UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Lecture-wise Plan

Subject Name: **Economics for Engineers**   Subject Code: **HU802**

Year: **4th Year**   Semester: **Eighth**

Module Number	Topics	Number of Lectures
1	1. Economic Decisions Making – Overview, Problems, Role, Decision making process.	**2L**
	2.EngineeringCosts&Estimation– Fixed, Variable, Marginal & Average Costs, Sunk Costs ,Opportunity Costs, Recurring And Non recurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs;	5L
	Types Of Estimate, Estimating Models-Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement &Learning Curve, Benefits.	3L
2	3. Cash Flow, Interest and Equivalence: Cash Flow Diagrams, Categories & Computation, Time Value of Money, Debtre payment, Nominal & Effective Interest.	**2L**
		2L
	4. Cash Flow & Rate Of Return Analysis–Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity And Break even Analysis. Economic Analysis In The Public Sector – Quantifying And Valuing Benefits & drawbacks.	2L
3	5.Inflation And Price Change Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates.	**2L**
	6. Present Worth Analysis: End-Of Year Convention, View point Of Economic Analysis Studies, Borrowed Money View point, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.	4L
	7. Uncertainty In Future Events-Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options.	
4	8. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances.	**4L**
	9. Replacement Analysis- Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems.	4L

	10. Accounting–Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.	
	TOTAL NO. OF HOURS= 36L	

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Lesson- Plan

Subject Name: Industrial Robotics   Subject Code-ME801 B
Year: 4th Year   Semester: Eighth

Module/Unit Number	Topics	Number of Lectures
Unit :1	Introduction: Brief history of robotics;	1L
	definition of robot; Main components of robot:.	1L
	manipulator, sensors, controller, powerconversion unit;	1L
	Robot geometry: types of joints,	1L
	workspace, number of degrees of freedom;	1L
	Common configurations used in arms:	1L
	rectangular, cylindrical, spherical, joined;	1L
Unit :2	Robot End Effector End effector:	1L
	definition, gripper, tools; Gripper	1L
	: main parts, source of power;	1L
	Types of grippers: mechanical grippers,	1L
	vacuum cups, magnetic grippers, adhesive grippers,.	1L
	Hooks, scoops, ladles, universal gripper; Robot Tools:	1L
	Spot welding gun, pneumatic impact wrench,	1L
	pneumatic nut runner, inert gas welding torch, heating torch,	1L
	grinder, spray painting gun	1L
Unit :3	Robot Actuators: Definition; Characteristics:	1L
	power to weight ratio, stiffness, compliance, reduction gears;	1L
	Conventional actuators: hydraulic actuator,	1L
	pneumatic actuator, electric motor,	1L
	shape memory alloy, elastomer	1L
Unit :4	Robot Sensors:	1L
	Definition; of Sensor and transducer; Calibration;	1L
	Basic categories of measuring devices: analog, discrete;	1L
	Main types of sensors: position, velocity, acceleration, force and pressure,	1L
	torque, slip and tactile, proximity. Definition of	1L

	digital image, generation of digital image;	
	Robot Vision System: definition, use, functions, components, classification;	1L
	vision cameras; Techniques of image processing and analysis:.	1L
	feature extraction, object recognition; Application of robot vision system	1L
	Image data reduction, segmentation,	1L
Unit :5	Robot Kinematics: Definition of Robot kinematics,.	1L
	Tool frame and base frame. Word –coordinate system,	1L
	Direct kinematics, Inverse kinematics,	1L
	Describing position and orientation of an object in space,	1L
	Homogenous transformation,	1L
	Translational transformations,	1L
	Rotational transformations,	1L
	Denavit- Hartenberg representation	1L
Unit :6	Robot Kinematics: Definition of Robot Robot Programming :	1L
	Definition of robot programming;	1L
	Different methods of robot programming: teach-pendant programming,	1L
	key board programming;,.	1L
	Programming languages:	1L
Unit :7	Industrial Applications of Robots Welding,	1L
	Spray painting, Grinding;Material Transfer:	1L
	machine loading and unloading,	1L
	underwater prospecting and repairs, Mining,.	1L
	Space Exploration, Surgery	1L

Total Number Of Hours = 45L(45H)

 ASSIGNMENTS

UNIT 1 - FUNDAMENTALS OF ROBOT

1. Define robot
2. Define base and tool coordinate systems.
3. Name the important specifications of an industrial robot.
4. What is meant by pitch, yaw and roll?

5. What is work volume?

6. What is meant by a work envelope?

7. Sketch a robot and name its parts. (Nov/Dec-2007)

8. What are the four basic robot configuration available commercially? (Apr/May-2010)

9. Classify the robot as per the type of control and mobility (May/Jun 2013)

1. (i) Explain the speed of motion in industrial robots. (8)(Apr/May 2010)

(ii) Explain the load- carrying capacity of a robot.(8) (Apr/May 2010)

2. (i) With a neat sketch explain the three degrees of freedom associated with the robot wrist. (10) (Apr/May 2010) (ii) Discuss the four types robot controls.(6) (Apr/May 2010)

3. (i) Classify the industrial robots and briefly describe it.(8)

(ii) Describe the major elements of an industrial robot.(8) (Nov/Dec-2012)

4. (i) Describe in detail the anatomy of an industrial robot(8)(16) (May/Jun 2013)

(ii) Describe the industrial application of robots.(8) (Nov/Dec-2012)

5. Describe the specifications of an industrial robot and with its configuration.(16) (May/Jun 2013)

6. (i) Sketch a robot wrist and explain it's the joint movements.(8) (Nov/Dec 2007)

(ii) Briefly explain the need for robots in industries.(8) (Nov/Dec 2007)

7. Classify the robots according to the coordinates of motion. with a sketch and example, explain the features of each type.(12+4) (Nov/Dec 2007)

8. Explain the various parts of a robot with neat sketch. (Nov/Dec 2008)

9. (i) Explain the different types of robots(8) (Nov/Dec 2008)

(ii) What are the specifications of robots?(8) (Nov/Dec 2008)

10. (a) Sketch and explain the following configuration of robot.

(i) TRR ii) TRL:R iii) RR:R (8)

(b) Briefly explain in the following terms:

(i) Payload (ii) compliance (iii) Precision (iv) Accuracy. (8) (Nov/Dec 2012)

UNIT 2 ROBOT DRIVE SYSTEM AND END EFFECTORS
TWO MARK QUESTIONS

1. Which type of drive system is more suitable for heavy load robot application? (Nov/Dec-2012)

2. What is end effector? Classify. (Nov/Dec-2012) (May/Jun 2013)

3. Compare pneumatic drive robots with stepper motor drive robots. (Nov/Dec-2008)

4. What is the difference between internal grippers and external grippers? (Nov/Dec-2008)

5. Classify robots according to the drive system. (Nov/Dec-2007)

6. List any TWO important advantages and disadvantages of a pneumatic gripper. (Nov/Dec-2007)

7. What is a mechanical gripper? (May/apr 2010)

8. How will sensor evaluated? (May/Jun 2013)

10. Give some examples of tool as robot end effector. (Nov/Dec 2011)

11. What are the types of hydrulic actuators? (Nov/Dec 2011)

12. What are the properties of stepper motor? (May/apr 2010)

1. Discuss about the salient features of stepper and servo motor with limitations. (Nov/Dec-2012)

2. Describe the types of end effector & gripper mechanisms with simple sketches. (Nov/Dec-2012) (May/Jun 2013) (Nov/Dec 2008)

3. (i))Discuss the types of drive systems used in robots.(12) (ii) discuss any one of the types of gripper mechanism.(4) (Apr/May 2010)

4. (i)discuss about magnetic and vacuum grippers.(8)

(ii)explain the working of DC servo motors used in robotics.(8) (Apr/May 2010)

5. Explain the different types of electrical drives used in robot actuation. (Nov/Dec 2008)

6. (i) with neat sketch, explain the working of a stepper motor. (8) (Nov/Dec 2007)

(ii) with suitable illustration explain working on external and internal grippers. (8) (Nov/Dec 2007)

7. With neat sketch explain any five types of mechanical grippers (Nov/Dec 2007)

8. Discuss about the salient features of different drive systems used in robots.

(May/Jun 2013)

9. Discuss the performance characteristics of actuators. Compare electrical, pneumatic & hydraulic actuators for their characteristics. (Nov/Dec 2011)

10. Discuss in detail the selection and design considerations of grippers in robot. (Nov/Dec 2011)

11.

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Lesson- Plan

Subject Name: Industrial Robotics   Subject Code-ME801 B

Year: 4th Year   Semester: Eighth

UNIT-3 SENSORS AND MACHINE VISION
TWO MARK QUESTIONS

1. Differentiate between the sensor & transducer. (Nov/Dec-2012)

2. Name any two algorithms for image enhancement application. (Nov/Dec-2012)

3. Briefly explain the function of a piezoelectric sensor. (May/Jun 2013)

4. What is image analysis? (May/Jun 2013)

5. What is triangulation? (Apr/May 2010)

6. What is smoothing in vision system? (Apr/May 2010)

7. What is LVDT? (Nov/Dec 2008)

8. What is meant by segmentation in image analysis? (Nov/Dec 2008)

9. What is function frame grabber? (Nov/Dec 2007)

10. State the working principle of the touch sensor? (Nov/Dec 2007)

11. Name some feedback devices used in robotics. (Nov/Dec 2011)

12. What are the application of machine vision system? (Nov/Dec 2011)

1. Explain the principal of sensing. Describe force sensing with strain gauge and wrist force sensor. (Nov/Dec 2011)

2. Explain machine vision system with a sketch. Give practical examples of its applications. (Nov/Dec 2007) (Nov/Dec 2011) (May/Jun 2013)

3. (i)With suitable sketch and an application example ,explain the principle of working of the following sensors:

(a) Inductive proximity sensor

(b) Slip sensor. (8) (Nov/Dec 2007)

(ii) Write a note on the applications of a machine vision system.(8) (Nov/Dec 2007)
4. Explain the segmentation methods used in vision system with suitable example. (Apr/May 2010)

5. (i)Describe the construction ,working and application of incremental encode.(8)

(ii) Explain the two object recognition technique used in industries.(8) (Apr/May 2010)
6. Explain the principle of the following sensors and also mention how they are used in robots.

(i) Piezo elecric sensor

(ii) Inductive proximity sensor

(iii) Touch sensor

(iv) Slip sensor (4 x 4) (Nov/Dec 2008)

7. Describe the classification of sensors and the factors to be considered for its selection(May/Jun 2013)

8. Describe any one algorithm for image edge detection and image segmentation with advantages. (Nov/Dec 2012)

9. Describe the principle and application of LVDT, Resolver and Range sensor. (Nov/Dec 2012)

UNIT 4 ROBOT KINEMATICS AND ROBOT PROGRAMMING
TWO MARK QUESTIONS

1. List the different robot parameters. (Nov/Dec-2012)

2. What are the limitations of on-line robot programming? (Nov/Dec-2012)

3. What is inverse kinematics? (May/Jun 2013)

4. Write down the basic types of robot programming. (May/Jun 2013)

5. Determine the translated vector for the given vector v=25i+10j+20k, perform a translation by a distance of 8 units in "X" direction, 5 units in "Y" direction and 0 units in "Z" direction. (Apr/May 2010)

6. Write the meaning of the following command D MOVE (1,10),D MOVE (<4,5,6>,<30,-45,90>)(Apr/May 2010)

7. What are the motion commands available in VAL programming? (Nov/Dec 2008)

8. What is meant by Inverse kinematics of robots? (Nov/Dec 2008)

9. What is meant by a teach pendant? (Nov/Dec 2007) (Nov/Dec 2011)

10. Explain any two commands associated with the programming of end effectors. (Nov/Dec 2007)

11. Define reverse kinematics. (Nov/Dec 2011)

1. Write a VAL robot program to perform pick and place operation on the conveyer system. it consist of two conveyors running parallel with centre distance of 600 mm at same level. An industrial robot is fixed centrally between the conveyors. The robot is used to transfer work pieces from conveyor 1 to 2 at a constant speed. Draw a schematic view of the system .assume all necessary dimension. (May/Jun 2013) . (Nov/Dec 2012)

2. (i) Consider two frames {A}&{B}.The frame {B} is rotated with respect to frame{A} by 30 degree. around z-axis and the origin of{B} is shifted with respect to the origin of{A} by[5,10,5].the Z a and Z b axes are parallel point 'p' is described in {B} by 1,2,3).describe

Subject Name: Industrial Robotics   Subject Code-ME801 B
Year: 4th Year   Semester: Eighth

the same point with respect to {A} using the transform matrix .(8) (Apr/May 2010)

(ii) Write short note dynamics of a robot.(8) . (May/Jun 2013)

3. Describe briefly the kinematics and dynamics of a robot. . (Nov/Dec 2012)

4. (i) Explain the manual lead through programming in robot application.(6)

(ii) Write about end effectors command & sensor command.(10) (Apr/May 2010)
5. Derive forward & inverse kinematics equations of manipulator for a particular position. (Nov/Dec 2008)

6. (i) write short notes on teach pendant.(8)

(ii) Explain the various features robot programming languages.(8) (Nov/Dec 2012)
7. Using VAL language, discuss the basic commands and explain the structure of the program for a typical pick and place operation. (Nov/Dec 2007)

8. (i) Write a critical note on forward and inverse kinematics of a 3 degrees of freedom: robot(10)

9. (ii) Write a note on lead –through programming.(6) (Nov/Dec 2007)

10. Explain the various programming methods used in robotics with examples and features of each. (Nov/Dec 2011)

11. Discuss various difficulties associated with the inverse kinematic solution and explain 'geometric approach' used in inverse kinematic problem. (Nov/Dec 2012)

UNIT 5 IMPLEMENTATION & ROBOTS ECONOMICS
TWO MARK QUESTIONS
1. List out the few robot applications area in manufacturing. (May/Jun 2013) (Nov/Dec 2008) (Nov/Dec 2011)

2. What are the functions of work cell controller? (May/Jun 2013)

3. How an AVG will differ with Robot? (Nov/Dec-2012)

4. List few safety precautions necessary for robotic application. (Nov/Dec-2012) (Nov/Dec 2007) (Nov/Dec 2011)

5. What are the three levels of safety sensor systems in robotics defined by National Bureau of Standards? (Apr/May 2010)

6. What is AGV? (Nov/Dec 2008)

7. How do you calculate the robot economics by rate of investment method? (Nov/Dec 2007)

8. Function of robots in a Computer Integrated Manufacturing environment. (Nov/Dec 2011)

1. Discuss in detail various methods available for the analysis of robot economics. (Nov/Dec 2008)

2. Write a critical note on the steps that a company should follow during implementing robotics. (Nov/Dec 2007) (may/june2013)

3. (i) write a note on AGV.(8)

(ii) Explain the features of safety sensors & safety monitoring of robots.(8)

4. (i) explain the different safety considerations for robot operations.(8) (Apr/May 2010) (Nov/Dec 2007)

(ii) Explain about robot welding.(8) (Nov/Dec 2008)

5. (i) explain the working of automated guided vehicles with

(a) Component –based DCS

(b) Design with field bus technology.(10) (Apr/May 2010)

(ii) Explain the design consideration for workplace safety.(6) (Apr/May 2010)

6. Write short note on Equivalent Uniform Annual cost and rate of return methods. (may/june2013)

7. Discuss about the implementation issues of robots in an assembly environment. (Nov/Dec 2012)

8. Illustrate the economics of robot implementation with help of pay back method(Nov/Dec 2012)

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Lession- Plan

Subject Name: Energy conservation & Management   Subject Code-ME801C

Year: 4th Year   Semester: Eighth

Module/Unit Number	Topics	Number of Lectures
Unit :1	**Introduction:**	1L
	Energy resources; New and renewable energy resources;	1L
	Energy forms and energy technologies;	1L
	Energy and environmental concerns;	1L
	Energy scenario and energy crisis;	1L
	energy resources management and energy conservation – principles;.	1L
	Potential areas industries;	1L
	Agriculture and municipal for energy conservation;	1L
	Conservation methods	1L
Unit :2	**Energy efficient technologies in thermal systems:**	1L
	Fuels and combustion; Boilers and turbines;	1L
	Cogeneration and combined cycles;	1L
	DG sets; Circulating cooling water systems;	1L
	Steam system and condensate systems and insulation;	1L
	Heat exchangers; Multiple effect evaporations;	1L
	Furnaces;	1L
	Thermo-compressors and mechanical vapour compressors;	1L
	Waste heat recovery and reuse	1L
Unit :3	**Energy efficient technologies in electrical systems:**	1L
	Electrical motors and drives;	1L
	Pumps; Fans and Blowers;	1L
	Air compressors and compressed air systems;	1L
	Buildings and space heating and lighting systems;	1L
	HVAC systems	1L
Unit :4	**Energy management:**	1L

	Supply side and demand side management; Energy conservation methods;	1L
	Energy management systems;	1L
	Energy monitoring;	1L
	Energy review and energy bench marking;	1L
	Energy action planning;	1L
	Energy auditing	1L
Unit :5	**Energy policy and legislation:**	1L
	; Energy conservation act; 2001;	1L
	Energy managers and energy auditors;	1L
	Energy labeling and energy standards	1L
	Energy policy	1L
Total Number Of Hours = 36L(36H)		

.

Assignment: 1

Q.1 (a) Discuss in brief Energy conservation Act 2001 and its features.

(b) Define Energy management. State the basic principles and benefits of

energy management.

Assignment: 2

Q.2 (a) What do you mean by 'Energy audit'? Discuss types of energy audit

briefly.

 (b) Write note on 'Indian Energy scenario.'

(c) A domestic food refrigerator maintains a temperature of -100C. The

ambient temperature is 400C. If heat leaks into the freezer at a

continuous rate of 2kJ/s, determine the least power necessary to pump

this heat out continuously.

Assignment: 3

Q.3 (a) State key elements of Energy monitoring and targeting system. Also

discuss its benefits.

(b) Explain in brief the following:

(i) Renewable and nonrenewable energy.

(ii) Commercial and Noncommercial energy

(iii) Low grade and High grade energy

(iv) Energy security

Q.4 (a) What do you mean by Pay back period?

A co-generation plant installation is expected to reduce a company's

annual energy bill by Rs.24 lakhs. If the capital cost of the new cogeneration

installation is Rs.90 lakhs and the annual maintenance and

operating costs are Rs. 6 lakhs, What will be the expected pay back

period for the project?

(b) The following sample data are produced during monitoring programme.

Establish Energy-Production relationship for the given foundry case.

Also Plot the Energy-production graph for nine months.

Month Production

Month	Production ton month	Energy Toe month
1	320	300
2	520	400
3	240	280
4	620	424
5	600	420
6	380	340
7	440	340
8	460	380
9	520	38 0

Q.5 (a) Using the net present value method, evaluate the financial merits of two proposed projects shown in table. The annual rate is 8 % for each project.

Capital cost Year	Project 1	Project 2
30000	30000	
Net amount	Net amount	
Saving Amt(Rs.)	Saving amount(Rs.)	

1	+6600	+6000
2	+6600	+6000
3	+6300	+6000
4	+6300	+6000
5	+6000	+6000
6	+6000	+6000
7	+5700	+6000
8	+5700	+6000
9	+5400	+6000
10	+5400	+6000

Total net saving at end of tenth year +60000 +60000

 (b) Discuss the role of Energy service companies (ESCOs).

Assignment: 4

Q.6 (a) Discuss the sources of waste heat and its potential applications.

(b) With a neat sketch explain Gas turbine co-generation plant

Assignment: 5

Q.7 (a) A three phase induction 75 kW motor operates at 55 kW. The measured

voltage is 415 V, Current 80 A. Calculate the power factor of the motor.

 (b) Explain the following :

(i) Reactive power and Active power

(ii) Explain the importance of TOD (time of the day) tariff

  (c) Prepare a list of five measures for energy optimization in boilers and in

lighting systems.

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Lession- Plan

Subject Name: Quality & Reliability Engineering   Subject Code-ME 801D
Year: 4th Year   Semester: VIII

Module/Unit Number	Topics	Number of Lectures
Unit :1	**Introduction and Process Control for Variables:**	1L
	Introduction, definition of quality.	1L
	, basic concept of quality, definition of SQC,	1L
	benefits and limitation of SQC, Quality assurance,	1L
	Quality cost-Variation in process- factors - process capability -	1L
	process capability studies and simple problems -	1L
	Theory of control chart- uses of control chart-	1L
	Control chart for variables - X chart, R chart and s chart.	1L
Unit :2	**Process Control for Attributes:**	1L
	Control chart for attributes -control chart for proportion or fraction defectives -	1L
	p chart and np chart -.	1L
	control chart for defects -	1L
	C and U charts,	1L
	State of control and process out of control identification in charts	1L
Unit :3	**Acceptance Sampling**	1L
	: Lot by lot sampling - types -	1L
	probability of acceptance in single, double, multiple sampling techniques-	1L
	O.C. curves - producer's Risk and consumer's Risk.	1L
	AQL	1L
	LTPD	1L
	AOQL	1L
	uses of standard sampling plans.	1L
Unit :4	**Life Testing - Reliability:**	1L

	Life testing - Objective - failure data analysis,	1L
	Mean failure rate, mean time to failure,	1L
	mean time between failure, hazard rate,	1L
	system reliability, series, parallel and mixed configuration -	1L
	simple problems. Maintainability and availability-	1L
	simple problems. Acceptance sampling based on reliability test - O.C Curves.	1L
Unit :5	**Quality and Reliability:**	1L
	Reliability improvements -techniques-	1L
	use of Pareto analysis - design for reliability -	1L
	redundancy unit and standby redundancy -.	1L
	Bottleneck Optimization in reliability -	1L
	Product design - Product analysis -	1L
	Product development -	1L
	Product life cycles and theory of constraints.	1L
Total Number Of Hours = 37L(37H)		

.

Assignment: 1

Q.1 (a) Discuss views of different Quality Gurus.
 (b) Explain 7 New Quality Improvement Tools

Assignment: 2

 Q.2 (a) Explain Failure Mode and Effect analysis (FMEA)
 (b) Explain Total Quality Control

(b) Discuss TQM Implementation and Limitations
Assignment: 3

Q.3 (a) Explain Steps in experimental design
(b) Explain KANBAN system

Q.3 (a) Briefly explain Taguchi approach
(b) Explain Methods of Total Productive Maintenance

Assignment: 4

 Q.4 (a) Short note (1) Cost of Quality (COQ) system (2) Bench Marking
(b) Discuss Advantages and Limitation of Six Sigma

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Lession- Plan

Subject Name: Quality & Reliability Engineering   Subject Code-ME 801D

Year: 4th Year   Semester: VIII

Q.4 (a) Short note (1) Discrete and continuous distribution (2) Bench Making

(b) Explain Concurrent Engineering list out its merits and demerits
   Assignment: 5

Q.5 (a) Explain Reliability in terms of Hazard rate and failure density, Conditional probability
   and multiplication rules

(b) Short note (1) Mean time to failure (2) Mean time between failure

Q.5 (a) Short note (1) Failure data analysis (2) Mean time to repair

(b) Explain QS 9000 list out its merits and demerits

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Lesson- Plan

Subject Name: CAD/CAM   Subject Code-ME801A
Year: 4th Year   Semester: Eighth

Module/Unit Number	Topics	Number of Lectures
Unit :1	**Introduction:**	**3L**
	Computers in industrial manufacturing	1L
	basic structure	1L
	CPU, memory types, input devices, display devices, hard copy devices, storage devices	1L
Unit :2	**Computer Graphics:**	**4L**
	Raster scan graphics coordinate system, database structure for graphics modeling	2L
	Transformation of geometry, 3D transformations	1L
	Mathematics of projections	1L
	Clipping, hidden surface removal.	1L
Unit :3	**Geometric Modelling**	**6L**
	Requirements, geometric models	2L
	geometric construction	1L
	Models, curve representation methods	1L
	surface representation methods	1L
	modelling facilities desired	1L
Unit :4	**Drafting And Modelling Systems/ Group Technology**	**7L**
	Basic geometric commands, layers, display	1L
	Control commands, editing	1L
	dimensioning, and solid modelling	1L
	Part family	1L
	coding and classification, types and advantages	1L
	Computer aided processes planning	1L
	Importance and types	1L
Unit :5	**Part Programming For Nc Machines**	**6L**
	NC modes, NC elements	1L
	CNC machine tools, structure of CNC machine tool	1L
	features of machining center, turning center	1L
	CNC Part Programming: fundamentals	1L
	manual part programming methods	1L
	Computer Aided Part Programming	1L
Unit :6	**Computer Integrated Manufacturing Systems**	**7L**
	Types of manufacturing systems	1L
	machine tools and related equipment	1L
	material handling systems	2L
	Computer control systems,	1L
	human labour in manufacturing systems	1L
	CIMS benefits	1L
Total Number Of Hours = 33L(33H)		

Text Books
1. P.N. Rao, CAD/CAM, Tata McGraw Hill Publication.
2. I. Zeid, CAD/CAM - Theory and Practice, Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

References
1. P.N. Rao, N.K. Tewari and T.K. Kundra, Computer Aided Manufacturing, Tata McGraw-Hill Publication.
2. M.P. Groover and E.W. Zimmers Jr., CAD/CAM, Prentice Hall of India

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Lesson- Plan

Subject Name: Automation and Control   Subject Code-ME802B
Year: 4th Year   Semester: VIII

Module/Unit Number	Topics	Number of Lectures
Unit :1	**Introduction to control system:** Concept of feedback and Automatic control, Effects of feedback	1L
	, Objectives of control system, Definition of linear and nonlinear systems, Elementary concepts of sensitivity and robustness.	1L
	Types of control systems, Servomechanisms and regulators, examples of feedback control systems	1L
	. Transfer function concept. Pole and Zeroes of a transfer function. Properties of Transfer function.	1L
	Mathematical modeling of dynamic systems:	1L
	Translational systems, Rotational systems,	1L
	Mechanical coupling, Liquid level systems,	1L
	Electrical analogy of Spring–Mass-Dashpot system. Block diagram representation of control systems.	1L
	Block diagram algebra. Signal flow graph. Mason's gain formula.	1L
	Control system components: Potentiometer,	1L
	Synchros, Resolvers, Position encoders	1L
Unit :2	**Time domain analysis:** Time domain analysis of a standard second order closed loop system.	1L
	Concept of undamped natural frequency,	1L
	damping, overshoot, rise time and settling time.	1L
	Dependence of time domain performance parameters on natural frequency and damping ratio.	1L
	Step and Impulse response of first and second order systems.	1L

	Effects of Pole and Zeros on transient response. Stability by pole location.	1L	
	Routh-Hurwitz criteria and applications.	1L	
	Error Analysis: Steady state errors in control systems due to step, ramp and parabolic inputs.	1L	
	Concepts of system types and error	1L	
Unit :3	**State variable Analysis:** , properties of the State transition matrix,	1L	
	State transition equation,	1L	
	Definition of transfer function & Characteristic equation,	1L	
	definition of controllability and observability	1L	
	State variable model of Linear Time-invariant system	1L	
Unit :4	**Stability Analysis using root locus:**	1L	
	Importance of Root locus techniques,	1L	
	construction of Root Loci for simple systems.	1L	
	Effects of gain on the movement of Pole and Zeros.	1L	
	Frequency domain analysis of linear system:	1L	
	Bode plots, Polar plots, Nichols chart, Concept of resonance	1L	
	frequency of peak magnification.	1L	
	Nyquist criteria, measure of relative stability, phase and gain margin. Determination of margins in Bode plot.	1L	
	Nichols chart. Mcircle and M-Contours in Nichols chart.	1L	
Unit :5	**Control System performance measure:**	1L	
	Improvement of system performance through compensation..	1L	
	Lead, Lag and Lead- lag compensation,	1L	
	PI,	1L	
	PD and PID control	1L	
Total Number Of Hours = 40L(40H)			

.

Assignment: 1

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Lesson- Plan

Subject Name: Automation and Control   Subject Code-ME802B
Year: 4th Year   Semester: VIII

Q.1 (a) Explain the procedure for analyzing a process and applying instrumentation.
Q.1 (b) Answer the following
i Write a short note on dynamic characteristics of an instrument.
ii Explain the direct measurement and indirect measurement respectively.

Assignment: 2

Q.2 (a) Discuss in detail about the simple two level factorial experimental design with suitable example.
Q.2 (b) Answer the following
i Which general considerations are made for process capability studies?
ii Write brief note on material specifications.

Q.2 (b) Answer the following
i With suitable example of rubber processing equipment, explain the concept of open loop control.

ii Write brief note on product specification. **03**

Assignment: 3

Q.3 (a) List the various elastic pressure transducers. Discuss any two in detail.
Q.3 (b) Answer the following
i Give the statement of Thomson effect. Write down the relationship between temperature and e.m.f. A thermocouple produces an e.m.f in mV according to temperature difference between the sensor tip 1 and 2. Determine the mV output when the tip is at 220°C and gauge head is 20°C. Take = 3.5*10-2 and = 8.2*10-6.

ii Write a brief note on thermocouple lead wires.

Q.3 (a) Discuss in detail about the electric force transducers.
Q.3 (b) Answer the following
i Write a short note on thermistors.
ii Which mechanical properties must be considered in selection of thermal well?

Assignment: 4

Q.4 (a) Compare the hydraulic controller with pneumatic controller.

Q.4
(b) Answer the following
i A unit step change is given to PI controller. If the proportional sensitivity is 2/24, integral time is 2, obtain the response of PI controller.
ii Explain the positive feedback system and negative feedback system respectively.

Q.4 (a) Discuss in detail about the dynamic behavior of pneumatic control valve.
Q.4 (b) Answer the following
i Derive the transfer function of PID controller.
ii Define the following terms: (i) Process (ii) Measuring Element (iii) Comparing Element

Assignment: 5

Q.5 (a) Give the advantages and disadvantages of post calendar thickness measurement.
Q.5 (b) Answer the following
i How the data acquisition in rubber factory is carried out using turn key software?
ii Give the importance of LANs to rubber factories.
Q.5 (a) Discuss in detail about the variety of sensors available for gum sheet measurements on calender rolls.
Q.5 (b) Answer the following
i List the hardware steps necessary to bring information from rubber test sensor to microcomputer.
ii Mention the different technologies used for thickness measurement in calendering.

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR
Lecture-wise Plan

Subject Name: Water Resource Engineering　　　　　**Subject Code-ME802C**
Year: 4th Year　　　　　　　　　　　　　　　　　　**Semester: Eighth**

Module Number	Topics	Number of Lectures
1.	Catchment area and Hydrologic cycle, Measurement of rainfall – Rain gauges, Estimation of missing rainfall data, checking of consistency, Optimum number of Rain gauges. Calculation of average rainfall over area – different methods, Frequency analysis of rainfall intensity duration curve. Rainfall mass curve, hyetograph, Examples Evaporation, evapo-transpiration and infiltration: Processes, Factors affecting run off, estimation of run-off, rainfall run off relationship.	8 L
2.	Stream flow measurement: Direct and indirect methods, Examples. Stage discharge relationships Hydrographs; characteristics: Base flow separation. Unit Hydrographs. Derivation of unit hydrographs, S-curve, flood routing. Types of Irrigation systems, methods of irrigation: Water requirements of crops: Crop period or Base period, Duty & Delta of a crop, relation between Duty & Delta, Duty at various places, flow Duty & quantity Duty, factors affecting Duty, measures for improving Duty of water, crop seasons.	8 L
3.	Canal Irrigation: Introduction, classification of irrigation canals, efficient section, certain important definitions, Time factor, Capacity factor, full supply coefficient, Nominal duty, Channel losses, Examples. Design of unlined alluvial channels by silt Theories: Introduction, Kennedy's theory, procedure for design of channel by Kennedy's method, Lacey's theory, concept of True regime Initial regime and final regime, design procedure using Lacey's theory, examples.	9L
4.	Water logging and drainage: Causes, effects and prevention of waterlogging. Type of drains-open drains and closed drains (introduction only), Discharge and spacing of closed drains. Examples. Lining of Irrigation Canals: Objectives, advantages and disadvantages of canal lining, economics and requirements of canal lining, Design of lined Canals examples.	9L
5.	Introduction to ground water flow, Darcy law; Wells: Definition, Types-open well or Dug well, Tube well, open well-shallow open well, deep open well, cavity formation in open wells, construction of open wells, Yield of an open well – Equilibrium pumping test, Recuperating test, examples, Tube wells – Strainer type, cavity type, slotted type. Examples.	10L
Total Number Of Hours = 44		

Assignment:
Module 1:

1. **A)** Define irrigation. What is the necessity of irrigation?
    B) Discuss the hydrological water budget equation.

2. A) what is hydrological cycle? Explain it with suitable sketch diagram.
    B) What are the techniques of water distribution in the farms? Explain in brief.

3. A) what are the advantages of canal lining?
    B) What are the consumptive uses of water? Explain the factor affecting   consumptive use
    of water

Module 2:

1. Write short notes –
    A) Capillary and Hygroscopic Water
    B) Channel routing
    C) Penman's method
.

2. A) Derive the relation between Duty and Delta.
    B) Define precipitation. Explain different forms of precipitation?

3. A) Explain crop period and base period?
    B) What are the precaution to be taken for controlling water-logging?

Module 3:

1. A) Explain double mass curve.
    B) Lake had a water surface elevation of 103.200 m above datum at the beginning of a   certain month. In that month the lake received an average inflow of 6.0 m3/sec from surface runoff sources. In the same period the outflow from the lake had an average   value of 6.5 m3/sec. Further, in that month, the lake received a rainfall of 145 mm and the evaporation from the lake surface was estimated as 6.10 cm. Write the water budget equation for the lake and calculate the water surface elevation of the lake at the end of the month. The average lake surface area can be taken as 5000 ha. Assume that there is no contribution to or from the ground water storage.

2. A) what do you understand with adequacy of rain gauge stations?
    B) Catchment has six rain gauge stations. In a year, the annual rainfalls recorded by the gauges are as follows:

Station	A	B	C	D	E	F
Rainfall (cm)	82.6	102.9	180.3	110.3	98.8	136.7

 For a 10% error in the estimation of the mean rainfall, calculate the optimum number of stations in the catchment.

Module 4:

1. A)

S. No.	Isohyets (cm)	Area (square km)
1	Station-12	30
2	12.0-10.0	140
3	10.0-8.0	80
4	8.0-6.0	180
5	6.0-4.0	20

Estimate the mean precipitation due to storm.

B) The ordinates of a 3 hour unit hydrograph are given below :
Find the ordinates of a 6 hour unit hydrograph for the same.

Time in hour	0	03	06	09	12	15	18	21	24	27	30
Ordinate m^3/sec i.e. cumec	0	10	25	20	16	12	09	07	08	03	00

2. A) Differentiate   index and W index.
   B) B) Design a trapezoidal shaped concrete lined channel to carry a discharge of 200 cumec at a slope of 30 cm/km. The side slopes of the channel are 1.5 : 1. The value of N may be taken as 0.017. Assume limiting velocity in the channel as 2 m/s.

Module 5:

1. A) Compare Lacey's theory with Kennedy's theory
   B) Calculate the value of   -index from the following data of storm of 8 cm precipitation that resulted in a direct runoff of 4.4 cm :

Time in Hr.	1	2	3	4	5	6
Incremental Rainfall per	0·57	0·58	1·25	3·00	1·40	1·2

2. A) What do you mean by initial regime, final regime and permanent regime ?
   B) Explain field capacity and permanent wilting point ?
   C) A) Locations of rain gauge stations on a river basin A, B, C, D,E, F is forming a regular hexagon of side 5 km. Rainfall recorded in each of them are as follows :

St^n –	A	B	C	D	E	F
Rainfallincm	4·6	3·9	6·9	10·6	12·7	4·2

Calculate the mean rainfall by Thiessen Polygon method and Arithmetic mean method.

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Lesson- Plan

Subject Name: Automobile Engineering   Subject Code-ME802D

Year: 4th Year   Semester: Eighth

Module/Unit Number	Topics	Number of Lectures
Unit :1	**Introduction:** .	**1L**
	History & Development of Automobile.	1L
	various sub system of Automobile	1L
	Prime Mover: Engine for Two –Wheeler & Three-	1L
	Wheeler vehicles, Engine for passenger cars, commercial and other vehicle,.	1L
	Fuel system for carburetted engine,	1L
	MPFI engine and Diesel engine, Lubrication and cooling system	1L
Unit :2	**Auto Electrical:** Electric Motor as prime mover,	**1L**
	Battery, generator,	1L
	Ignition system, Starting system, .	1L
	lighting & signalling	1L
	Steering System:	1L
	Devis steering & Ackerman steering system.	1L
	Rack & pinion,	1L
	cam & lever,	1L
	worm & sector system	1T
Unit :3	**Transmission System:**	**1L**
	Flywheel & clutch.	1L
	Gearbox sliding and constant mesh type	1L
	, Automoatic Transmission, Universal joint,	1L
	Propeller shaft.	1L
	Differential & Axle:	1L
	Construction & function of differential,	1L
	Different types of front & rear axles	1L

Unit :4	**Suspension System:**	1L
	Conventional and independent suspension system,	1L
	application **Brake System:** Disc & drum brake,	1L
	Hydraulic brake, Parking brake. Stopping distance.	1L
Unit :5	**Power Requirement:**	**1L**
	Various resistances such as air resistance	1L
	, gradient resistance, rolling resistance.	1L
	Tractive effort. Torque- Speed curve	1L
	. Horse power calculation.	1L
	Maintenance of Vehicle	1L
Total Number Of Hours = 34L(34H)		

.

Assignments

UNIT 1
1. State the difference between S.I and C.I engine
2. What is clearance volume? And what are its effects?
3. What is the function of piston, connecting rod , crank shaft and cylinder head?
4. What is the purpose of cooling system?
5. State the merits and demerits of air and water cooling system.
6. What is the purpose of lubricating system? State its types
7. What is meant by turbo charging?
8. What are the various pollutants in I.C engine? What are its effects?
9. What is meant by P.C.V ? and what are its effects?
10. What is a Catalyst?
11. Write down the firing order a 4 cylinder and 6 cylinder engine
PART B
1. Explain the construction and working principle of S.I and C.I engine
2. State the construction and working principle three way catalytic converter with neat diagram
3. Explain the construction and working principle of pressure lubrication system with neat diagram.
4. Explain the construction and working principle of any one type of water cooling system and
state its advantages and disadvantages .
5. What are the various methods of controlling the HC and NOX emission present in I.C engine?
Discuss any one method
6. Explain the following terms a) Load distribution in frame, b) Frame type with neat sketch c) Frame materials d) Frame testing
UNIT 2
PART A

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR
Lesson- Plan

Subject Name: Automobile Engineering   Subject Code-ME802D
Year: 4th Year   Semester: Eighth

1. What is meant by carburetion in I.C engine?
2. What are the advantageous of electronic fuel injection system over conventional injection system ?
3. What are the functions of generator and starting motor
4. What is the function of ignition system in I.C engine
5. State the requirements of ignition system? And state its types
6. What is the ignition advance?
7. What are the difference between battery coil ignition and magneto ignition system?
8. What is the sealed head lamp system?
9. What is the function of carburetor?
10. What are the merits and demerits of mono point and multi point fuel injection system
PART B
1. Explain the construction and working principle of SOLEX Carburetor with neat diagram
2. Explain the construction and operation of lead acid battery neat diagram
3. What is the purpose of ignition system? Explain any one type with neat diagram.
4. Explain the electrical system of a typical Indian car
5. What is meant by compensation in carburetor? Explain any one method with neat diagram
UNIT 3

PART A
1. What is the function of clutch?
2. What are the types of clutch? State its requirements.
3. What is the function of gear box? State its types.
4. Why is gear box necessary in automobile?
5. What is tractive effort
6. Why is sliding mesh gear box not preferred?
7. What is automatic transmission?
8. What is an over drive?
9. What is an universal joint? What are its types?
10. What is the necessity of a propeller shaft?
11. What is HOTCHKISS drive and TORQUE TUBE drive?
12. What is the function of differential unit?
PART B
1. Explain the construction and working principle of multi plate clutch with neat diagram
2. Explain the construction and working of synchromesh gear box with neat diagram
3. Describe the constant mesh gear box and how does its differs from sliding mesh gear box with neat diagram
4. Explain the construction and working differential with neat diagram
5. What are the various type of rear axle? Explain any one in detail with diagram
UNIT 4
PART A
1. What is meant by wheel base and wheel tramp
2. What is a tyre? How is tyre constructed?
3. What is steering ratio?
4. What is camber? Why is camber angle provided?
5. What is toe in and toe out?
6. What are the types of steering gear box? State the function of gear box.

7. What are main advantages of power steering?
8. What is function of suspension system in automobile?
9. What is the function of brake? State its type.
10. What are the function of front axle? And what its function?

PART B
1. Why wheel alignment is necessary? Explain caster, camber, king pin inclination
2. Explain the construction and working of telescopic shock absorber with neat diagram
3. State the different types of steering box? Explain any one with neat diagram.
4. Sketch the air brake system in a motor vehicle and describe its working.
5. What is the purpose of front axle? Describe the live and dead front axle
6. Explain the construction and operation of hydraulic braking system with a neat sketch

UNIT 5

PART A
1. What are the alternative fuels? Give its characteristics.
2. Compare the properties of gasoline, CNG and LPG
3. What is meant by Hybrid vehicle?
4. What are fuel cells?
5. What are the various properties of gaseous fuel?
6. What is CNG?
7. What is BIO- DIESEL? State its advantages.
8. What are advantages of LPG over conventional fuels?
9. What are the disadvantages of using alcohol as an alternative fuel?

PART B
1. How is CNG better than Diesel from pollution view point
2. Describe the salient features of using LPG as an alternate fuel. Explain why hydrogen is considered as the most favorable fuel for future
3. Explain the difference between CNG and LPG used in I.C.engines.
4. Explain the advantages and disadvantages of BIO- DIESEL over conventional fuels used in I.C. engines.
5. Explain the construction and working of Hybrid vehicle with neat diagram
.

Title of Course: Design of Mechanical System lab
Course Code: ME891
L-T –P Scheme: 3P   **Course Credits: 2**

Course Description & Objectives:
Lectures and projects covering problem solving methodology in the design, analysis, and synthesis of mechanical and thermal systems. The student's academic background combines with engineering principles and topics to serve as a foundation for broad engineering projects. Emphasis on creative thinking and the engineering design process in projects involving optimal conversion of resources.

Objective 1: To teach students the fundamentals of mechanical engineering design theory to design, create and select components of complete mechanical systems from the recognition of need and definition of design objectives, design innovation.

Objective 2: To illustrate to students the setting up and solving of structured and unstructured design problems, stages of design.

Objective 3: To teach students how to apply computer based techniques in the analysis, design/selection of mechanical systems and to enhance student's communication skills.

Course Outcomes:

(a) an ability to apply knowledge of mathematics, science and engineering
 (b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
 (d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
 (j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Course Contents:

In this sessional course work the students have to make design calculations and prepare component & assembly drawings/sketches (preferably in CAD) on a mechanical system assigned to a group of 4 to 5 students. Mechanical systems will include plants, equipment,instruments, drives, mechanisms, hydraulic/pneumatic/lubrication systems etc. The teachers will allocate one suitable mechanical system appropriate for a 8th. semester Mechanical Engineering student to each group of students.The students have to carryout the design work in consultation with the respective teacher/s and submit the design work in bound volumes individually and face a viva voce examination as proof of their individual understanding of the design work.

TEXT BOOKS:
Lab Manual and Lecture Notes for ME 4053a Thermal Energy and Fluids Laboratory, The George W. Woodruff School of Mechanical Engineering. Lab Manual for ME 4053b Mechanical Systems Lab, The George W. Woodruff School of Mechanical Engineering.

REFERENCES:

Sheldon Jeter and Jeffrey Donnell, Writing Style and Standards in Undergraduate Reports, 2nd Edition, College Publishing, 2011.

1. DESIGN PROJECT TITLE:

DESIGN OF PRESSURE VESSEL

SCOPE OF THE PROJECT:
The design project consists of two imperial size sheets to be drawn with 3D/2D CAD software- one involving assembly drawing with a part list and overall dimensions and the other sheet involving drawings of individual components, manufacturing tolerances, surface finish symbols and geometric tolerances should be specified so as to make it working drawing.

Students are required to be submitted a design report giving all necessary calculations of the design of components and assembly.

PRE-REQUSITES:
Basics of Strength of Materials, Metallurgy, 2D/3D modeling, etc.

PRESSURE VESSEL CALCULATIONS:
Students are supposed to take reference of any standard reference book from the list provided in the Reference Books.

SAMPLE DRAWINGS:
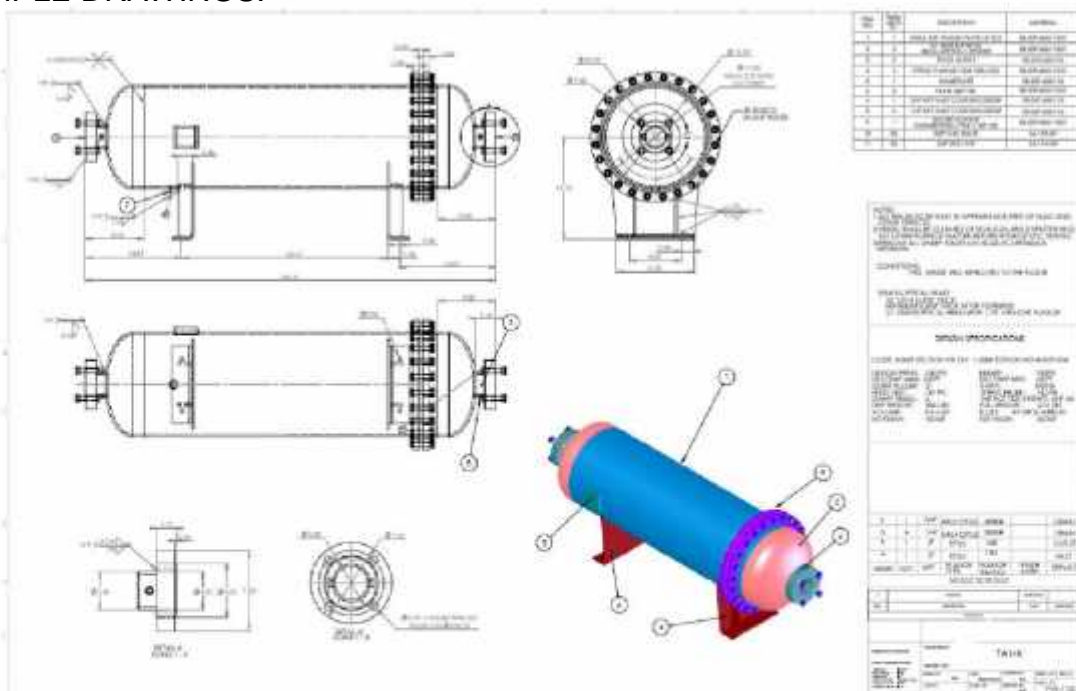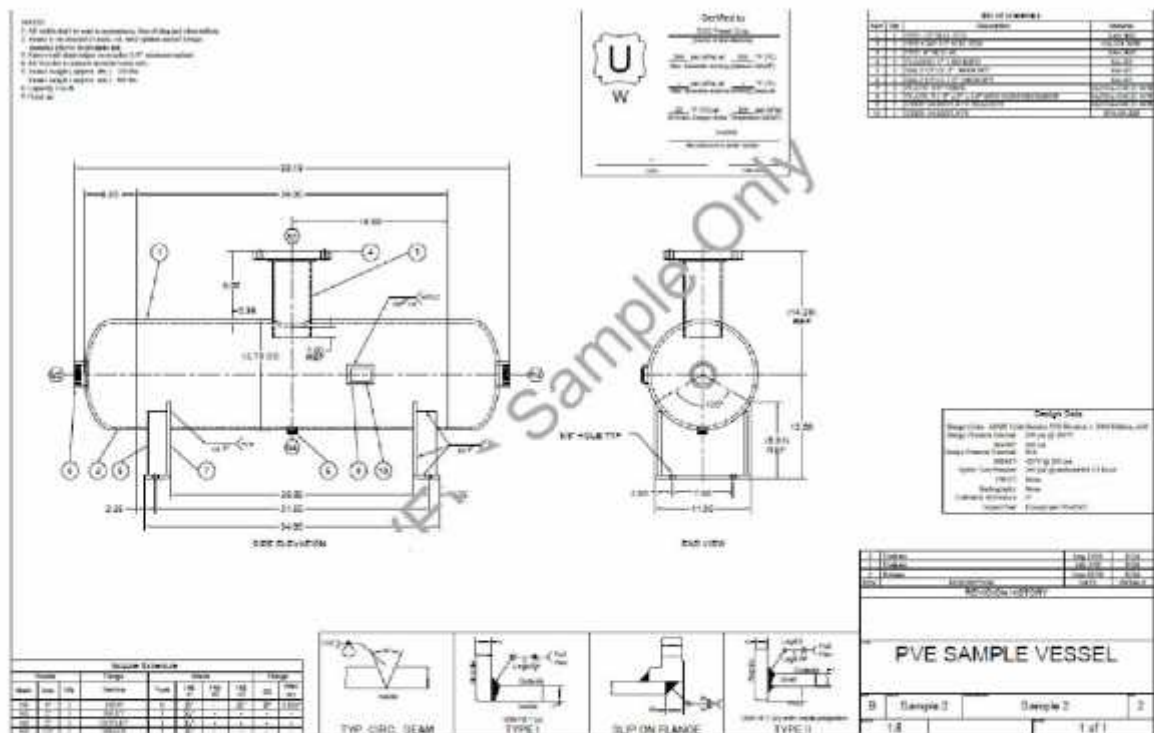
PVE SAMPLE VESSEL

2. ASSIGNMENTS

Assignment No. 01
Design review of product for aesthetic and ergonomic considerations

Although industrial and product designers are keenly aware of the importance of design aesthetics, they make aesthetic design decisions largely on the basis of their intuitive judgments and 'educated guesses'. Whilst ergonomics and human factors researchers have made great contributions to the safety, productivity, ease-of-use, and comfort of human-machine-environment systems, aesthetics is largely ignored as a topic of systematic scientific research in human factors and ergonomics. There are two major questions need to addressed: How do we use engineering and scientific methods to study aesthetics concepts in general and design aesthetics in particular? How do we incorporate engineering and scientific methods in the aesthetic design and evaluation process?

What is aesthetics?
The term 'aesthetics' concerns our senses and our responses to an object. If something is aesthetically pleasing to you, it is 'pleasurable' and you like it. If it is aesthetically displeasing to you, it is 'displeasurable' and you don't like it. Aesthetics involves all of your senses - vision, hearing, touch, taste, and smell - and your emotions.

Elements of Aesthetics
There are many different things that contribute to your overall perception of a product, and to your opinion as to whether it is aesthetically pleasing to you.
      Vision   Hearing   Touch   Taste   Smell

Your opinion about a product may also be influenced by certain associations that are important to you, such as:
- ☐ how fashionable it is
- ☐ whether it is a novelty, or an old favorite
- ☐ whether it is a symbol of wealth or love
- ☐ how much danger or risk is involved
- ☐ if it provides a link with your past

You might also take into account whether it is safe and reliable and fit for its purpose. Consistency with a particular aesthetic concept may be a significant factor in creating a product's appeal too, for example, the current appreciation of 'retro' designs. However, such trends are often cultural and almost certainly always short-lived, so their popularity can't be guaranteed.

Consideration of aesthetics in design
There are four different 'pleasure types' to consider:

Physio-pleasure - pleasure derived from the senses from touch, smell, sensual pleasure etc. For example the smoothness of a curve in a hand-held product or the smell of a new car.

Socio-pleasure - pleasure gained from interaction with others. This may be a 'talking point' product like a special ornament or painting, or the product may be the focus of a social gathering such as a vending machine or coffee machine. This pleasure can also come from a product that represents a social grouping, for example, a particular style of clothing that gives you a social identity.

Psycho-pleasure - pleasure from the satisfaction felt when a task is successfully completed. Pleasure also comes from the extent to which the product makes the task more pleasurable, such as the interface of an ATM cash machine that is quick and simple to use. It is closely related to product usability.

Ideo-pleasure - pleasure derived from entities such as books, art and music. This is the most abstract pleasure. In terms of products, it is the values that a product embodies, such as a product that is made of eco-friendly materials, and processes that convey a sense of environmental responsibility to the user.

Each of these pleasures should be considered in turn - their importance to the product you are designing, and how each aspect might show itself in that product.

Aesthetics and ergonomics in product design

"More and more people buy objects for intellectual and spiritual nourishment. People do not buy my coffee makers, kettles and lemon squeezers because they need to make coffee, to boil water, or to squeeze lemons, but for other reasons."

Alberto Alessi, Designer

This quote gives an indication of how the world of product design has changed over the past few decades. An appreciation of pleasure in product use is fast becoming of primary importance to both consumer and the design industry alike. Consumers' expectations have been raised; they no longer simply expect the products they buy to be functional and usable. Consumers demand functionality, expect usability and are seeking products that that elicit other feelings such as pleasure or that strike a certain emotional chord. It likely to be the aesthetics

of the product; the way it looks, the feel of the material, the tactile or 'haptic' response of controls or more abstract feelings, such as reflected status, that give pleasure. Traditionally, product design has been considered to comprise three main elements:

Product Designers need knowledge of all these elements. In the case of the design of a small or simple product, the designer's responsibility may be for all of these elements. In the case of larger products, such as cars, the designer's responsibility may be for aesthetics only; ergonomists and engineers providing the expertise needed for the other elements. Conventionally, ergonomics has consisted of usability and functionality, and designing pleasure into the product has been the job of the designer. However, increasingly the boundaries between the two disciplines are disappearing, and ergonomists are taking some responsibility for the aesthetics of the design, using scientific methods to increase understanding of the aesthetics (both pleasurable and displeasurable) and applying this to the design of products.

The best design occurs when all three components are considered together from the start of the design process. Usually, compromises will have to be made, but understanding all the issues involved will help to make the most acceptable compromises. For example, if you are designing a sports car, you will make different compromises from those that you will make if you are designing a family saloon car.

Sports car

The emphasis is on aesthetics and performance. The car may go very fast, look beautiful and make all the right sort of noises. However, it is likely to be difficult to get in and out of, have little storage space, seat only two people and have limited visibility. The physical and functional ergonomics are not the best but the car is exactly what the consumer is expecting of a sports car.

Ergonomics is compromised in order to achieve performance and aesthetics.

Family saloon car

The emphasis is on functionality and usability. The car should first serve the needs of the family, so will have adequate seating and storage space and be suitable for family travelling. It should also have aesthetic appeal but there may be compromises in design in order to provide the required levels of functionality and usability.

Working with aesthetics and ergonomics

Compromises need to be made in different ways depending upon the product.

Where ergonomics and aesthetics meet

Clearly, many aesthetic ideas are easily combined with good ergonomics, for example, chairs that look good and are comfortable too; buttons on your mobile phone that give good feedback. This Alessi corkscrew has obviously been designed to be more than just a corkscrew, but it is extremely functional as well.

Where aesthetics may predominate

There are other products that conflict directly with ergonomics principles. For example, cars that go so fast they thrill you despite (or is it because of?) the risk that you are taking. However, whilst speed limits and traffic calming measures exist to slow fast cars down in dangerous situations, these fast, thrilling objects of desire are still designed and manufactured. Another example of aesthetics having more influence than ergonomics is shoes that are beautiful and very fashionable, but are bad for your feet and your posture, and increase the risk of slipping and hurting yourself. We are all educated as small children about the need to wear well-fitting, flat shoes for healthy feet, but we would complain if all footwear had to be designed by ergonomic principles only.

Where aesthetics must never predominate

Conversely, there are situations where ergonomics principles must override aesthetics, such as products that are used in safety-critical situations. For example, equipment designed for use in operating theatres or by air traffic controllers. There is much legislation concerning the safety of products and designers must work within these constraints of legislation or their products will not be allowed to enter the market place. For more on product safety, see the product evaluation topic.

Where to compromise

Many products are not safety-critical and the designer must take the responsibility for balancing aesthetics and ergonomics appropriately. Miniaturisation of products is an example worth considering. When mobile telephones were first designed, technology dictated that they were the size of a small housebrick! The displays and controls were easily usable by most people, but they considered the phones to be too large and heavy to be very 'mobile'. Technological advances allowed the production of smaller phones and they became truly 'mobile'; fitting easily into handbags and pockets. However, the control and display sizes were compromised and many have become too small for easy use. The optimum compromise was not recognised.

Assignment No. 02
Analysis of product using reverse engineering

Reverse engineering is the process of discovering the technological principles of a device, object, or system through analysis of its structure, function, and operation. It often involves taking something (e.g., a mechanical device, electronic component, software program, or biological, chemical, or organic matter) apart and analyzing its workings in detail to be used in maintenance, or to try to make a new device or program that does the same thing without using or simply duplicating (without understanding) the original.

Reverse engineering has its origins in the analysis of hardware for commercial or military advantage. The purpose is to deduce design decisions from end products with little or no additional knowledge about the procedures involved in the original production. The same techniques are subsequently being researched for application to legacy software systems, not for industrial or defense ends, but rather to replace incorrect, incomplete, or otherwise unavailable documentation.

Motivation
Reasons for reverse engineering:
- ☐ Interoperability.
- ☐ Lost documentation: Reverse engineering often is done because the documentation of a particular device has been lost (or was never written), and the person who built it is no longer available. Integrated circuits often seem to have been designed on obsolete, proprietary systems, which means that the only way to incorporate the functionality into new technology is to reverse-engineer the existing chip and then re-design it.
- ☐ Product analysis. To examine how a product works, what components it consists of, estimate costs, and identify potential patent infringement.
- ☐ Digital update/correction. To update the digital version (e.g. CAD model) of an object to match an "as-built" condition.
- ☐ Security auditing.
- ☐ Acquiring sensitive data by disassembling and analysing the design of a system component.
- ☐ Military or commercial espionage. Learning about an enemy's or competitor's latest research by stealing or capturing a prototype and dismantling it.
- ☐ Removal of copy protection, circumvention of access restrictions.
- ☐ Creation of unlicensed/unapproved duplicates.
- ☐ Materials harvesting, sorting, or scrapping.
- ☐ Academic/learning purposes.
- ☐ Curiosity.

☐ Competitive technical intelligence (understand what your competitor is actually doing, versus what they say they are doing).

☐ Learning: learn from others' mistakes. Do not make the same mistakes that others have already made and subsequently corrected.

Reverse engineering of machines

As computer-aided design (CAD) has become more popular, reverse engineering has become a viable method to create a 3D virtual model of an existing physical part for use in 3D CAD, CAM, CAE or other software. The reverse-engineering process involves measuring an object and then reconstructing it as a 3D model. The physical object can be measured using 3D scanning technologies like CMMs, laser scanners, structured light digitizers, or Industrial CT Scanning (computed tomography). The measured data alone, usually represented as a point cloud, lacks topological information and is therefore often processed and modeled into a more usable format such as a triangular-faced mesh, a set of NURBS surfaces, or a CAD model.

Reverse engineering is also used by businesses to bring existing physical geometry into digital product development environments, to make a digital 3D record of their own products, or to assess competitors' products. It is used to analyze, for instance, how a product works, what it does, and what components it consists of, estimate costs, and identify potential patent infringement, etc. Value engineering is a related activity also used by businesses. It involves de-constructing and analysing products, but the objective is to find opportunities for cost cutting.

Reverse engineering of protocols

Protocols are sets of rules that describe message formats and how messages are exchanged (i.e., the protocol state-machine). Accordingly, the problem of protocol reverse-engineering can be partitioned into two subproblems; message format and state-machine reverse-engineering.

The message formats have traditionally been reverse-engineered through a tedious manual process, which involved analysis of how protocol implementations process messages, but recent research proposed a number of automatic solutions. Typically, these automatic approaches either group observed messages into clusters using various clustering analyses, or emulate the protocol implementation tracing the message processing.

There has been less work on reverse-engineering of state-machines of protocols. In general, the protocol state-machines can be learned either through a process of offline learning, which passively observes communication and attempts to build the

most general state-machine accepting all observed sequences of messages, and online learning, which allows interactive generation of probing sequences of messages and listening to responses to those probing sequences. In general, offline learning of small state-machines is known to be NP-complete, while online learning can be done in polynomial time.

Other components of typical protocols, like encryption and hash functions, can be reverse-engineered automatically as well. Typically, the automatic approaches trace the execution of protocol implementations and try to detect buffers in memory holding unencrypted packets.

Reverse engineering of integrated circuits/smart cards

Reverse engineering is an invasive and destructive form of analyzing a smart card. The attacker grinds away layer by layer of the smart card and takes pictures with an electron microscope. With this technique, it is possible to reveal the complete hardware and software part of the smart card. The major problem for the attacker is to bring everything into the right order to find out how everything works. Engineers try to hide keys and operations by mixing up memory positions, for example, bus scrambling. In some cases, it is even possible to attach a probe to measure voltages while the smart card is still operational. Engineers employ sensors to detect and prevent this attack. This attack is not very common because it requires a large investment in effort and special equipment that is generally only available to large chip manufacturers. Furthermore, the payoff from this attack is low since other security techniques are often employed such as shadow accounts.

Reverse engineering for military applications

Reverse engineering is often used by militaries in order to copy other nations' technologies, devices, or information that has been obtained by regular troops in the fields or by intelligence operations. It was often used during the Second World War and the Cold War. Well-known examples from WWII and later include:
Jerry can: British and American forces noticed that the Germans had gasoline cans with an excellent design. They reverse-engineered copies of those cans. The cans were popularly known as "Jerry cans".

Tupolev Tu-4: Three American B-29 bombers on missions over Japan were forced to land in the USSR. The Soviets, who did not have a similar strategic bomber, decided to copy the B-29. Within a few years, they had developed the Tu-4, a near-perfect copy.

V2 Rocket: Technical documents for the V2 and related technologies were captured by the Western Allies at the end of the war. Soviet and captured German engineers had to reproduce technical documents and plans, working from captured hardware, in order to make their clone of the rocket, the R-1, which began the postwar Soviet rocket program that led to the R-7 and the beginning of the space race.

K-13/R-3S missile (NATO reporting name AA-2 Atoll), a Soviet reverse-engineered copy of the AIM-9 Sidewinder, was made possible after a Taiwanese AIM-9B hit a Chinese MiG-17 without exploding. The missile became lodged within the airframe, and the pilot returned to base with what Russian scientists would describe as a university course in missile development.

BGM-71 TOW Missile: In May 1975, negotiations between Iran and Hughes Missile Systems on co-production of the TOW and Maverick missiles stalled over disagreements in the pricing structure, the subsequent 1979 revolution ending all plans for such co-production. Iran was later successful in reverse-engineering the missile is currently producing their own copy: the Toophan.

China has reversed engineered many examples of Western and Russian hardware, from fighter aircraft to missiles and HMMWV cars.
During the Second World War, British military intelligence at the Bletchley Park centre studied captured German "Enigma" message encryption machines. Their operation was then simulated on electro-mechanical devices called "Bombes" that tried all the possible scrambler settings of the "Enigma" machines to help break the coded messages sent by the Germans. Legality

United States

In the United States even if an artifact or process is protected by trade secrets, reverse-engineering the artifact or process is often lawful as long as it is obtained legitimately. Patents, on the other hand, need a public disclosure of an invention, and therefore, patented items do not necessarily have to be reverse-engineered to be studied. (However, an item produced under one or more patents could also include other technology that is not patented and not disclosed.) One common motivation of reverse engineers is to determine whether a competitor's product contains patent infringements or copyright infringements.

The reverse engineering of software in the US is generally a breach of contract as most EULAs specifically prohibit it, and courts have found such contractual prohibitions to override the copyright law;[clarification needed] see Bowers v. Baystate Technologies.

Sec. 103(f) of the DMCA (17 U.S.C. § 1201 (f)) says that if you legally obtain a program that is protected, you are allowed to reverse-engineer and circumvent the protection to achieve interoperability between computer programs (i.e., the ability to exchange and make use of information). The section states:

(f) Reverse Engineering.—

 (1) Notwithstanding the provisions of subsection (a)(1)(A), a person who has lawfully obtained the right to use a copy of a computer program may circumvent a technological measure that effectively controls access to a particular portion of that program for the sole purpose of identifying and analyzing those elements of the program that are necessary to achieve interoperability of an independently created computer program with other programs, and that have not previously been readily available to the person engaging in the circumvention, to the extent any such acts of identification and analysis do not constitute infringement under this title.

 (2) Notwithstanding the provisions of subsections (a)(2) and (b), a person may develop and employ technological means to circumvent a technological measure, or to circumvent protection afforded by a technological measure, in order to enable the identification and analysis under paragraph (1), or for the purpose of enabling interoperability of an independently created computer program with other programs, if such means are necessary to achieve such interoperability, to the extent that doing so does not constitute infringement under this title.

 (3) The information acquired through the acts permitted under paragraph (1), and the means permitted under paragraph (2), may be made available to others if the person referred to in paragraph (1) or (2), as the case may be, provides such information or means solely for the purpose of enabling interoperability of an independently created computer program with other programs, and to the extent that doing so does not constitute infringement under this title or violate applicable law other than this section.

 (4) For purposes of this subsection, the term interoperability means the ability of computer programs to exchange information and of such programs mutually to use the information which has been exchanged.
European Union

Article 6 of the 1991 EU Computer Programs Directive allows reverse engineering for the purposes of interoperability, but prohibits it for the purposes of creating a

competing product, and also prohibits the public release of information obtained through reverse engineering of software.

In 2009, the EU Computer Program Directive was superseded and the directive now states:

(15) The unauthorized reproduction, translation, adaptation or transformation of the form of the code in which a copy of a computer program has been made available constitutes an infringement of the exclusive rights of the author. Nevertheless, circumstances may exist when such a reproduction of the code and translation of its form are indispensable to obtain the necessary information to achieve the interoperability of an independently created program with other programs. It has therefore to be considered that, in these limited circumstances only, performance of the acts of reproduction and translation by or on behalf of a person having a right to use a copy of the program is legitimate and compatible with fair practice and must therefore be deemed not to require the authorization of the rightholder. An objective of this exception is to make it possible to connect all components of a computer system, including those of different manufacturers, so that they can work together. Such an exception to the author's exclusive rights may not be used in a way which prejudices the legitimate interests of the rightholder or which conflicts with a normal exploitation of the program.

Assignment No. 03
Failure mode and effect analysis of one product

Also called: potential failure modes and effects analysis; failure modes, effects and criticality analysis (FMECA).

Description

Failure modes and effects analysis (FMEA) is a step-by-step approach for identifying all possible failures in a design, a manufacturing or assembly process, or a product or service.

"Failure modes" means the ways, or modes, in which something might fail. Failures are any errors or defects, especially ones that affect the customer, and can be potential or actual.

"Effects analysis" refers to studying the consequences of those failures.

Failures are prioritized according to how serious their consequences are, how frequently they occur and how easily they can be detected. The purpose of the FMEA is to take actions to eliminate or reduce failures, starting with the highest-priority ones.

Failure modes and effects analysis also documents current knowledge and actions about the risks of failures, for use in continuous improvement. FMEA is used during design to prevent failures. Later it's used for control, before and during ongoing operation of the process. Ideally, FMEA begins during the earliest conceptual stages of design and continues throughout the life of the product or service.

Begun in the 1940s by the U.S. military, FMEA was further developed by the aerospace and automotive industries. Several industries maintain formal FMEA standards. Before undertaking an FMEA process, learn more about standards and specific methods in your organization and industry through other references and training.

When to Use FMEA

- ☐ When a process, product or service is being designed or redesigned, after quality function deployment.
- ☐ When an existing process, product or service is being applied in a new way.
- ☐ Before developing control plans for a new or modified process.

☐   When improvement goals are planned for an existing process, product or service.

☐   When analyzing failures of an existing process, product or service.

☐   Periodically throughout the life of the process, product or service

FMEA Procedure

(Again, this is a general procedure. Specific details may vary with standards of your organization or industry.)

1. Assemble a cross-functional team of people with diverse knowledge about the process, product or service and customer needs. Functions often included are: design, manufacturing, quality, testing, reliability, maintenance, purchasing (and suppliers), sales, marketing (and customers) and customer service.

2. Identify the scope of the FMEA. Is it for concept, system, design, process or service? What are the boundaries? How detailed should we be? Use flowcharts to identify the scope and to make sure every team member understands it in detail. (From here on, we'll use the word "scope" to mean the system, design, process or service that is the subject of your FMEA.)

3. Fill in the identifying information at the top of your FMEA form. Figure 1 shows a typical format. The remaining steps ask for information that will go into the columns of the form.

4.   Identify the functions of your scope. Ask, "What is the purpose of this system, design, process or service? What do our customers expect it to do?" Name it with a verb followed by a noun. Usually you will break the scope into separate subsystems, items, parts, assemblies or process steps and identify the function of each.

5. For each function, identify all the ways failure could happen. These are potential failure modes. If necessary, go back and rewrite the function with more detail to be sure the failure modes show a loss of that function.

6. For each failure mode, identify all the consequences on the system, related systems, process, related processes, product, service, customer or regulations. These are potential effects of failure. Ask, "What does the customer experience because of this failure? What happens when this failure occurs?"

7. Determine how serious each effect is. This is the severity rating, or S. Severity is usually rated on a scale from 1 to 10, where 1 is insignificant and 10 is catastrophic. If a failure mode has more than one effect, write on the FMEA table only the highest severity rating for that failure mode.

8. For each failure mode, determine all the potential root causes. Use tools classified as cause analysis tool, as well as the best knowledge and experience of the team. List all possible causes for each failure mode on the FMEA form.

9. For each cause, determine the occurrence rating, or O. This rating estimates the probability of failure occurring for that reason during the lifetime of your scope. Occurrence is usually rated on a scale from 1 to 10, where 1 is extremely unlikely and 10 is inevitable. On the FMEA table, list the occurrence rating for each cause.

10. For each cause, identify current process controls. These are tests, procedures or mechanisms that you now have in place to keep failures from reaching the customer. These controls might prevent the cause from happening, reduce the likelihood that it will happen or detect failure after the cause has already happened but before the customer is affected.

11. For each control, determine the detection rating, or D. This rating estimates how well the controls can detect either the cause or its failure mode after they have happened but before the customer is affected. Detection is usually rated on a scale from 1 to 10, where 1 means the control is absolutely certain to detect the problem and 10 means the control is certain not to detect the problem (or no control exists). On the FMEA table, list the detection rating for each cause.

12. (Optional for most industries) Is this failure mode associated with a critical characteristic? (Critical characteristics are measurements or indicators that reflect safety or compliance with government regulations and need special controls.) If so, a column labeled "Classification" receives a Y or N to show whether special controls are needed. Usually, critical characteristics have a severity of 9 or 10 and occurrence and detection ratings above 3.

13. Calculate the risk priority number, or RPN, which equals S × O × D. Also calculate Criticality by multiplying severity by occurrence, S × O. These

numbers provide guidance for ranking potential failures in the order they should be addressed.

14. Identify recommended actions. These actions may be design or process changes to lower severity or occurrence. They may be additional controls to improve detection. Also note who is responsible for the actions and target completion dates.

15. As actions are completed, note results and the date on the FMEA form. Also, note new S, O or D ratings and new RPNs.

FMEA Example

A bank performed a process FMEA on their ATM system. Figure 1 shows part of it—the function "dispense cash" and a few of the failure modes for that function. The optional "Classification" column was not used. Only the headings are shown for the rightmost (action) columns.

Notice that RPN and criticality prioritize causes differently. According to the RPN, "machine jams" and "heavy computer network traffic" are the first and second highest risks.

One high value for severity or occurrence times a detection rating of 10 generates a high RPN. Criticality does not include the detection rating, so it rates highest the only cause with medium to high values for both severity and occurrence: "out of cash." The team should use their experience and judgment to determine appropriate priorities for action.

Assignment No. 04
Concurrent Engineering

Concurrent Engineering - which is sometimes called Simultaneous Engineering or Integrated Product Development (IPD) - was defined by the Institute for Defense Analysis (IDA) in its December 1988 report 'The Role of Concurrent Engineering in Weapons System Acquisition' as a systematic approach to the integrated, concurrent design of products and their related processes, including manufacture and support. This approach is intended to cause the developers, from the outset, to consider all elements of the product life cycle from conception through disposal, including quality, cost, schedule, and user requirements.

Concurrent Engineering is not a quick fix for a company's problems and it's not just a way to improve Engineering performance. It's a business strategy that addresses important company resources. The major objective this business strategy aims to achieve is improved product development performance. Concurrent Engineering is a long-term strategy, and it should be considered only by organizations willing to make up front investments and then wait several years for long-term benefits. It involves major organizational and cultural change.

The problems with product development performance that Concurrent Engineering aims to overcome are those of the traditional serial product development process in which people from different departments work one after the other on successive phases of development.

In traditional serial development, the product is first completely defined by the design engineering department, after which the manufacturing process is defined by the manufacturing engineering department, etc. Usually this is a slow, costly and low-quality approach, leading to a lot of engineering changes, production problems, product introduction delays, and a product that is less competitive than desired.

Concurrent Engineering brings together multidisciplinary teams, in which product developers from different functions work together and in parallel from the start of a project with the intention of getting things right as quickly as possible, and as early as possible.

A cross-functional team might contain representatives of different functions such as systems engineering, mechanical engineering, electrical engineering, systems producibility, fabrication producibility, quality, reliability and

maintainability, testability, manufacturing, drafting and layout, and program management.

Sometimes, only design engineers and manufacturing engineers are involved in Concurrent Engineering. In other cases, the cross-functional teams include representatives from purchasing, marketing, production, quality assurance, the field and other functional groups. Sometimes customers and suppliers are also included in the team.

In the Concurrent Engineering approach to development, input is obtained from as many functional areas as possible before the specifications are finalized. This results in the product development team clearly understanding what the product requires in terms of mission performance, environmental conditions during operation, budget, and scheduling.

Multidisciplinary groups acting together early in the workflow can take informed and agreed decisions relating to product, process, cost and quality issues. They can make trade-offs between design features, part manufacturability, assembly requirements, material needs, reliability issues, serviceability requirements, and cost and time constraints. Differences are more easily reconciled early in design.

Getting the design correct at the start of the development process will reduce downstream difficulties in the workflow. The need for expensive engineering changes later in the cycle will be reduced. Concurrent Engineering aims to reduce the number of redesigns, especially those resulting from post-design input from support groups. By involving these groups in the initial design, less iteration will be needed. The major iterations that do occur will occur before the design becomes final. The overall time taken to design and manufacture a new product can be substantially reduced if the two activities are carried out together rather than in series. The reductions in design cycle time that result from Concurrent Engineering invariably reduce total product cost.

Concurrent Engineering provides benefits such as reduced product development time, reduced design rework, reduced product development cost and improved communications. Examples from companies using Concurrent Engineering techniques show significant increases in overall quality, 30-40% reduction in project times and costs, and 60-80% reductions in design changes after release.

The implementation of Concurrent Engineering addresses three main areas: people, process, and technology. It involves major organizational changes because it requires the integration of people, business methods, and technology

and is dependent on cross-functional working and teamwork rather than the traditional hierarchical organization. One of the primary people issues is the formation of teams. Collaboration rather than individual effort is standard, and shared information is the key to success. Team members must commit to working cross-functionally, be collaborative, and constantly think and learn. The role of the leader is to supply the basic foundation and support for change, rather than to tell the other team members what to do. Training addressed at getting people to work together in teams plays an important role in the successful implementation of Concurrent Engineering.

An example of the use of Concurrent Engineering can be found in General Electric's Aircraft Engines Division's approach for the development of the engine for the new F/A-18E/F. It used several collocated, multi-functional design and development teams to merge the design and manufacturing process. The teams achieved 20% to 60% reductions in design and procurement cycle times during the full-scale component tests which preceded full engine testing. Problems surfaced earlier and were dealt with more efficiently than they would have been with the traditional development process. Cycle times in the design and fabrication of some components have dropped from an estimated 22 weeks to 3 weeks.

Another example concerns Boeing's Ballistic Systems Division where Concurrent Engineering was used in 1988 to develop a mobile launcher for the MX missile and was able to reduce design time by 40% and cost by 10% in building the prototype.

Polaroid Corp.'s Captiva instant camera is also the result of a Concurrent Engineering approach, as a result of which Polaroid was able to make literally hundreds of working prototypes. Throughout the process, development was handled by cross-functional teams.

To be successful with Concurrent Engineering, companies should initially:
- compare themselves to their best competitors (i.e. benchmark)
- develop metrics
- identify potential performance improvements and targets
- develop a clear Vision of the future environment
- get top management support
- get cross-functional endorsement
- develop a clear Strategy to attain the envisioned environment
- get top management support
- get cross-functional endorsement
- develop a detailed implementation plan

- ☐ get top management support
- ☐ get cross-functional endorsement

Concurrent Engineering is a business strategy, not a quick fix. It will take many years to implement. If management doesn't have the time or budget to go through the above steps, then it is unlikely that Concurrent Engineering will be implemented.

Many companies have problems introducing Concurrent Engineering. Warning signs include:

- ☐ unwillingness to institutionalize Concurrent Engineering
- ☐ maintenance of traditional functional reward systems
- ☐ maintenance of traditional reporting lines
- ☐ no training in teamwork
- ☐ unrealistic schedules
- ☐ no changes in relationships with vendors
- ☐ a focus on computerization rather than process improvement

To make Concurrent Engineering a real success, all the necessary information concerning products, parts and processes, has to be available at the right time. A lot of partially-released information has to be exchanged under tightly controlled conditions. EDM/PDM enables Concurrent Engineering by allowing users, whether in small teams or enterprise-wide groups, to access, distribute, store, and retrieve information from a variety of sources. EDM/PDM systems give engineers and project managers access and release control over projects and drawings, as well the ability to track them.

Making Concurrent Engineering a success is really a management issue. If management doesn't get it right then it's not going to matter much whether EDM/PDM is used or not. On the other hand, EDM/PDM can provide valuable support to a successful implementation of Concurrent Engineering.

REFERENCES:

1. Shigley J. E. and Mischke C.R., "Mechanical Engineering Design", McGraw Hill Pub. Co. Ltd.
2. Bhandari V.B., "Design of Machine Elements", Tata McGraw Hill Pub. Co. Ltd.
3. Khurmi R. S., Gupta J. K., "A Textbook of Machine Design", S. Chand Publications
4. Black P.H. and O. Eugene Adams, "Machine Design" McGraw Hill Book Co. Inc.
5. "Design Data", P.S.G. College of Technology, Coimbatore.
6. I.S. 2825: Code for unfired pressure vessels.
7. Johnson R.C., "Mechanical Design Synthesis with Optimization Applications", Von Nostrand -Reynold Pub.
8. Dieter G.E., "Engineering Design", McGraw Hill Inc.
9. Sharma, P. C. and Agarwal, D. K., "Machine Design", S. K. Kataria and Sons, Delhi
10. Pandy, N. C. and Shah, C. S., "Elements of Machine Design", Charotar Publishing House,

Course Description

Title of Course: Grand Viva
Course Code: ME881
L-T –P Scheme: 0P   **Course Credits: 4**

Aims and Objectives

1. To compare the traditional viva examination (TVE) with OSVE (Objective Structured Viva Examination).

2. To obtain the students' opinion regarding OSVE as an assessment tool.

3. A suggestion to include OSVE as a part of university examination.

Materials and Methods

The study was carried out in November 2012, at K.J. Somaiya Medical College, in the department of Anatomy. 50 students were exposed to different stations of viva as well as OSVE. A comparison was made of the student's performance and a feedback was taken from the students regarding the same.

As the OSVE was being conducted for the first time, the students were notified in advance regarding the plan for conducting the part ending practical assessment – by both the TVE and OSVE. The OSVE was planned for 20 marks, viva voce of 20 marks.

Purpose and Format of the Viva Voce Examination

Literally, "viva voce" means by or with the living voice - i.e., by word of mouth as opposed to writing. So the viva examination is where you will give a verbal defence of your thesis.

Put simply, you should think of it as a verbal counterpart to your written thesis. Your thesis demonstrates your skill at presenting your research in writing. In the viva examination, you will demonstrate your ability to participate in academic discussion with research colleagues.

Purpose of the Exam

The purpose of the viva examination is to:

ʃ demonstrate that the thesis is your own work

ʃ confirm that you understand what you have written and can defend it verbally

ʃ investigate your awareness of where your original work sits in relation to the wider research field

⌡ establish whether the thesis is of sufficiently high standard to merit the award of the degree for which it is submitted

⌡ allow you to clarify and develop the written thesis in response to the examiners' questions

The Examiners and Exam Chair

You will normally have two examiners:

⌡ an internal examiner who will be a member of academic staff of the University, usually from your School/Department but not one of your supervisors

⌡ an external examiner who will normally be a member of academic staff of another institution or occasionally a professional in another field with expertise in your area of research (candidates who are also members of University staff will normally have two external examiners in place of an internal and an external examiner)

Your supervisor should let you know who your examiners will be as it is important that you ensure you are familiar with their work and any particular approach that they may take when examining your thesis.

In some cases there may also be a Chair person for the examination. A Chair is appointed if the Graduate Dean or either of the examiners feels this is appropriate, for example where the examining team has relatively little experience of examining UK research degrees. The Chair is there to ensure the examination is conducted in line with University regulations and is not there to examine your thesis. If there is a Chair person, it will usually be a senior member of the academic staff of your School/Department.

Normally no one else is present in the exam.

Exam Venue and Arrangements

Your internal examiner is responsible for arranging your viva exam and they will contact you with the relevant details - date, time, venue, etc.

Usually the viva exam will take place in your School/Department, though occasionally another University location may be used. If you are unsure where you need to go, make sure you check this before the day of your exam.

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR
Course Description

If you returned your Notice of Intention to Submit Your Thesis three months before your submission date, your viva exam should normally take place quite soon after submission. Almost all viva exams take place within three months of thesis submission and in many cases it is within one month.

Format of the Exam

All viva examinations are different, so it is not possible to describe exactly what will happen - but there are general points which can be made which may be helpful, and you should have the opportunity before your examination to discuss what will happen with your supervisor or to attend the University's pre-viva examination workshop.

The purpose of the viva is to establish that your work is of a sufficiently high standard to merit the award of the degree for which it is submitted. In order to be awarded a research degree, the thesis should demonstrate an original contribution to knowledge and contain work which is deemed worthy of publication.

In order to do this, examiners may:

ʃ ask you to justify your arguments

ʃ ask you to justify not only things which you have included in your thesis but also things which you may have left out

ʃ ask you questions about the wider research context in which the work has been undertaken

ʃ argue certain points with you

ʃ expect you to discuss any developments which may flow from your work in the future

Inevitably, your thesis will have strengths and weaknesses and the examiners will want to discuss these. It is considered a positive thing, indeed an essential thing, that you can discuss both the strengths and the weaknesses. You can think of the weaknesses as an opportunity to demonstrate your skill at critical appraisal.

Remember that examiners seek to find and discuss weaknesses in all theses - you should not interpret criticism as an indication that the examination will not end successfully.

Course Description

Title of Course: Project Part- II Lab
Course Code: ME882
L-T –P Scheme: 12P   **Course Credits: 6**

Project: an activity where the participants have some degree of *choice* in the outcome. The result is complete and functional, that is, it has a beginning, middle and end. Usually, it spans multiple lab periods and requires work outside scheduled lab periods. Since there are choices in implementation, *design* is inherently a component of a project. A project is inherently different from an *analysis* or *exercise*, in which the solution has a predictable form. Projects span a wide variety of possibilities: design and build, identify a system, do a forensic analysis, evaluate a product or assess some environmental situation.

Program Objective 1
Graduates shall make their way to the society with proper scientific and technical knowledge in mechanical engineering.

Program Objective 2
Graduates shall work in design and analysis of mechanical systems with strong fundamentals and methods of synthesis.

Program Objective 3
Graduates shall adapt to the rapidly changing environment in the areas of mechanical engineering and scale new heights in their profession through lifelong learning.

Program Objective 4
Graduates shall excel in career by their ability to work and communicate effectively as a team member and/or leader to complete the task with minimal resources, meeting deadlines.

Program Outcomes:

1. Ability to apply knowledge of mathematics, science and mechanical engineering fundamentals for solving problems.
2. Ability to Identify, formulate and analyze mechanical engineering problems arriving at meaningful conclusions involving mathematical inferences.
3. Ability to design and develop mechanical components and processes to meet desired needs considering public health, safety, cultural, social, and environmental aspects.
4. Ability to understand and investigate complex mechanical engineering problems experimentally.
5. Ability to apply modern engineering tools, techniques and resources to solve complex mechanical engineering activities with an understanding of the limitations.
6. Ability to understand the effect of mechanical engineering solutions on legal, cultural, social, public health and safety aspects./li>

7. Ability to develop sustainable solutions and understand their impact on society and environment.
8. Ability to apply ethical principles to engineering practices and professional responsibilities.
9. Ability to function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
10. Ability to comprehend, design documentation, write effective reports, make effective presentations to the engineering community and society at large.
11. Ability to apply knowledge of engineering and management principles to lead teams and manage projects in multidisciplinary environments.
12. Ability to engage in independent and life-long learning in the broad context of technological changes and advancements.