

# STUDY & EVALUATION SCHEME

## B. Tech. Mechanical Engineering

4<sup>th</sup> year

7<sup>th</sup> Semester

Sl. No.	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total
						Sessional			End Sem. Exam.	
			L	T	P	CT	TA	Total		
<b>Theory Subjects</b>										
1.	IME - 701	Computer Aided Design (CAD)	03	01	-	30	20	50	100	150
2.	IME - 702	Computer Aided Manufacturing (CAM)	03	01	-	30	20	50	100	150
3.	IME - 703	Automobile Engineering	03	01	-	30	20	50	100	150
4.	IOE-00	Open Elective-I	03	01	-	30	20	50	100	150
5.	IEME-04-	Elective -4	03	01	-	30	20	50	100	150
6.	IME-706	Advanced Welding Technology	02	01	-	15	10	25	75	100
<b>Practicals/ Training/ Project</b>										
7.	IME - 751	CAD/CAM Lab	-	-	03	10	10	20	30	50
8.	IME - 753	Automobile Engg.	-	-	03	10	10	20	30	50
9.	IME - 754	Industrial /Practical Training (1&2)	-	-	03	10	10	20	30	50
10.	IME -755	Project	-	-	03	10	10	20	30	50
11.	GP-701	General Proficiency	-	-	-	-	-	50	-	50
<b>Total</b>			<b>17</b>	<b>06</b>	<b>12</b>	<b>205</b>	<b>150</b>	<b>405</b>	<b>695</b>	<b>1100</b>

L – Lecture    T – Tutorial    P – Practical    CT – Class Test    TA – Teacher Assessment

**Sessional Total** = Class Test + Teacher Assessment

**Subject Total** = Sessional Total + End Semester Examination

# LIST OF ELECTIVE SUBJECTS

## B.Tech. Mechanical Engineering

### Elective –4 (Seventh Semester)

IEME-041	Drilling Technology for Water, Oils and Mineral Exploration
IEME-042	Engineering Materials
IEME-043	Unconventional Manufacturing processes
IEME-044	Total Quality Management (TQM)
IEME-045	Environmental Protection and Management
IEME-046	Product Development and Design
IEME-047	Operations Management Models and Concepts

### Elective –5 (Eighth Semester)

IEME-051	Mechanical Vibrations
IEME-052	Advanced Fluid Mechanics
IEME-053	Non-conventional Energy Resources and Utilization *
IEME-054	Concurrent Engineering
IEME-055	Management Information System
IEME-056	Automatic Controls
IEME-057	Concepts of Modern Physics

### Elective –6 (Eighth Semester)

IEME-061	Experimental Stress Analysis
IEME-062	Optimization Techniques in Engineering
IEME-063	Industrial Ergonomics
IEME-064	Advanced Dynamics of Machines
IEME-065	Introduction to Nuclear Engineering
IEME-066	Energy Management
IEME-067	Advanced Synthesis of Mechanism
IEME-068	Automation and Robotics

### Open Elective Subjects (Seventh Semester) offered by Mechanical Engg. Deptt. for other Branches.

IOE-007	Quality System and Management
IOE-008	Condition Monitoring and Diagnostics
IOE-009	Value Engineering
IOE-018	Nanotechnology
IOE-019	Solar Energy
IOE-020	Human Resource Management

\* This subject (IEME-053) will not be available to those students who have already studied similar paper as main subject in their curriculum, with the name Non-Conventional Energy.

# COMPUTER AIDED DESIGN (CAD)

IME-701

w.e.f. Session 2015-2016

L T P  
3 1 0

## UNIT –I

### Introduction and Review of Computer Programming :

Introduction to CAD/CAE, Elements of CAD, Concepts of integrated CAD/CAM, CAD Engineering applications, its importance and necessity. Review of C, C<sup>++</sup>, statements such as if else, for while and switch, functions, pointer notations, structure and class, concept of OOP. Introduction TO MATLAB, Multiplication, addition, subtraction and division. Utility and application. Functions and 2D plots. 5

### Computer Graphics-I

Computer systems, Graphics input devices-cursor control devices, Digitizers, Scanners, speech oriented devices and touch panels, Graphics display devices CRT, colour CRT monitors, DVST, Flat-panel display, Graphics output Devices. 3

## UNIT-II

### Computer Graphics -II

Graphics software, Graphics functions, output primitives-Bresenham's line drawing and Mid-point circle algorithms. 3

### Geometric Transformations:

Word/device co-ordinate representations, 2D and 3D geometric transformations, Matrix representations-translation, scaling, shearing, rotation and reflection, composite transformations, concatenation about arbitrary axis. Exercise and programs. 5

## UNIT-III

### Plane Curves :

Curve representation, Interpolations Vs approximation, Parametric Continuity conditions, Spline Curves-Hermite spline, Bezier spline and B-spline Curves and its Properties. 4

### 3-D Graphics :

Polygon surfaces- Polygon mesh representations, Quadric and Superquadric surfaces and Blobby objects, Fractals. Solid modeling-wire mesh and sweep representation, constructive solid geometry, Boolean operations, Boundary representations. Colour models. 4

## UNIT-IV

### Computer Aided Design of Machine Elements and other Systems :

CAD of machine elements such as shaft, springs, bearings and problems from other systems such as heat exchanger, inventory control etc. Writing Computer program in C, Drafting/Design of software such as Auto-CAD and Pro-E. 4

## UNIT-V

### Numerical Methods :

Introduction, Errors in numbers, Binary, Octal and Hexadecimal number representation. Rot-finding and Optimization. Interactive methods-Bisection method, Regula-Falsi Method, Newton Raphson method, Interpolation Lagrange and Newton's interpolation, Curve fitting-Least Square method, Numerical differentiation-interpolation methods, Numerical integration-Trapezoidal and Simpson Method. 6

### Finite Element Methods:

Introduction and Application of FEM, Stiffness Matrix/Displacement Matrix, One/Two Dimensional bar and beam element (as spring system) analysis. 6

**Books:**

1. Computer Graphics: Hearn and Baker (Pearson/Prentice hall)
2. Computer Aided Design : R.K. Srivastava.
3. Computer Graphics, Theory and Practice: Foley, Van Dam, Feiner, (Pearson Education)
4. CAD/CAM, Theory and practice: Ibrahim Zeid (McGraw Hill International)
5. Computer Aided Analysis and Design of Machine Elements: (Rao and Dukkipati)
6. Mathematical Elements for Computer Graphics: Rogers and Adams (McGraw Hill)
7. CAD/CAM : Groover and Zimmers (Prentice Hall of India Pvt. Ltd.)
8. Computer Oriented Numerical Methods: Rajaraman (Prentice Hall)
9. FEM : S/o Mr. Rao.

# COMPUTER AIDED MANUFACTURING (CAM)

IME-702

w.e.f. Session 2015-2016

L T P  
3 1 0

## UNIT –I

### Introduction :

Introduction to Automation, Need and future of NC systems and CAM; Advantages and disadvantages; Classification; Open and closed loop systems; Historical development and future trends. 4

### Features of NC Machines:

Difference between ordinary and NC machine tools; Methods for improving Accuracy and Productivity. 4

## UNIT-II

### NC Part programming:

(a) Manual (word address format) programming; Examples Drilling and Milling. 4

(b) APT programming, Geometry, Motion and Additional statements, Macro-statement. 4

## UNIT-III

### System Devices :

Introduction to DC motors, stepping motors, feed back devices such as encoder counting devices, digital to analog converter and vice versa. 3

### Interpolators :

Principle, Digital Differential Analyzers; Linear interpolator, Circular Interpolator and its software. 2

### Control of NC Systems :

Open and closed loops. Automatic control of closed loops with encoder and tachometers; Speed variation of DC motor; Adaptive control. 3

## UNIT-IV

### Computer Integrated Manufacturing System:

Group Technology, Manufacturing cell, Transfer lines, FMS, CIM, CAD/CAM, CAPP, Concept of Mechatronics. 8

## UNIT-V

### Robotics :

NC machine vs Robots. Types and generations of Robots, Robot applications and Economics; Robot programming methods; VAL and AML with examples. 6

### Intelligent Manufacturing:

Introduction to Artificial Intelligence for Intelligent manufacturing. 2

### Books:

1. Computer Control of Manufacturing Systems: Koren. .
2. Robots: Koren
3. NC machines : Koren.
4. CAD/ CAM: Grover.
5. NC Machine Tools : S.J. Martin

# AUTOMOBILE ENGINEERING

IME-703

w.e.f. Session 2015-2016

L T P  
3 1 0

## UNIT –I

### Power UNIT and Gear Box :

Principles of Design of main components. Valve mechanism. Power and Torque characteristics. Rolling, air and gradient Resistance. Tractive effort. Gear Box. Gear ratio determination. Design of Gear box. 8

## UNIT-II

### Transmission System :

Requirements. Clutches. Torque converters. Over Drive and free wheel. Universal Joint. Differential Gear Mechanism of Rear Axle. Automatic transmission. Steering and Front Axle. Castor Angle, Wheel chamber and Toe in Toe out etc. Steering geometry. Ackerman Mechanism. Understeer and Oversteer. 8

## UNIT-III

### Braking System :

General requirements, Road, tyre adhesion. Weight transfer. Braking ratio. Mechanical brakes, Hydraulic brakes. Vacuum and air brakes, Thermal aspects. 5

### Chassis and Suspension System:

Loads on the frame. Strength and stiffness. Various suspension systems. 3

## UNIT-IV

### Electrical System :

Types of starting motors, generator and regulators, lighting system. Ignition system, Horn, Battery etc. 4

### Fuel Supply System :

Diesel and Petrol vehicle system such as Fuel Injection Pump, Injector and Fuel Pump, Carburetor etc. MPFI 4

## UNIT-V

### Automobile Air Conditioning :

Requirements, Cooling and heating systems 3

### Cooling and Lubrication System :

Different type of Cooling and lubrication system. 3

### Maintenance System :

Preventive Maintenance, break down maintenance, and over hauling system. 2

Books:

1. Automotive Engineering : Hietner
2. Automobile Engineering : Kripal Singh
3. Automobile Engineering : Narang
4. Automotive Mechanics : Crouse
5. Automobile Engineering : Newton and Steeds

# ADVANCED WELDING TECHNOLOGY

IME-706

w.e.f. Session 2015-2016

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## UNIT –I

### Introduction :

Importance of welding and its applications conditions for obtaining satisfactory welds, Selection of a welding process. Review of advanced welding Process: TIG, MIG, Laser beam welding, Plasma Arc welding, , Electron beam welding and Ultrasonic welding. 8

## UNIT-II

### Advanced Welding Techniques :

Principles, working and application of advanced welding processes such as Explosive welding, Cladding Metalizing Hard facing and underwater welding 8

## UNIT-III

### Weld Design :

Weld design, Welding power sources and their characteristics. Weld defects and distortion and residual stresses in welds. Inspection and testing of welds, Macrostructure and microstructure of weld zone, HAZ and parent metal, Welding of pipe-lines and pressure vessels. 8

## UNIT-V

### Thermal and Metallurgical Consideration :

Thermal consideration for welding, heating and cooling curves. Metallurgical consideration of weld zone, HAZ and Parent metal, 8

### Books:

1. Welding Hand Book : AWS
2. Welding Science of Technology : M.I. Khan, New Age

## CAD/CAM LAB

IME-751

w.e.f. Session 2015-2016

(6 from CAD experiments, 4 from CAM experiments)

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### A. CAD Experiments:

1. Line drawing or Circle drawing algorithm experiment: Writing the program and running it on computer.
2. Transformations algorithm experiment for translation/ rotation / scaling: Writing program in C or MATLAB and running it on computer.
3. Design problem experiment: Writing the program for design of a machine element or other system and running it on computer.
4. Optimization problem experiment: Writing a program for optimization a function and running it on computer.
5. AutoCAD experiment: Understanding and use of AutoCAD commands.
6. Writing programs for FEM, and simulation.
7. Use of graphics software standards packages e.g. GKs/PHYSICS/GL etc.
8. Solidworks experiment: Understanding and use of Solidworks commands.

### B. CAM Experiments :

1. Writing a part-programming (in word address format or in APT) for a job for drilling operation (point-to-point) and running on NC machine.
2. Writing a part-programming (in word address format or in APT) job for milling operation (continuing) and running on NC machine.
3. Experiment on Robot and its programs.
4. Experiment on Transfer line/Material handling.
5. Experiment on difference between ordinary machine and NC machine, study or retrofitting.
6. Experiment on study of system devices such as motor and feed back devices.
7. Experiment on Mechatronics and controls.

**AUTOMOBILE ENGINEERING LAB**

**IME-753**

**w.e.f. Session 2015-2016**

(Say any 10 study and experiments from the following or such experiments).

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1. Study the working mechanism of braking system.
2. Study the working mechanism of fuel supply system.
3. Study the working mechanism of ignition system.
4. Study the working mechanism of steering system.
5. Study the working mechanism of transmission system.
6. Study the working mechanism of suspension system.
7. Study safety aspect of automobile design.
8. Study the working mechanism of lighting or lubrication system.
9. Study the working mechanism of lubrication and cooling system.
10. Comparative study and features of common small cars (such as Fiat, Ambassador, Maruti, Matiz, Santro, Indica and its variations) available in India.
11. Comparative study and technical features of common heavy vehicles available in India. Case study/term paper.
12. Comparative study and technical features of common scooters and motorcycles available in India. Case study/term paper.
13. Engine tuning and carburetor servicing experiment.
14. Study the working mechanism of MPFI system.
15. Experiment on fuel consumption measurement.
16. Review experiment on IC Engine and modern trends.
17. Visit of an Automobile factory.
18. Study the working mechanism of main gear box and differential gear box.

## **OPEN ELECTIVE SUBJECTS**

# QUALITY SYSTEM AND MANAGEMENT

IOE-007

w.e.f. Session 2015-2016

	<b>L</b>	<b>T</b>	<b>P</b>
<b>UNIT –I</b> Definition, need of quality system, role of quality standards, stages of quality assurance systems.	<b>3</b>	<b>1</b>	<b>0</b>
<b>UNIT-II</b> Quality charts, control charts for variables and attributes, acceptance sampling.			<b>8</b>
<b>UNIT-III</b> Overall responsibility for progress of quality systems. Quality manuals, procedures and role of auditing, auditing for conformance versus quality for effectiveness, auditing a tool for quality improvement.			<b>8</b>
<b>UNIT-IV</b> ISO 9000 quality systems, British Standards BS5750/ISO 9000 origin of standards, requirements issues associated with implementation.			<b>8</b>
<b>UNIT-V</b> Registration and accreditation in quality system certification, approval, registration of leading accessors.			<b>8</b>

## Books:

1. Total Quality Management for Engineers: Mohamed Isiri
2. Quality Planning and Analysis: Juran J., McGraw Hill
3. Total Quality Management, Organization and Strategy : James R.Evans and J.W. Dean, Thomson Asia Pvt. Ltd. Singapore.

# CONDITION MONITORING AND DIAGNOSTICS

IOE-008

w.e.f. Session 2015-2016

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## UNIT –I

Productivity, Quality circle in maintenance, Reliability assurance, Maintainability vs. Reliability.  
Failure analysis, Equipment downtime analysis, breakdown analysis.

**8**

## UNIT-II

Maintenance type, Breakdown maintenance, Corrective maintenance, OpportUNITY maintenance, Routine maintenance, preventive and predictive maintenance, Condition based maintenance systems, Design-out maintenance.

**8**

## UNIT-III

Equipment health monitoring, Signals, Online and off line monitoring, Visual and temp. Monitoring, Leakage monitoring, Lubricant monitoring.

**8**

## UNIT-IV

Ferrography, Spectroscopy, Crack monitoring, Corrosion monitoring, Thickness. Noise/Sound monitoring, Smell/Odour monitoring, Thermography.

**8**

## UNIT-V

Vibration-characteristics, Vibration monitoring-causes, identification, measurement of machine vibration.  
C.M. of lubes and hydraulic-systems, C.M. of pipe lines, Selection of C.M. techniques advantages.

**8**

**VALUE ENGINEERING**  
**IOE-009**  
**w.e.f. Session 2015-2016**

**L T P**  
**3 1 0**

**UNIT – I**

**Introduction :**

Definition purpose of value engineering and its effectiveness, gains from VE, benefit areas of value analysis, value engineering in India. **3**

**Basic and Secondary Functions :**

Evaluation of functions, determining the functions, evaluation of costs meaning of value and types of values, determining the value, factors to be considered for value engineering and cost improvement unnecessary costs. VE and standardization, cost models and life cycle costs. **6**

**UNIT-II**

**VE Job Plan :**

VE methodology and Techniques

Elements of VE study, information phase, speculation phase, analysis phase, decision and action phase and evaluation phase, DARSIRI method, examples and illustrations. **7**

**UNIT-III**

**VE Team:**

Team Composition and major tasks, Requirement for creativity, phases of creativity, characteristics of creative people, process model of creativity, creativity and brain storming, creative thinking, place of value engineering team in company organization. **8**

**UNIT-IV**

**Principles of Value Analysis:**

Principle of functional utility, principle of balanced combination principle of direct motivation, principle of responsibility, principle of adequate information, principle of objectivity and allocation principle of simplification and selectivity, examples and case studies. **8**

**UNIT-V**

**Impact of V.E. and Applications:**

Profit impact, VE in maintenance and repairs, purchasing, VE in transportations, VE design and construction management some examples and case studies. **5**

**Initiating a VE Program:**

Introduction, training, career development for VE speciality. **3**

**Books:**

Techniques of Value Engineering: LD Miles.

**NANO-TECHNOLOGY**  
**IOE-018**  
**w.e.f. Session 2015-2016**

**L T P**  
**3 1 0**

**UNIT –I**

**Introduction TO Physics of Solid State :**

**Structure :**

Size dependence of properties; crystal structures, face centered cubic nanoparticles; Tetrahedrally bounded semiconductor structures; lattice vibrations.

**Energy Bounds:**

Insulators, semiconductor and conductors; Reciprocal space; Energy bounds and gaps of semiconductors; effective masses; Fermi Surfaces.

**Localized Particles:**

Acceptors and deep traps; mobility; Excitons.

**Methods of Measuring Properties:**

**Structure :**

Atomic Structures; Crystallography; Particle size determination; Surface structure.

**8**

**UNIT-II**

**Microscopy :**

Transmission electron microscopy; Field ion microscopy; Scanning microscopy.

**Spectroscopy:**

Infrared and Raman Spectroscopy, Photoemission and X-ray Spectroscopy; Magnetic resonance, optical and vibrational spectroscopy, Luminescence.

**Properties of Individual Nano Particles:**

**Metal Nano Clusters:**

Magic numbers; Theoretical modeling of nanoparticles Geometric structure; Electronic structure; Reactivity; Fluctuations magnetic clusters; Bullets to nano structure.

**Semi Conducting Nanoparticles:**

Optical properties; Photo fragmentation; Coulombic explosion..

**8**

**UNIT-III**

**Rare Gas and Molecular Clusters:**

Inert gas clusters; Super fluid clusters; Molecular clusters.

**Method of Synthesis:**

RF plasma; Chemical methods; Chemical methods; Thermolysis; pulsed laser methods.

**Carbon Nanoparticles:**

**Carbon Molecule:**

Nature of carbon bond; New carbon structures.

**Carbon Clusters:**

Small carbon clusters; Discovery of C<sub>60</sub>; Alkali doped C<sub>60</sub>;superconductivity in C<sub>60</sub>; Large and smaller fullerenes; Other buckyballs.

**Carbon Nano Tubes:**

Fabrication; Structure; Electrical properties; Vibrational properties; Mechanical properties.

**8**

**UNIT-IV**

**Appls:**

Field emission and shielding; Computers; Fuel cells; Chemicals sensors; Catalysis; Mechanical reinforcement.

**Balle Nanostructured Materials:**

Solid disordered nanostructure; Nanostructured crystals

**Nanostructured Ferromagnetism:**

Basics of Ferromagnetism; Effect of structuring of Magnetic properties, Dynamics of Nanomagnets; Nanopore containment of magnetic particles. Nanocarbon Ferromagnets, Giant and colossal magnetoresistance; Ferrofluids.

**8**

**UNIT-V**

**Quantum Wells, Wires and Dots :**

Preparation of quantum Nanostructure; Size and dimensionality effect; Fermi levels; Potential wells; Partial confinement; Excitons; Single electron tunneling; Infrared detectors; Quantum dot laser superconductivity.

**Nano-Machines and Nano-Device:**

Micro electromechanical systems (MEMS) Nanoelectromechanical systems (NEMS), Fabrication, Nanodevices and Nanomachines. Molecular and Supermolecular switches Applications areas of Nanotechnology in Engineering.

**8**

**Books:**

1. Introduction to Nanotechnology : C.P. Poole Jr. F.J. Owens
2. Introduction to S.S. Physics : (7<sup>th</sup> Edn.) Wiley 1996
3. Microcluster physics: S.Sugano and H. Koizuoni Springer 1998
4. Handbook of Nanostructured Materials and Nanotechnology vol. 5: Academic Press 2000.

**SOLAR ENERGY**  
**IOE-019**  
**w.e.f. Session 2015-2016**

**L T P**  
**3 1 0**

**UNIT –I**

**Introduction:**

Energy alternative, Devices for thermal collection and storage, Thermal applications.

**Solar Radiation :**

Instruments for measuring solar radiation. Solar radiation geometry, Empirical equations for prediction the availability of solar radiation, Solar radiation on titled surface. **8**

**UNIT-II**

**Liquid Flat-Plate Collectors :**

General performance analysis. Transmissivity- absorptivity product and overall loss coefficient and heat transfer correlations, Collector efficiency factor, Numerical .

Analysis of collectors similar to the conventional collectors Testing procedures, Alternatives to the conventional collector, Numericals. **8**

**UNIT-III**

**Solar Air Heaters :**

Performance analysis of a conventional air heater, Other types of air heaters.

**Concentrating Collectors :**

Flat plate collectors with plane reflectors, Cylindrical parabolic collector, Compound parabolic dish collector. Central receiver collector, Numericals. **8**

**UNIT-IV**

**Thermal Energy Storage :**

Sensible heat storage, Latent heat Storage, Thermo-chemical storage.

**Solar Distillation :**

Introduction, working principle of solar distillation, Thermal efficiency of distiller UNIT, External heat transfer, Top loss coefficient, Bottom and side loss coefficient, Internal heat transfer, Radioactive loss coefficient, connective loss coefficient, Evaporative loss coefficient, Overall heat Evaluation of distillation output, Passive solar stills, Conventional solar still, Basin construction, Thermal analysis of conventional solar still. **8**

**UNIT-V**

**Photovoltaic Systems :**

Introduction, doping Fermi level, P-N Junction characteristics, Photovoltaic effect, Photovoltaic material, Module, Cell temperature, Numericals.

**Economic Analysis :**

Introduction, cost analysis. **8**

**Books:**

1. Solar Energy, Thermal Processes: Duffie John A, Beckman W.A. John Wiley and sons.
2. Solar Energy: S.P. Sukhatme, Tata McGraw Hill.
3. Treatise on Solar Energy, : H.P. Garg, John Wiley and Sons.

# HUMAN RESOURCE MANAGEMENT

IOE-020

w.e.f. Session 2015-2016

L T P  
3 1 0

## UNIT -I

Scope and Importance of Human Resource management, Historical background of Evolution of HRM and HRD in 20<sup>th</sup> century, Outlining the contemporary role for HRM in organization Goals of HRM. (Why behavioural approach?)  
8

## UNIT-II

Manpower as a resource in job related behaviour and individual motivation in a work setting. Various theories of human motivation, Maslow's hierarchy of needs. Needs for achievement, power and affiliation, other theories, group motivation and conflicts.  
8

## UNIT-III

Manpower planning and recruitment, Testing procedures and their limitations, Reservations in jobs, pre induction training.  
5

## UNIT-IV

Wage and salary administration-pay roll and compensation. Job analysis and job specification, other pay plans, employment contracts, special compensation plans for example personnel, effect of Financial rewards on individuals performance.  
5

Goal setting and performance evaluation, promotion policy, employee satisfaction, turnover.  
4

## UNIT-V

Assessment of training needs, forces promoting investment in HRD, Human resource development through individual and group efforts. Training analysis and training methods guidelines for individual development, job enlargement and job enrichment, job rotation, special assignment, Sponsored courses cost benefit exercise.  
7

Importance of unions, industrial petitions and conflict analysis and resolution, relevant labour laws.  
3

**ELECTIVE SUBJECTS**

# DRILLING TECHNOLOGY FOR WATER, OILS AND MINERAL EXPLORATION

IEME-041

w.e.f. Session 2015-2016

L T P  
3 1 0

## Unit –I

### Basic Concepts

History of Drilling, Geology & classification of rocks, Application of Geo-physics, Hydrology, Geo-chemical prospecting and remote sensing for water, oil & mineral exploration, soil testing location of site. **8**

## Unit-II

### Drilling Logging and Testing

Reverse and direct rotary, Percussion, DTH, Odex Drilling, Conventional, Wire Line, Auger Drilling and Drilling for Standard Penetration Test (SPT). Borehole Logging, Well testing, Drill stem test, insitu Geotechnical Test, Permeability Test **4**

### Drilling Rigs Tools and Equipment

Drill rods, Castings, Core Barrel, Diamond Tools, R. R. Bits, Button Bits, T.C. Bits and Air hammer, Stabilizer, Type of screens. **4**

## Unit-III

### Drilling Fluids

Type of Drilling Fluid, Bentonite –constituents, Maintenance of parameters, Viscosity, Sp. Gravity, Filtration loss, Additives to maintain parameters, use of polymers as fluids. **8**

## Unit-IV

### Water Well Drilling

Origin, occurrence and movement of ground water, Genetic classification of water, Aquifer, Transmissibility, Darcy's law, Coefficient of Permeability, Construction of tube well, well development, drilling method, alignment and verticality of well, installation of well screen, placement Gravel pack, collection of representative samples from formation, Yield Test, Chemical Test **8**

## Unit-V

### Drilling for Oil and Minerals

Diamond Core Drilling, Horizontal, vertical and directional Drilling, Core samples, Geotechnical order (GTO), Deviation in borehole and wedge design, Drilling for Coal Based Methane (CBM), Geothermal Drilling, Oil Drilling Exploration. **8**

# ENGINEERING MATERIALS

IEME-042

w.e.f. Session 2015-2016

L T P  
3 1 0

## Unit –I

### **Ferrous Materials, their Properties and Applications:**

Plain carbon steels, their properties and application: plain carbon steels, effects of alloying elements in plain carbon steels. Alloy steels, tool steels, stainless steels, low and high temperature resisting steels, high strength steels, selections, specifications, form and availability of steel.

Cast irons-white, grey, nodular malleable and alloy cast irons. Recognized patterns of distribution of graphite flakes in grey cast iron. 10

## Unit-II

### **Heat Treatment of Steels:**

TTT diagrams, annealing, normalizing, hardening and tempering of steel. Austempering and martempering of steel. Hardenability, Jominy end quench test. Grain size and its determination. Effect of grain on the properties of steel.

### **Surface Hardening of Steel:**

Carbonizing, nitriding, carbonitriding, cyaniding, flame and induction hardening microscopic determination of case depth and depth of hardening. 7

## Unit-III

### **Nonferrous Materials:**

Their properties and application, brasses, bronzes, cupro-nickel alloys, aluminum, magnesium and titanium alloys, bearing materials, selection, specific form and availability. Heat treatment of nonferrous materials- solutionising and precipitation hardening. 8

## Unit-IV

### **Composites:**

Polymer-polymer, metal-metal, ceramic-ceramic-polymer, metal-ceramic, metal-polymer composites. Dispersion reinforced, particle reinforced, laminated and fibre reinforced composites. 6

## Unit-V

### **Elastomers and Miscellaneous:**

Types, properties and identifications of different types of rubbers vulcanization, fabrication and forming techniques of rubber. Introduction of plastics and ceramics-types, application and process. Smart materials-introduction and types. Selection of materials and factors affecting selection, Selection process and systematic evaluation. 9

# UNCONVENTIONAL MANUFACTURING PROCESSES

IEME-043

w.e.f. Session 2015-2016

L T P  
3 1 0

## UNIT-I

**Introduction:** Limitations of conventional manufacturing processes need of unconventional manufacturing processes & its classification and its future possibilities. **5**

## UNIT-II

**Unconventional Machining Process:** Principle and working and applications of unconventional machining process such as Electro-Discharge machining, Electrochemical machining, ultrasonic machining, Abrasive jet machining etc. **8**

## UNIT-III

**Unconventional Machining Process (continued) :**Principle and working and application of unconventional machining processes such as Laser beam machining, Electron beam machining, Ultrasonic machining etc. (these can also be used for welding). **8**

## UNIT-IV

**Unconventional welding processes:** Explosive welding, Cladding etc. Under water welding, Metalizing, Plasma arc welding/cutting etc. **7**

## UNIT-V

**Unconventional Forming processes:** Principle, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro-Discharge forming, water hammer forming, explosive compaction etc. **7**

**Electronic-device Manufacturing:** Brief description of Diffusion and Photo- Lithography process for electronic-device manufacturing. **5**

## Books

1. Modern Machining Processes – P.C. Pandey
2. Unconventional Machining – V.K. Jain

# TOTAL QUALITY MANAGEMENT (TQM)

IEME-044

w.e.f. Session 2015-2016

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## Unit-I

### Quality Concepts

Evolution of Quality control, concept change, TQM Modern concept, Quality concept in design, Review off design, Evolution of proto type.

### Control on Purchased Product

Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure.

### Manufacturing Quality

Methods and Techniques for manufacture, Inspection and control of product, Quality insales and services, Guarantee, analysis of claims.

8

## Unit-II

### Quality Management

Organization structure and design, Quality function, decentralization, Designing and fitting organization for different types products and company, Economics of quality value and contribution, Quality cost, optimizing quality cost, seduction programme.

### Human Factor in Quality

Attitude of top management, co-operation, of groups, operators attitude, responsibility, causes of operators error and corrective methods.

8

## Unit-III

### Control Charts

Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts.

### Attributes of Control Charts

Defects, construction and analysis off-chart, improvement by control chart, variable sample size, construction and analysis of C-chart.

8

## Unit-IV

### Defects Diagnosis and Prevention

Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

8

## Unit-V

### ISO-9000 and its concept of Quality Management:

ISO 9000 series, Taguchi method, JIT in some details

8

## References:

1. Lt. Gen. H.LaI, "Total Quality management", Wiley Eastern Limited, 1990. .
2. Greg Bounds. "Beyond Total Quality Management". McGraw Hill, 1994.
3. Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992

# ENVIRONMENTAL PROTECTION AND MANAGEMENT

IEME-045

w.e.f. Session 2015-2016

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## Unit –I

Introduction, Importance of environmental protection for engineering and Scientists Chemistry of hazardous materials. 6

## Unit-II

Toxic Materials and its environmental and health effects. 8

## Unit-III

Fundamentals of environmental laws. Laws related to Air pollution, water pollution, toxic substance control, safe drinking-water, occupational safety and health and noise control. 9

## Unit-IV

Environmental hazards and their control, General principle of Hazards Control. Hazard and its control from; Chemicals, noise and vibration, radiation, hazardous waste, heat and cold, fire, tools and machines, Personal-protective-equipment. 10

## Unit-V

Environmental impact assessment, rationale for assessing impact, Phases of environmental impact assessment. Air and water quality managements. 7

## **Books:**

1. Ecology, Impact Assessment and Environmental Planning: Walter E. Westman Johnwilly and sons U.S.A.
2. Hand Book on Hazardous Materials Management: Tom Carson Institute of Hazardous Materials Management, USA.
3. Environmental Law Handbook: J. Gordon Arbuckle, Government Institute Inc. Rockville, M.D., USA.
4. Safety and Health for Engineers: Roger L. Brauer, VAN Nostrance Reinhold Newyork, USA.
5. Environmental Chemistry: Stanley E. Manehan, Books/cole Publishing Company Motherly, California.
6. Public Policies for Environmental Protection: Paul R. Portney Resources for the future. Washington D.C.

**PRODUCT DEVELOPMENT AND DESIGN**  
**IEME -046**  
**w.e.f. Session 2015-2016**

**L T P**  
**3 1 0**

**UNIT-I**

**Introduction to Product Design**

Introduction to PDD, Applications, Relevance, Product Definition, Scope, Terminology. Design definitions, the role and nature of design, old and new design methods, Design by evolution. Examples such evolution of bicycle, safety razor etc. Need based development, technology based developments. Physical reliability & Economic feasibility of design concepts. 7

**UNIT II**

**Morphology of Design**

Divergent, transformation and convergent phases of product design. Identification of need, Analysis of need. Design for what? Design criteria, functional aspects. Aesthetics, ergonomics, form (structure). Shape, size, color. Mental blocks, Removal of blocks, Ideation Techniques. Creativity, Checklist. 7

**UNIT III**

**Transformations**

Brainstorming & Synectics. Morphological techniques. Utility concept, Utility value, Utility index. Decision making under multiple criteria. Economic aspects of design. Fixed and variable costs. Break-even analysis. 9

**UNIT IV**

**Reliability**

Reliability considerations, Bath tub curve, Reliability of systems in series and parallel. Failure rate, MTTF and MTBF. Optimum spares from reliability consideration. Design of displays and controls, Man-Machine interface, Compatibility of displays and controls. Ergonomic aspects. Anthropometric data and its importance in design. Applications of Computers in product design. 7

**UNIT IV**

**Product Appraisal**

Information and literature search, patents, standards and codes. Environment and safety considerations. Existing techniques such as work-study, SQC etc. which could be used to improve method & quality of product. Innovation versus Invention. Technological Forecasting. 8

**Recommended Books:**

1. Product Design & Manufacturing - A.K.Chitab & R.C.Gupta, PHI (EEE).
2. The Technology of Creation Thinking - R.P. Crewford – Prentice Hall
3. The Art of Thought – Grohem Walls – Bruce & Co., New York
4. Product Design & Decision Theory - M.K. Starr - Prentice Hall
5. Engg . Product Design -C .D. Cain, Bussiness Books.
6. Industrial design for Engineers –W .H. Mayall, Itiffe.
- Design Methods – seeds of human futures – J. Christopher Jones, John Wiley & Sons.
7. Human Factor Engg. – McCormick E.J., Mc GrawHill.
8. Engineering: An Introduction to Creative profession – G.C. Beakley Hw leach, Macmillan.
9. Industrial Design In Engineering – A marriage of Techniques – Charles H . Flurschein, The Design Council - London.
10. Quality Control & Reliability Analysis – Bijendra Singh, Khanna Publications.

# OPERATIONS MANAGEMENT, MODELS AND CONCEPTS

IEME-047

w.e.f. Session 2015-2016

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## Unit –I

### **Production and Operations Strategy:**

Production and Operations Strategy, Capacity growth planning, economics of scale and economics of scope, make or buy dynamic capacity expansion, issues in plant location, learning curves, experience curves, learning and experience curves and manufacturing strategy, matching process and product life cycles, recent advances in manufacturing technology and control. 8

## Unit-II

### **Forecasting Methods and Aggregate Planning:**

Time horizon in forecasting, characteristics of forecasts, subjective and objective forecasting methods, casual methods, time series methods, evaluating forecasts, methods forecasting stationery series, exponent smoothing, methods for seasonal series.

The aggregate planning problem, evaluation of chase strategy and constant work force plan, solution of aggregate problem as LP problem, linear decision rule, disaggregating the aggregate plan. 8

## Unit-III

### **Inventory Control and MRP :**

Inventory control subject to known demand, characteristics of inventory systems, relevant costs, the EOQ model with and without order lead time, EOQ and JIT, quantity discount model, resource constrained multiple product systems, inventory control subjected to uncertain demand, determining optimal policy. 4

### **MRP :**

The explosion calculus, lot sizing schemes- heuristic lot sizing, incorporating lot-sizing algorithms into explosion calculus, use of MRP in real world. 4

## Unit-IV

### **Operation Scheduling :**

Characteristics of job shop scheduling problems, comparison of specific sequencing relues FCFS, SPT EDD, critical ratio. Theory of sequencing for single machine-with rules such as SPT, EDD, and minimum number of tardy jobs (NT). Minimizing the Nt. Incorporating the precedence constraints. Sequencing algorithms for multiple machines-n jobsx2 machines, extension to 3 machines, 2 job flow shop problem, stochastic scheduling-static analysis, vehicle scheduling and assembly line balancing. 8

## Unit-V

### **Facility Layout and Location:**

The facility layout problems, patterns of flow, activity relationship chart, from/to chart. Layout types, layout problem and assignment model, computerized layout planning techniques e.g. CRAFT, COFAD, ALDEP. CORLEP, PLANET etc. Locating new facilities, measures of distance, single facility, rectilinear distance problem, minimax problem. Euclidean distance problem, gravity problem, straight-line distance problem, locating multiple facilities. 8