ASME sections, ASTM, AWS, IS, BIS, JIS, EN, DIN, TEMA, EJMA.

Unit - III

Fabrication Processes and Safety: Preheating and inter-pass: need, method and applications , Post heating-need, method and applications , Post Weld Heat Treatment (PWHT)need, methods, applications and selection criteria , Methods of relieving thermal stresses , Arc welding parameters-setting criteria: i. Voltage. ii. Current. iii. Welding speed. iv. Welding feed. v. Arc length, Advance welding methods and their applications. Ultrasonic welding. Laser beam welding. Electron beam welding. Friction stir welding , Need, precautions and safety norms during welding and fabrication process.

Unit - IV

Inspection and Testing.: Common weld defects, their causes and remedies , Thermal distortion-concept, meaning, definition, causes, effect and types , Weld quality-concept, meaning, definition, importance and affecting factors.

Introduction to inspection and testing: Stages of inspection , Types, methods of testing and importance of destructive testing (DT).(tensile test, compressive test, impact test, bend test, hardness test.) Special types of test like Hydro test, Pneumatic test, and Leak test by soap water and helium gas.

Unit-V

Surface preparation, Finishing and Coating Methods: Surface preparation methods, sand blasting and ball blasting , Surface finishing methods, brushing and grinding , Surface colour coating by brush, roller and spray applications.

Installation, Erection and Commissioning: Erection steps for equipment to be fabricated , Erection steps for piping , Installation and commissioning procedures for plant machineries and fabricated equipment.

References

1. *Welding technology by Khanna,O.P; Dhanpat Rai Publications, New Delhi - 22nd Edition*
2. *Welding engineering and technology by Parmar, R.S. ; Khanna Publishers, New Delhi - 1st edition.*
3. *Structural steel fabrication and erection by Saxena, S.K.; Asthana, R.B. ; Somaiya Publishers, New Delhi – 3rd edition.*
4. *Metal cutting science and production technology by Jain, K.C.; Agrawal L.N. ; Khanna Publishers, New Delhi 4th edition.*
5. *Metal fabrication technology ,Syamal Mukherjee ,PHI.*

List of Experiments

1. Prepare Sheet Metal Pattern Development of Box.
2. Prepare Sheet Metal Pattern Development of Funnel.

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3. Prepare Sheet Metal Pattern Development of Three Piece Elbow.
4. Perform Gas welding operation on given job (Two jobs of different type).
5. Perform Spot welding operation on given job.
6. Perform Upset butt welding operation on given jobs (Two jobs of different type).
7. Perform any two quality test on welded joint.
8. Inspect strength of joint by any one method.

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
DTME604(A)	DES	Operational Research and SCM	60	20	20	30	20	2	1	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):

Describe various theories of organizations, their characteristics, strengths, and Weaknesses (A) Operation Research (B) Application of operation research (C) Supply chain management and concepts.

Course Outcomes (COs):

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Collaborative project experiences involving both written and oral presentations.
2. Courses with significant experiential learning components.
3. Experiences with identifying, accessing, evaluating, and interpreting information and data
4. In support of assignments, projects, or research.
5. Course experiences with large-scale datasets.

Syllabus

Unit – I

Introduction: History and development of Operations Research, Scientific Methods, Characteristics, Scope, Models in Operations Research.

Linear Programming: Formulation, graphical methods, simplex method, Big- M- method.

Unit – II

Assignment Models: Definition, Mathematical Representation, Formulation and Solution, Alternate optimal solution.

Transportation Models: Definition, Formulation and solution, Alternate optimal solution, Stepping stone method, Modified distribution (MODI) or u-v method.

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Unit - III

Forecasting: Introduction, Definition, Need of Forecasting, Applications and Limitations of forecasting. Forecasting methods, Qualitative vs. quantitative methods Average approach Time series methods Causal /Forecasting accuracy econometric forecasting methods.

Unit - IV

Network Analysis: Network diagram, Time estimation, Basic steps in PERT and CPM, PERT computation, CPM computation, critical path, Float, Cost analysis, crashing the network.

Unit-V

Introduction to SCM: Definition, elements of supply chain, building blocks of supply chain network, drivers of supply chain, Decision making in supply chain, Decision making models, supply chain performance measurement.

References:

1. *"Operations Research", by Perm Kumar Gupta, Dr. D.S Hira, S. Chand publication.*
2. *"Operations Research",by Tasha Hamady 7th edition, (USA: Macmillan PublishingCompany), 2003*
3. *"Operations Research", by Tasha, Tata McGraw Hill.2002*
4. *"Operations Research", by Wagner, PHI. New Delhi, 2003*
5. *"Operations Research", by Ravi dram & Philips, Tata McGraw Hill.2005*
6. *"Quantitative Techniques for Management" by Vohra N.D, Kataria S.K, Tata McGraw Hill, 2004*

List of Experiments:

1. Use computer and software to solve problems contained in the syllabus.
2. Case studies in SCM.

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
DTME604(B)	DES	Hydraulic and Pneumatic Devices	60	20	20	30	20	2	1	2	4

Legends: L - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):

The course should be taught and curriculum should be implemented with (A) The aim to develop required skills in the students (B) Identify and solve various Hydraulic and Pneumatic problems.

Course Outcomes (COs):

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

1. Draw symbols used in hydraulic systems.
2. Operate different types of valves used in hydraulic systems
3. Classify the valves used in hydraulic systems.
4. Maintain different valves and auxiliaries.
5. Assemble pumps and motors to rectify problems.
6. Develop efficient hydraulic circuits.
7. Maintain the pneumatic and hydraulic system

Syllabus

Unit - I

Basic Concepts of Hydraulics: Introduction & Definitions of important terms like Hydraulics, Pressure, Force, Vacuum etc., and Pascal's Law and its Application to Hydraulics, Bernoulli's Principle, Hydraulic Jack, Hydraulic Symbols, Advantages and Disadvantages of Hydraulic System, Hydraulic Oil, Purpose of Hydraulic Oil, Ideal Characteristics of Hydraulic Oil, Maintenance of Hydraulic Oil

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Unit - II

Accessories of Hydraulic System: Classify the accessories use in hydraulic system i.e. Connectors, Steel pipe, Tubing, Hose, Gauges, Packing & Seals, Filters & Strainers, Hydraulic Tank.

Hydraulic Valves and Auxiliaries: Directional Control Valves, Pressure Control Valves, Flow Control Valves, Pressure Intensifiers, Accumulators, Cartridge Valves.

Unit - III

Hydraulic Pumps and Motors: Pump Specifications, Construction & Working of Gear Pump, Vane Pump, Radial Piston Pump , Pump Maintenance & Trouble Shooting , Hydraulic Motor Specifications, Construction & Working of Gear Motor, Vane Motor, Radial Piston Motor.

Unit – IV

Hydraulic Circuits: Clamp Control Circuit, Injection Control Circuit, Reciprocating Screw Circuit Oil Filtration Circuit, Deceleration Circuit, Prefill Circuit, Hydraulic Motor Circuit, Hi-Low Pump Circuit.

Unit-V

Pneumatics: Pneumatics, Comparison with Hydraulic System, Air Compressors: Single Acting and Double Acting, Components of Pneumatic System , Air receiver and pressure control, Stages of Air Treatment, Intercooler, Lubricator, Filter, Air dryer, Pneumatic Circuit for Plastic Processing Machine.

References:

1. *"Hydraulic and Pneumatic Power and Control", Yeaple D. Franklin, McGraw-Hill.*
2. *"Hydraulic and Pneumatic controls", Shanmugasundaram.K, Chand & Co, 2006.*
3. *"Oil Hydraulics Systems-Principles and Maintenance", Majumdar, S.R., Tata McGraw Hill, 2001*
4. *"Pneumatic Systems-Principles and Maintenance", Majumdar, S.R., Tata McGraw Hill, 2007.*
5. *"Power Hydraulics", Micheal J, Pinches and Ashby, J.G., Prentice Hall, 1989.*
6. *"Fluid Power with Applications", Anthony Esposito," PHI / Pearson Education, 2005.*
7. *"Basic Fluid Power", Dudelyt A. Pease and John J Pippenger, Prentice Hall, 1987.*
8. *"Hydraulic and Pneumatic Control", Srinivasan. R, IIndEdition, Tata McGraw-Hill Education.*
9. *"Industrial Hydraulic Manual", Vickers (Second Edition).*
10. *"Hydraulics and Pneumatics", Parr Andrew, Elsevier (Third Edition).*

List of Experiments:

1. Demonstrate application of Pascal's law in hydraulic system.
2. Demonstrate various accessories and their uses in hydraulic system.
3. Demonstrate use of directional control valves.

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4. Demonstrate use of pressure control valves.
5. Demonstrate application of flow control valves.
6. Demonstrate applications of various types of pumps.
7. Demonstrate use of hydraulic motors.
8. Demonstrate application of injection control circuit.
9. Demonstrate use of clamp control and reciprocating screw circuits.
10. Demonstrate application of single stage compressors.

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM	MST	Quiz/Assignment	END SEM	LAB WORK				
DTME604(C)	DES	Foundry Technology	60	20	20	30	20	2	1	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C – Credits

Course Educational Objectives (CEO s): This course provides:

(A) A basic understanding of foundry practice and metal casting as one of the important manufacturing processes. (B) An explanation of the fundamental process of solidification of pure metals and alloys. (C) Sand molding and permanent die molding are explained in detail. (D) The standard foundry practices for casting of ferrous and non-ferrous alloys elaborated. (E) An overview of the designing of molds, casting defects, inspection and testing of castings and modernization of foundries.

Course Outcomes (CO s):
After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes:

1. Be able to understand casting process and the steps involved in casting.
2. Be able to analyze the basic foundry furnace, pattern and pattern making.
3. Be able to understand the requirement of sand molding and various properties.
4. Know about the various molding processes and their use.
5. Be able to understand the different foundry practices such as cast iron, steels.

Syllabus

Unit - I
Introduction: Introduction to casting process and the steps involved; Components produced by casting process, Comparison of metal casting with metal joining, Advantages and limitations of casting process, Rate of solidification; Chvorinov's Rule.

Unit - II

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Foundry Furnaces: Types of foundry furnaces – crucible, pot and reverberatory furnace; Cupola; Electric arc furnace, Induction furnace.
Patterns and Pattern Making: Definition, functions; Materials used for patterns, pattern allowances and their significance; Classification of patterns; BIS colour coding of patterns, Core boxes.

Unit - III
Sand Molding: Types and requirements of base sand; Binders and additives used – types and properties; Molding tools and equipment – hand molding tools, molding machines – Jolt type, squeeze type, Jolt and Squeeze type; Cores – types, core prints, core venting and baking, core shifting and chaplets, method of making cores, binders used, core sand molding; stack molding, green sand molding, dry sand molding, loam molding.

Unit - IV
Special Molding Processes: Study of important molding processes, No bake molds, Flask less molds, Sweep mold, CO2 mold, Shell mold, Investment mold.
Metal Molds: Gravity die casting, Pressure die casting, Centrifugal casting, Squeeze casting, Slush casting, Thixo-casting, Continuous casting.
Non-Metal Molding: Plaster and Ceramic molding; Expandable pattern mold casting.

Unit-IV
Types of Gates. Element of gating system. Design of gating system. Gating ratios and chills. Casting Process Planning, Cost estimation and product design for castability

Unit-V
Finishing processes: Fettling and cleaning of castings; removal of gates and risers, grinding.
Inspection and testing of castings: Defects in castings – types, causes and remedies; Inspection and non-destructive testing of castings.
Modernization and mechanization of foundry: Material handling; Pollution control in foundry; Application of computers in casting process.

Text Books:

1. *P.N.Rao, "Manufacturing Technology: Foundry, forming and welding", 3rd Ed., Tata McGraw Hill, 2003*
2. *R.A.Flinn, "Fundamentals of Metal casting", Addison Wesley, 1963.*
3. *R.W. Heine, C.R.Loper & P.C. Rosenthal, "Principles of Metal casting", Tata McGraw Hill, 2001.*
4. *R.A. Lindberg, "Processes and Materials for Manufacturing", 4th Ed, Pearson Education, 2006.*
5. *"ASM Handbook: Volume 15: Casting" 9th Ed., American Society of Metals, Ohio, 2008.*

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List of Experiments:

1. To Study about Pattern and Pattern Making.
2. To Study about Mould and Mould Making.
3. To Study about Melting Furnaces.
4. To Study about Gating Systems.
5. To Study about Finishing Processes.
6. To Study about Advance Casting Processes.
7. To Study about Inspection and Testing of Casting.
8. To Study about Modernization and Mechanization of Foundry.
9. Foundry Industries Industrial Visit with student's individual report.

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
DTME605	DS	CNC Technology Lab	0	0	0	30	20	0	0	4	2

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):

To introduction with (A) To study the basic principles and applications of the CNC machine tools (B) To provide the student with an understanding of the modern CNC machine tools and their programming methods.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes:

1. Understand the basic principle of CNC machine tools.
2. Describe tooling and work holding devices for CNC machine tools.
3. Explain drives and positional transducers used in CNC machine tools.
4. Able to program for CNC machine tools.

Syllabus

Unit – I

Introduction to CNC Machine Tools: Evolution of CNC Technology, principles, features, advantages, applications, CNC and DNC concept, classification of CNC Machines – turning centre, machining centre, grinding machine, EDM, types of control systems, CNC controllers, characteristics, interpolators– Computer Aided Inspection.

Unit - II

Structure of CNC Machine Tool: CNC Machine building, structural details, configuration and design, guide ways-Friction, Anti friction and other types of guide ways, elements used to convert the rotary motion to a linear motion-Screw and nut, recirculating ball screw, planetary roller screw, recirculating roller screw, rack and pinion, spindle assembly, torque transmission elements- gears, timing belts, flexible couplings, Bearings.

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
DTME605	DS	CNC Technology Lab	0	0	0	30	20	0	0	4	2

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):

To introduction with (A) To study the basic principles and applications of the CNC machine tools (B) To provide the student with an understanding of the modern CNC machine tools and their programming methods.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes:

1. Understand the basic principle of CNC machine tools.
2. Describe tooling and work holding devices for CNC machine tools.
3. Explain drives and positional transducers used in CNC machine tools.
4. Able to program for CNC machine tools.

Syllabus

Unit – I

Introduction to CNC Machine Tools: Evolution of CNC Technology, principles, features, advantages, applications, CNC and DNC concept, classification of CNC Machines – turning centre, machining centre, grinding machine, EDM, types of control systems, CNC controllers, characteristics, interpolators– Computer Aided Inspection.

Unit - II

Structure of CNC Machine Tool: CNC Machine building, structural details, configuration and design, guide ways-Friction, Anti friction and other types of guide ways, elements used to convert the rotary motion to a linear motion-Screw and nut, recirculating ball screw, planetary roller screw, recirculating roller screw, rack and pinion, spindle assembly, torque transmission elements- gears, timing belts, flexible couplings, Bearings.

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Unit - III

Drives and Controls: Spindle drives-DC shunt motor, 3 phase AC induction motor, feed drives stepper motor, servo principle, DC and AC servomotors, Open loop and closed loop control, Axis measuring system-synchro, synchro-resolver, gratings, moiré fringe gratings, encoders, inductosysn, laser interferometer.

Unit - IV

CNC Programming: Coordinate system, structure of a part program, G & M Codes, tool length compensation, cutter radius and tool nose radius compensation, do loops, subroutines, canned cycles, mirror image, parametric programming, machining cycles, programming for machining centre and turning centre for well known controllers such as Fanuc, Heidenhain, Sinumerik etc., generation of CNC codes from CAM packages.

Unit-V

Tooling and Work Holding Devices: Introduction to cutting tool materials-Carbides, Ceramics, CBN, PCD–inserts classification- PMK, NSH, qualified, semi qualified and preset tooling, tooling system for Machining centre and Turning centre, work holding devices for rotating and fixed work parts, economics of CNC, maintenance of CNC machines.

References:

1. *"Computer Numerical Control Machines", by Radha krishnan P, New Age Publication, 2012.*
2. *"CAD/CAM", by Rao P.N., Tata McGraw-Hill Publishing Company Limited, New Delhi, 2002.*
3. *"Mechatronics", by HMT Ltd., Tata McGraw-Hill Publishing Company Limited, New Delhi.*
4. *"Computer Numeric Control", by Warren S.Seamers, Fourth Edition, Thomson Delmar, 2002*
5. *"CNC Machining Hand Book", by James Madison, Industrial Press Inc., 1996.*
6. *"Programming of CNC Machines", by Ken Evans, John Polywka & Stanley Gabrel, Second Edition, Industrial Press Inc, New York, 2002*
7. *"CNC Programming Hand book", by Peter Smid, Industrial Press Inc., 2000*
8. *"Introduction to Computer Numerical Control", by Berry Leathan – Jones, Pitman, London, 1987.*

List of Experiments:

1. Preparatory activity: a. Collect mechanical components manufactured on CNC machines and show difference compared to conventional machining b. Identify operations on those components. c. Prepare conventional process plan for at least two components.
2. Demonstrate constructional features and modes of operations of CNC.
3. Demonstrate inserts, holders and tool management systems.
4. Develop and simulate CNC Turning part program (at least five) ,identify errors and manufacture on CNC turning machine.
5. Develop and simulate CNC Milling part program (at least five) and identify errors and manufacture on CNC milling machine.
6. Prepare part program with CAD/ CAM software (like master cam, NX) and interface with CNC machine.
7.

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
DTME606	DS	MAJOR PROJECT	0	0	0	100	50	0	0	8	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 15 marks.

Course Educational Objectives (CEOs):

(A) To develop the ability to solve a specific problem right from its identification to successful solution of the same. (B)To train the students in preparing project reports and viva voce examination.

Course Outcomes (COs):

After completion of this course the students are expected to be able to

1. Identify real world problems of mechanical engineering and related systems.
2. Interpret the working of mechanical engineering systems.
3. Apply the principles of mechanical engineering in real world systems.
4. Criticize and experiment to arrive at solutions for real world mechanical engineering problems.
5. Analyse and evaluate to obtain solution for problems in mechanical engineering systems.
6. Develop a prototypes/models, experimental set-up and software systems necessary to meet the objectives.
7. Identify methods and materials to carry out experiments/develop code.
8. Reorganize the procedures with a concern for society, environment and ethics.
9. Analyze and discuss the results to draw valid conclusions.
10. Prepare a report as per recommended format and defend the work.

Syllabus/Guidelines

1. Major Project Title

Each major project will cover all the aspects (to the extent possible) of real life application of concepts studied under the program. Alternately, a few research problems also may be identified for investigation. The project shall be driven by realistic constraints like that related to economic, environmental, social, political, ethical, health & safety, manufacturability and sustainability. The outcomes to be attained by students by doing the project work shall be spelt out clearly. A

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project report is to be submitted on the topic which will be evaluated during the final review. Assessment procedure will be as spelt out in the regulations.

2. Evaluation

Evaluation of major project will be as per guidelines of H.O.D/project coordinator/guide. But, progress report must be submitted by student(s) at-least in every 15 days period to project coordinator/guide for evaluation.

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