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OURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
							THEORY			PRACTICAL	
			L	T	P	CREDITS	END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTME501	DCS	OPERATION RESEARCH AND SUPPLY CHAIN	3	0	0	3	60	20	20	0	0

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 10 marks.

Course Educational Objectives (CEOs):

This course provides a fundamental understanding of (A) linear programming, assignment models and transportation model (B) Network model, waiting line models and (C) Supply chain management.

Course Outcomes (COs):

After completion of this course the students will be able to describe the followings:

1. Students will be able to solve linear-programming problems.
2. Students will be able to solve assignment and transportation problems.
3. Students will be able to do network analysis and waiting line problems.
4. Students will be able to understand & describe supply chain, inventory management and supply chain integration.

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.

Linear programming models:

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.

Sequencing Models: Processing n jobs through two machines, m machines and processing two jobs through m machines, minimal path problem

Unit-II

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

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Unit-III

Waiting Line and Dynamic programming Models:

Waiting Line Model: Introduction, classification, state in queue, probability distribution of arrival and service times, Single server model (M/M/I), Multiple server model (MMS), Birth and death process.

Dynamic Programming: Introduction, Distribution characteristic, dynamic programming approach, optimal subdivision problem.

Unit-IV

Game Theory: Game Theory and Simulation Theory of Game, Competitive game, two persons, zero sum games, maxima and minima Principles, Saddle point, Method of Dominance, graphical and algebraic method of solution by transforming into linear programming problem, Monte-Carlo simulation and application.

Unit-V

Supply Chain and its Importance: Introduction and advantages of SC, Key National and International issues.

SC Integration: Push, pull and push-pull systems, SC strategies, direct shipment, cross-docking transshipment, centralized versus decentralized control, central versus local facilities.

SC Inventory Management and Risk Pooling: Single warehouse inventory, the economic lot size model, the effect of demand uncertainty, supply contracts, multiple order opportunities, continuous review policy, variable lead times, periodic review policy, risk pooling, centralized versus decentralized systems, forecasting techniques. Bullwhip effect, information and SC trade-offs.

Planning Demand and Supply in a SC: Demand forecasting in SC, Aggregate planning in a SC. Logistics and SC Network Configuration

Reference Books:

1. *"Textbook of Logistics and Supply Chain Management" by D. K. Agrawal, Macmilan, 2003.*
2. *"Fundamentals of Supply Chain Management: Twelve Drivers of Competitive Advantage" by John T. Mentzer, SAGE Publications, 2004.*
3. *"Operations Research" by Tasha Hamady 7th edition, (USA: Macmillan Publishing Company), 2003.*
4. *"Operations Research" by Perm Kumar Gupta,Dr. D.S Hira, S.Chand publication, 2010.*
5. *"Operations Research" by Tasha, Tata McGraw Hill, 2002.*
6. *"Operations Research" by Wagner, PHI. New Delhi, 2003.*
7. *"Operations Research" by Ravi dram & Philips, Tata McGraw Hill, 2005.*
8. *"Operations Research" by Gupta & Hira, S. Chand. 1ed, 2008.*

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							THEORY			PRACTICAL	
			L	T	P	CREDITS	END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTME502	DCS	METROLOGY AND MECHANICAL MEASUREMENT	2	1	2	4	60	20	20	30	20

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 10 marks.

Course Educational Objectives (CEOs)

To introduce basic principles and applications of (A)Metrology and Inspection (B)Linear and angular, force, torque and temperature measurements, (C) Displacement, Velocity/Speed, and Acceleration, Measurement, (D)metrology of screw threads and gears.

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. Students will describe basic concepts of Metrology
2. Students will select linear measuring instrument for measurement of various components
3. Students will select angular and taper measurement devices for measurement of various components
4. Students will select appropriate temperature measuring device for various applications
5. Students will describe methods of measurement for various quantities like force, torque, power, displacement, velocity/seed and acceleration
6. Students will be able to describe the metrology of screw threads and gears.

Syllabus

Unit - I

General concepts of measurement: Definition-standards of measurement; errors in measurement, limit-gauging, various systems of limits, fits and tolerance, interchangeability, ISI and ISO system, basic principles and design of standards of measuring gauges; types of gauges and their design, accuracy and precision, calibration of instruments, principles of light interference, interferometer, measurement and calibration.

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Unit – II

Linear and angular measurements: Slip gauges, micrometers, Vernier's, dial gauges, surface plates, comparators; mechanical, electrical, pneumatic and optical comparator; angular measuring instruments; sine bar, angle gauges; spirit level, autocollimators, clinometers; measurement of straightness, flatness and squareness.

Measurement of surface finish: Surface finish definitions, types of surface texture, surface roughness measurement methods, comparison, profile-meters, pneumatic and replica, measurement of run out and concentricity.

Unit –III

Metrology of screw threads and gears: internal/external screw thread, terminology, measurement of various elements of threads, thread micrometer method, two wire and three wire methods; gear terminology; measurement of various elements, constant chord method, base tangent method, plug method; gear tester, gear tooth measurement; rolling gear tester.

Unit – IV

Temperature Measurement: Temperature standards, Temperature scales, Thermometry based on thermal expansion, Liquid in glass thermometers, Bimetallic Thermometers; Electrical resistance thermometry: Resistance Temperature Detectors, Thermistors, Thermoelectric Temperature Measurement, Temperature measurement with thermocouples, thermocouple standards.

Pressure and Velocity Measurement: Relative pressure scales, pressure reference instruments, barometer, manometer, deadweight tester, pressure gauges and transducers, total and static pressure measurement in moving fluids.

Unit-V

Strain Measurement: Stress and strain, resistance strain gauges, gauge factor, strain gauge electrical circuits, multiple Gauge Bridge, bridge constant, apparent strain and temperature compensation, bending compensation Motion.

Force measurement: Load cells, piezoelectric load cells.

Torque measurement: Measurement of torque on rotating shafts, Power estimation from rotational speed and torque.

Reference books:

1. *"Elements of Workshop Technology", by Hajra Choudhury, Vol .II. Media Promoters,1986*
2. *"Manufacturing Technology - Metal Cutting and Machine Tools", by Rao. P.N, Tata McGraw-Hill, New Delhi, 2003.*
3. *"Machine Tool Practices", by Richerd R Kibbe, John E. Neely, Roland O. Merges and Warren J. White, Prentice Hall of India, 1998.*
4. *"Fundamentals of Metal Machining and Machine Tools", by Geofrey Boothroyd, Mc Graw Hill, 1984.*

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5. *"Process and Materials of Manufacture," by Roy. A. Lindberg, Fourth Edition, PHI/Pearson Education 2006.*
6. *"Engineering metrology and instrumentation," by Rajput R.K, Kataria & sons publishers.2009*
7. *"A text book of engineering metrology," by Gupta. I.C., Dhanpat rai and sons.2006.*

List of Experiments

1. To Measure the angle using Sine bar.
2. To study and use of Vernier's, micrometer and dial gauges
3. To study Performance on surface measurements
4. To study Measurement of straightness, flatness and squareness
5. To study Measurements of Surface roughness using Mechanical Comparator.
6. To study Performance on linear and angular measurements and check different characteristics of measurements.
7. To study Performance on Temperature measurements and check different characteristics of measurements and also do calibration.
8. To study Performance on Stress, strain and force measurements and check different characteristics of measurements and also do calibration.
9. To study Performance on Speed/Velocity, acceleration measurements.
10. To study Measurement of screw threads by one wire and two wire

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							THEORY			PRACTICAL	
			L	T	P	CREDITS	END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTME503	DCS	DYNAMICS OF MACHINE	3	1	2	5	60	20	20	30	20

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 10 marks.

Course Educational Objectives (CEOs):

To introduce basic principles and applications of (A) Engine Mechanisms, (B)Governor Mechanisms, (C) Balancing of Inertia Forces, Friction and Brakes

Course Outcomes (COs):

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

1. Student would be able to understand the need of Mechanisms in engine parts.
2. Students would be able to understand basics of Displacement, velocity and acceleration of piston.
3. Students would be able to understand Governor Mechanisms.
4. Students would be able to understand the basics of Balancing of masses.
5. Students would be able to understand utility of Friction in Machine parts.
6. Students would be able to analyze Cam movement.

Syllabus

Unit - I

Dynamics of Engine Mechanisms: Displacement, velocity and acceleration of piston; turning moment on crankshaft; turning moment diagram; Fluctuation of crankshaft speed; Analysis of flywheel.

Unit - II

Governor Mechanisms: Types of governors, characteristics of centrifugal governors, gravity and spring controlled centrifugal governors; hunting of centrifugal governors; inertia governors.

Unit - III

Balancing of Inertia Forces: Balancing of rotating masses; Two plane balancing; Determination of balancing masses (graphical and analytical methods); Balancing of rotors; Balancing of internal combustion engines, Single cylinder engines, In-line engines, V-twin

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engines, Radial engines, Lanchester technique of engine balancing.

Unit - IV

Friction: Frictional torque in pivots and collars by uniform pressure and uniform wear rate criteria, Boundary and fluid film lubrication, friction in journal and thrust bearings, concept of friction circle and axis, rolling friction.

Unit-V

Belt drives: Velocity ratio, limiting ratio of tension; power transmitted; centrifugal effect on belts; maximum power transmitted by belt; initial tension; creep; chain and rope drives.
Brakes: Band brake; Band and block brakes, Internal and external shoe brakes.
Dynamometer: Different types and their applications.
Dynamic Analysis of Cams: Response of un-damped cam mechanism (analytical method), follower response analysis by phase-plane method, jump and cross-over shock.

Reference Books:

1. *"Theory of machines", by Rattan; Publisher: TMH, 2009.*
2. *"Mechanism and Machine Theory", by Ambekar; Publisher: PHI, 2007.*
3. *"Theory of Machines", by Thomas Bevan; Publisher: Pearson, 2010.*
4. *"Theory of Mechanisms and Machines", by Ghosh and Malik; Publisher: East-West Press, 2015.*
5. *"Kinematics and dynamics of machinery", by Norton RL; Publisher: TMH, 2009.*
6. *"Theory of Machines", by P.L. Balaney; Publisher: Khanna, 2003.*

List of Experiments

1. To Perform Experiment on Watt and Porter Governors & also Prepare Performance Characteristic Curves in order to find Stability & Sensitivity.
2. To Perform Experiment on Proell Governor & also Prepare Performance Characteristic Curves in order to find Stability & Sensitivity.
3. To Perform Experiment on Hartnell Governor & also Prepare Performance Characteristic Curves in order to find Stability & Sensitivity.
4. To determine gyroscopic couple on Motorized Gyroscope.
5. To study gyroscopic effects through models.
6. To study Dynamically Equivalent System.
7. To study different types of dynamometers.
8. To study different types of clutch.
9. To study different types of Brakes.
10. To Study dynamic behavior of cam & follower under various operating conditions using CAM Analysis Apparatus.

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			L	T	P	CREDITS	THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTME504	DCS	INTERNAL COMBUSTION ENGINES	3	1	2	5	60	20	20	30	20

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 10 marks.

Course Educational Objectives (CEOs)

This course provides a fundamental understanding (A) To impart the knowledge of working of I.C. engines (B) To impart the knowledge of fuel injection and ignition system (C) To impart the detail knowledge of fuel combustion (D) To develop the knowledge of cooling and lubrication system of IC engines(E) To impart the ability of determination of engine performances through Testing.

Course Outcomes (COs)

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

1. Demonstrate the working of IC engines.
2. Describe the fuel injection and ignition system.
3. Explain the fuel combustion within IC engine.
4. Understand the cooling and lubrication system.
5. Evaluate Engine performance.

Syllabus

Unit - I

Air Standard Cycles: Internal and external combustion engines, classification and applications of I.C. Engines, IC engine components and terminology, four stroke cycle engines and two stroke cycle engines, Assumptions made in air standard cycle; Otto cycle, diesel cycle, dual combustion cycle, comparison of Otto, diesel and dual combustion cycles, Stirling and Ericsson cycles, air standard efficiency, specific work output, specific weight, work ratio, mean effective pressure, deviation of actual engine cycle from ideal cycle, valve and port timing diagrams.

Unit - II

Carburetion: factors influencing carburetion; mixture requirements for various operating conditions, types of carburettors.
Fuel Injection System: Functional requirements of an injection system, types of inject systems, components of injection system.
Ignition System: Requirements of ignition system, battery ignition system, magneto ignition system, electronic ignition system, firing order, ignition timing.

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Unit - III

Combustion in S.I. engines: Stages of combustion in S.I. engines; effect of engine variables on ignition lag, combustion phenomenon; knock in S.I. engines; effects of engine variables on knock, combustion chamber for S.I. engines.

Combustion in C.I. engines: Stages of combustion in C.I. engines; variables affecting delay period; knock in C.I. engines; C.I. engine combustion chambers.

Unit - IV

Lubrication and Cooling Systems: Functions of a lubricating system, types of lubrication system; mist, wet sump and dry sump systems, crankcase ventilation, properties of lubricant, SAE rating of lubricants, engine performance and lubrication, necessity of engine cooling; effect of engine variables on engine heat transfer, different types of cooling systems.

Unit - V

Performance parameters of IC engines: Engine power, engine efficiencies, mechanical efficiency, brake mean effective pressure and indicative mean effective pressure, torque, specific fuel consumption (BSFC, ISFC), variable affects engine performance, heat balance, engine performance curves.

Engine measurements and Testing: Friction power, indicated power, brake power, fuel and air consumption, speed, temperature of coolant and exhaust, noise and emission measurement.

Pollution and Its Control: Pollutants from S.I. and C.I. engines, Methods of emission control; alternative fuels for I.C. Engines, catalytic convertor.

Reference Books:

1. *"Internal Combustion Engine Fundamentals", by J.B. Heywood, McGraw-Hill, 1988.*
2. *"Fundamentals of Internal Combustion Engines", by Paul W. Gill & James H. Smith, Oxford & IBH Pub. Ltd.,1986.*
3. *"A Course in Internal Combustion Engines", by* V. *M. Domkundwa, Dhanpat Rai Publication, 2013.*
4. *"Internal Combustion Engines", by V. Ganesan, Tata McGraw-Hill, 2012.*
5. *"Internal Combustion Engines", by M.L. Mathur & R.P. Sharma, Dhanpat Rai Publications, 4th edition, 2014.*

List of Experiments

1. To study the working of 2 stroke and 4 stroke petrol (S.I.) engine
2. To study the working of 2 stroke and 4 stroke diesel (C.I.) engine
3. To study valve/port timing diagram of I.C. Engines.
4. To study fuel injection and ignition system of both S.I. & C.I. engines.
5. To study the different lubrication systems of I.C. engine.
6. Evaluate performance of 4-stroke C.I. engine and prepare heat balance sheet.
7. Evaluate performance of 2-stroke C.I. engine and prepare heat balance sheet.
8. Performance evaluation of four and two stroke S.I. engine.
9. Performance evaluation of multi-cylinder Diesel/Petrol Engine.

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							THEORY			PRACTICAL	
			L	T	P	CREDITS	END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTME505	DCS	CAD CAM CIM	2	1	4	5	60	20	20	30	20

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 10 marks.

Course Educational Objectives (CEOs):

This course provides a fundamental understanding of (A)The Design concepts with the help of computer Application (B) Comprehensive Knowledge of computer applications including geometric, Modeling, Assemblies and Manufacturing.

Course Outcomes (COs):

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

1. Student will be able to understand the various Design concepts with the help of computer application.
2. Students would be able to get familiarized with the computer graphics application in design and understand the basic 2D & 3D commands of CAD and distinguish the CAD from manual paper drafting, in current industrial & product development scenarios.
3. Students would be able to understand the Solid and Assembly modeling tools to develop virtual product and part programming for manufacturing in various experiments & real life.
4. Students will be able to acquire knowledge of the applications of computers in design and manufacturing of real world product.

Syllabus

Unit – I

Introduction: Introduction to CAD , Why CAD Software ,Scope, objective, benefit , limitation & evaluation, Engineering Design process, Considerations, Formulation Importance, Regulatory and social issues in Indian context, Conceptual Design, Product Design Cycle, Total life cycle, Digital Prototyping, Information requirements of mfg organizations; business forecasting and aggregate production plan; MPS, MRP and Production Activity Control (PAC), introduction of CAD, CAE, CAM, CAP, CAPP, CATD and CAQ.

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Unit – II

Graphics Fundamentals & Standards: Definition, Software configuration of a Graphic system, Functions of a Graphics package, CAD Interface, Coordinate system, Creating Basic Drawings, Creating Additional Drawing Objects, Altering Objects, Drawing Organization and Inquiry Commands, Modify and Manipulating Objects, Construction and Reference Geometry, Hatching Objects, Utility Commands, Layers& Blocks, Text, Table & Dimensions, Introducing Printing, Plotting, and Layouts. Database for graphic modeling; PDM, PIM, EDM; define EDM, features of EDM need for CAD data standardization, data exchange formats; GKS, PHIGS, CORE, IGES, DXF STEP DMIS AND VDI; ISO standard for data exchange.

Unit – III

Geometric Modeling & Assembly: Introduction to Geometric Modeling , Types of models, Construction of 3D Solid Primitives , Create 3D Solids from Objects, Extrude , Revolve, Sweep, Loft , Combine or Slice 3D Objects, Move Rotate & Scale 3D Objects, Object Sectioning , Save and Publish Section Objects Wire frame Models, Wire frame Entities, Curve Representation. Assembly Modeling, Mating conditions, Generation of assembling sequences, basics of boundary presentation- Spline, Bezier, B-Spline, and NURBS; Sculpture and Ruled surfaces, Precedence diagram, Liaison-sequence analysis; Mechanical tolerance: Tolerance concepts, Geometric tolerance, Types of geometric tolerances, Location tolerances, drafting practices in dimensioning and Tolerancing, Tolerance Analysis.

Unit – IV

Computer-Aided Manufacturing & Part Programming: Computer-Aided Manufacturing, Computer Applications in a Manufacturing Plant, Key Aspects of CAM in a Manufacturing System and Manufacturing Control, G Code & M Code generation through CAD CAM software, Feature Technology , NC, DNC, CNC, Programmed Automations, Machine control unit, Part program, NC tooling. NC machine tools: Nomenclature of NC machine axes, Types of NC machine tools, Machining centers, Automatic tool changes (ATC), Turning centers. ISO codes for turning tools and holders; ATC, modular work holding and pallets; time and power estimation in milling, drilling and turning; adaptive control, sequence control and PLC; simple part programming examples.

Unit-V

Computer Integrated Manufacturing and Group Technology: Introduction to CIM, Scope of Computer integrated Manufacturing; CIM Wheel; Types of Manufacturing systems; Machine tools and related equipment, Material handling systems; Computer control systems, FMS. Importance of batch and job shop production; merits of converting zigzag process layout flow to smooth flow in cellular layout, Production Flow Analysis (PFA) and clustering methods; concept of part families and coding; hierarchical, attribute and hybrid coding; OPITZ, MICLASS and DCLASS coding; FMS; material handling robots, Computer Aided Process Planning (CAPP).

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Reference Books:

1. *"CAD/CAM/CIM" by P. Radhakrishnan, Subramanian S and Raju V; New Age Pub., 2008.*
2. *"Principles of CIM", by S. Kant Vajpay; PHI, 1995.*
3. *"CAD/CAM" by Rao PN; TMH, 2010.*
4. *"CAD/CAM Computer Aided Design and Manufacturing", by Mikell P. Groover and Emory W. Zimmer, 2008.*
5. *"Computer Integrated Design and Manufacturing" by David D. Bedworth, Mark R. Henderson, Philip M. Wolfe, McGraw-Hill, 1991.*
6. *"Mastering CAD", by George Omura with Brian Benton Autodesk, 2004.*
7. *"PTC Creo Parametric 3.0 for Designers" byTickoo S, Textbooks Published by BPB, 2015.*
8. *"SOLIDWORKS 2017 for Designers", by Tickoo S, Textbooks Published by BPB, 2017.*
9. *"CATIA V5-6R2016 for Designers", by Tickoo S, Textbooks Published by BPB, 2017.*
10. *"Autodesk Inventor Professional 2017 for Designers", byTickoo S, Textbooks Published by BPB, 2017.*

List of Experiments

The students will be required to carry out the following exercises using educational software (Auto CAD, Creo, Solid works, Master CAM etc).

1. Setting up of drawing environment by setting drawing limits, drawing units, naming the drawing, naming layers, setting line types for different layers using various type of lines in engineering drawing, saving the file with .dwg extension.
2. Layout drawing of a building using different layer and line colours indicating all Building details. Name the details using text commands, Make a title Block.
3. To Draw Orthographic projection Drawings (Front, Top and side) of safety valve, knuckle joint, cotter joint & Plummer block etc.
4. Make an Isometric dimensioned drawing from orthographic drawings.
5. Draw different types of bolts and nuts with internal and external threading in Acme and square threading standards. Save the bolts and nuts as blocks suitable for insertion.
6. Draw 3D models by extruding, revolve, sweep, loft & other 3D Modelling commands in AutoCAD.
7. Prepare Assembled 3d cad models of knuckle joint, cotter joint & Plummer block through Creo cad modelling software.
8. Apply Constraints & Mechanism on 4 bar & piston cylinder mechanism through Creo Mechanism tools.
9. Generate G codes & M codes of any models through CAM tools of Creo Software.
10. Write the program prepare any work piece through CNC Machine.

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							THEORY			PRACTICAL	
			L	T	P	CREDITS	END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTME506	DS	PROTOTYPING LAB	0	0	2	1	0	0	0	0	50

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
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Course Outcomes (COs):

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1. Student will be able to understand the various Design concepts with the help of computer application.
2. Students would be able to get familiarized with the computer graphics application in design and understand the basic 2D & 3D commands of CAD and distinguish the CAD from manual paper drafting, in current industrial & product development scenarios.
3. Students would be able to understand the Solid and Assembly modeling tools to develop virtual product and part programming for manufacturing in various experiments & real life.
4. Students will be able to acquire knowledge of the applications of computers in design and manufacturing of real world product.

Syllabus

Unit – I

Introduction: Role of Computer Graphics in CAD/CAM; configuration of graphic workstations, menu design and Graphical User Interfaces (GUI), customization and parametric programming.

Geometric Transformations and Projections: Vector representation of geometric entities, homogeneous coordinate systems, fundamentals of 2D and 3D transformations: Reflection, translation, rotation, scaling, and shearing, various types of projections.

Unit – II

Curves: Modeling planar and space curves, analytical and synthetic approaches, non-parametric and parametric equations.

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Surfaces: Modeling of bi-parametric freedom surfaces, Coons, Bezier, B-spline, and NURBS surfaces; surface manipulation techniques.

Unit – III

Geometric Modeling: Geometric modeling techniques, wireframe modeling, solid modeling: B-Rep, CSG, hybrid modelers, feature based, parametric and variational modeling.

Data Structure in Computer Graphics: Introduction to product data standards and data structures, data-base integration for CIM.

Unit – IV

Introduction to Rapid Prototyping: History, Development of RP systems, Applications in Product Development, Reverse Engineering, Rapid Tooling, Rapid Manufacturing Principle, Fundamental; File format, Other translators, medical applications of RP On demand manufacturing , Direct material deposition, Shape Deposition Manufacturing.

Unit-V

Liquid Based and Solid Based Rapid Prototyping Systems:

Classification, Liquid based system; Stereo-Lithographic Apparatus (SLA), details of SL process; products, Advantages, Limitations, Applications and Uses. Solid based system; Fused Deposition Modeling, principle, process, products, advantages, applications and uses, Laminated Object Manufacturing

Reference Books:

1. *"Mechanics of Solids", by Singh, A.K., PHI Learning Private Limited, 2007.*
2. *"Advanced Mechanics of Solids", by Srinath, L.S., Tata McGraw Hill Education Private Limited, 2009.*
3. *"Foundations of Solid Mechanics", by Fung, Y.C., Prentice Hall Inc, 1965.*
4. *"Geometric Modeling", by V Mortenson, M. E., 3rd Ed., Industrial Press, 2006.*
5. *"Surface Modeling for CAD/CAM", by Choi, B. K., John Wiley & Sons, 1991.*
6. *"Rapid Manufacturing – An Industrial revolution for the digital age", by N.Hopkinson, R.J.M, Hauge, P M, Dickens, Wiley, 2006*

List of Experiments

1. Write a program to scale a geometric model
2. Write a program to rotate a geometric model
3. To draw a 3D model of mechanical components
4. Virtual Prototype modeling of assemblies by geometric modeling and rendering using commercial CAD/CAM systems
5. Surface modeling and sheet metal features design for industrial components

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6. CAD data preparation for Rapid prototyping, Virtual reality and Finite element Solvers
7. Surface reconstruction from point cloud data for reverse engineering and inspection
8. To study Liquid Based and Solid Based Rapid Prototyping Systems

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COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
							THEORY			PRACTICAL	
			L	T	P	CREDITS	END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTME507	DS	INDUSTRIAL TRAINING	0	0	2	1	0	0	0	0	50

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 10 marks.

Course Educational Objective of Industrial Training:-
The objective of undertaking industrial training is to provide work experience so that student's engineering knowledge is enhanced and employment prospects are improved. The student should take this course as a window to the real World and should try to learn as much as possible from real life experiences by involving and interacting with industry staff. Industrial training also provides an opportunity to students to select an Engineering problem and possibly an industry guide for their Major Project in final semester

Scheme of Studies:-
Duration: Minimum 2 weeks in summer break after IV semester, assessment to be done in V semester.

Scheme of Examination:-
For the assessment of industrial training undertaken by the students, following components are considered with their weightage.

(a) Term Work in Industry **Marks Allotted**
Attendance and General Discipline:-
Daily diary Maintenance:-
Initiative and participative attitude during training:-
Assessment of training by Industrial Supervisor:-

Total:

(b) Practical/Oral Examination (Viva-Voce) in Institution **Marks Allotted**
1. Training Report:-
2. Seminar and cross questioning:-

Total
*During training students will prepare a first draft of training report in consultation with section

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in-charge. After training they will prepare final draft with the help of T.P.O. /Faculty of the Institute. Then they will present a seminar on their training and they will face viva-voce on training in the Institute.

Learning through industrial training:-

During industrial training students must observe following to enrich their learning Industrial environment and work culture.

1. Organizational structure and inter personal communication.
2. Machines/equipment/instrument-their working and specifications.
3. Product development procedure and phases.
4. Project Planning, monitoring and control.
5. Quality control and assurance.
6. Maintenance system
7. Costing system
8. Stores and purchase systems.
9. Layout of Computer/EDP/MIS centers.
10. Roles and responsibilities of different categories of personnel.
11. Customer services.
12. Occupational Health and Safety: Issues at workplace, safety at workplace etc.

Students are supposed to acquire the knowledge on above by-

1. Direct Observations without disturbing personnel at work.
2. Interaction with officials at the workplace in free/ tea time
3. Study of Literature at the workplace (e.g. User Manual, processes, schedules, etc.)
4. "Hand's on" experience
5. Undertaking/assisting project work.
6. Solving problems at the work place.
7. Presenting a seminar
8. Participating in group meeting/discussion.
9. Gathering primary and secondary data/information through various sources, storage, retrieval and analysis of the gathered data.
10. Assisting official and managers in their working
11. Undertaking a short action research work.
12. Consulting current technical journals and periodicals in the library.

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Daily Diary: -Industrial Training

Name of the Trainee---------- College ----------

Industry / work place ---------- Week No----------

Department /Section ---------- Date ----------

Dates---------- Brief of observations made, work done, problem/project undertaken, Discussion held, literature consulted etc

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Signature of Supervisor (TPO/Faculty) Signature of Trainee Signature of Official in-charge for Training (In Industry)

Supervision of Industrial Training

Faculty and TPO are supposed to plan industrial training in such a manner that students get exposure on most of the above area in the field.

One faculty member or TPO will plan industrial training of students in consultation with training manager of the industry (work place) as per the predefined objectives of training.

Monitoring visits will be made by training and placement officer/faculty in-charge for the group of Students, of the college during training.

Guidance to the faculty / TPO for Planning and implementing the Industrial Training:-

Keeping in view the need of the contents, the industrial training program, this is spread to Minimum 2 weeks duration, has to be designed in consultation with the authorities of the workplace; Following are some of the salient points:

Spelling out the objectives of the industrial training in behavioral terms and same is informed in advance to the 1) students, 2) Authorities of the work place and 3)Supervising faculty members.

1. Discussing and preparing students for the training for which meetings with the students has to be planned.
2. Meeting with industrial personnel and orienting them regarding the objective of the training and the expectations of the program.
3. Correspondence with the authorities of the work place.

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4. Orientation classes for students on how to make the training most beneficial- monitoring daily diary, writing weekly reports, how to interact with various categories of industrial personnel, how to behave and undertake responsibilities, how to gather information from the workplace, ethics etc.
5. Guiding students to make individual plans (week wise/ day wise) to undertake industrial training.
6. Developing a system of maintaining training records, by teachers for every batch of students for convenient retrieval.
7. Inviting industrial personnel to deliver lectures on some aspects of training

Action plan for planning stages at the Institutional Level:-

S. No.	Activity	Commencing Week	Finishing Week	Remark
1.	Meeting with Principal			
2.	Meeting with colleagues			
3.	Correspondence with work place(Industry concerned)			
4.	Meeting with authorities of work place			
5.	Orientation of students for industry training			
6.	Scrutinizing individual training plan of students			
7.	Commencement of individual training			
8.	First monitoring of industrial training			
9.	Second monitoring of industrial training			
10.	Finalization of Training report			
11.	Evaluation of performance at industry level			
12.	Evaluation of Industry Program in the Institutions.			

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