

DIRECTORATE OF TECHNICAL EDUCATION,
KAHILIPARA, GUWAHATI-19



DIPLOMA PROGRAMME IN
MECHANICAL ENGINEERING
NEW SYLLABUS

M | OCTOBER,2018

SIXTH SEMESTER

MECHANICAL ENGINEERING BRANCH



COURSE STRUCTURE OF MECHANICAL ENGINEERING (6TH SEMESTER)

COURSE STRUCTURE OF 6th SEMESTER (MECHANICAL)															
Sl No	Code No.	Subject	Study Scheme (Contact)			Evaluation Scheme									Credit
			L	T	P	Theory			Practical			Total Marks(Theory+Practical)			
						ESE	Sessional (SS)	Pass(ES)	Practical Test (PT) #	Practical Assessment(PA)@	Pass (PT+PA)				
TA	HA	Total (TA+HA)	E+SS)												
1	Hu-601	Industrial Management & En	3			70	10	20	30	33/100				100	3
2	Me-602	Thermal Engineering-II	3	1	3	70	10	20	30	33/100	25	25	17/50	150	5
3	Me-603	Drawing,Estimating & Costin	3		3	100	20	30	50	50/150				150	4
4	Me-604	Metrology	3			70	10	20	30	33/100				100	3
5	Me-611	Project & Seminar		1	6						100	50	50/150	150	3
6	Me-612	General Viva		2							50		17/50	50	2
7	Me-610	Professional Practice IV	1		2						25	25	17/50	50	2
Optional (Any One)															
A	Me-605	CAD, CAM & Robotics	3	-	-	70	10	20	30	33/100	-	-	-	100	3
B	Me-606	Advance Machining Method	3	-	-	70	10	20	30	33/100	-	-	-	100	3
B	Me-607	Power Plant Engineering	3	-	-	70	10	20	30	33/100	-	-	-	100	3
			16	4	14						Total Marks			850	25
Grand Total			WeeklyTotal contact hours			34									



1: Course Title : Industrial Management and Entrepreneurship (All Branches)

Course Code: **Hu – 601**

Semester : **VI**

Aim of the Course:

1. To acquaint the students with managerial activities
2. To provide introductory knowledge of Cost Accounting
3. To introduce students with industrial legislation
4. To explain the scope for self-employment
5. To compare and contrast different forms of business organization
6. To identify the opportunities to start a small scale industry

Course Outcomes:

On completion of the course on IME, students will be able to

- CO₁ = explain managerial activities.
- CO₂ = describe leadership qualities and decision making process.
- CO₃ = state the elements of costs.
- CO₄ = explain important industrial laws.
- CO₅ = define different forms of business organisations
- CO₆ = identify entrepreneurial abilities for self employment through small scale industries.

Teaching Scheme (in hours)

Lecture	Tutorial	Practical	Total
42 hrs	3 hrs	--	45 hrs

Examination Scheme:

Theory				Practical				Total Marks
Examination Full Marks	Sessional Full Marks	Total Marks	Pass Marks	Examination	Sessional			
70	30	100	33	--	--	--	--	100

Detailed Course Content:

Chapter No.	Chapter Title	Content	Intended Learning Outcomes	Duration (in hours)
				42 hrs
1.0	Introduction to Management :	i) Meaning and Concept ii) Functions of Management iii) Principles of Management	i) Explain functions and principles of management	3
2.0	Leadership Decision Making & Communication :	i) Definition of Leader ii) Functions of a leader iii) Decision making – Definition iv) Decision making process v) Communication – definition, importance & types	i) Develop leadership qualities ii) Demonstrate decision making abilities	4
3.0	Introduction to Cost :	i) Definition and classification of Cost ii) Elements of Cost iii) Break Even Analysis	i) State elements of costs ii) Explain Break Even Analysis	3
4.0	Human Resource Management:	i) Meaning of manpower planning ii) Recruitment and Selection procedure iii) Payment of wages – factors determining the wage iv) Methods of payment of wages – Time rate and Piece rate v) Labour Turnover –	i) State selection procedure of employees ii) Distinguish Time rate and Piece rate system of wage payments iii) Explain causes and	5

		definition, its causes, impact and remedy	impact of labour turnover	
5.0	Industrial Legislation :	<ul style="list-style-type: none"> i) Need of Industrial legislation ii) Indian Factories Act – 1948 – Definition of Factory, main provisions regarding health, Safety and Welfare of Workers iii) Industrial Dispute Act – 1947 – Definition of Industrial dispute, Machineries for settlement of Industrial dispute in India 	<ul style="list-style-type: none"> i) Identify the needs and importance of industrial laws 	5
6.0	Production Management :	<ul style="list-style-type: none"> i) Meaning of Production ii) Production Management – definition, objectives, functions and scope iii) Inventory Management, Basic idea 	<ul style="list-style-type: none"> i) State the objectives and functions of Production management 	3
7.0	Marketing Management:	<ul style="list-style-type: none"> i) Meaning and functions of marketing ii) e- Commerce iii) Channels of distribution iv) Wholesale and retail trade 	<ul style="list-style-type: none"> i) state the functions of wholesalers and retailers 	2
8.0	Entrepreneur and Entrepreneurship:	<ul style="list-style-type: none"> i) Definition of Entrepreneur and Entrepreneurship ii) Qualities required by an entrepreneur iii) Functions of an 	<ul style="list-style-type: none"> i) State the qualities and functions of an entrepreneur 	3

		entrepreneur iv) Entrepreneurial motivation		
9.0	Forms of Business Organisation:	i) Sole Trader – meaning, main features, merits and demerits ii) Partnership – definition, features, merits and demerits iii) Joint Stock Company – Definition, types, features, merits and demerits	i) Differentiate different forms of Business organization ii) compare and contrast features, merits and demerits of different business organizations.	5
10.0	Micro and Small Enterprises:	i) Definition of Micro & Small enterprises ii) Meaning and characteristics of Micro and Small enterprise iii) Scope of SSI with reference to self-employment iv) Procedure to start SSI – idea generation, SWOT analysis v) Selection of site for factories	i) Define micro and small enterprises ii) Explain the procedure to start a small enterprise	4
11.0	Support to Entrepreneurs	a) Institutional support: i) Introduction ii) Sources of information and required application forms to set up SSIs iii) Institutional support of	i) identify the supporting agencies to entrepreneurs ii) Explain the role of financial	5

		various National & State level organizations – DICC, NSIC, IIE, MSME - DI, Industrial Estates	support organisations	
		b) Financial support: i) Role of Commercial banks, RRB, IDBI, ICICI, SIDBI, NEDFi, and State Financial Corporations ii) Special incentives and subsidies for Entrepreneurship Development in the North East		
	Class Test			3 hrs
	Total			45 hrs

(9) TABLE OF SPECIFICATIONS for Industrial Management & Entrepreneurship

Sl. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	Knowledge	Compre- hension	Application	HA
1	Introduction to Management	3	7	2	3	0	0
2	Leadership & Decision Making	4	9.5	3	4	0	0



3	Introduction to Cost	3	7	3	2	0	0
4	Human Resource Management	5	12	6	2	0	0
5	Industrial Legislation	5	12	4	4	0	0
6	Production Management	3	7	3	2	0	0
7	Marketing Management	2	5	4	0	0	0
8	Entrepreneur & Entrepreneurship	3	7	3	2	0	0
9	Forms of Business Organisation	5	12	3	5	0	0
10	Micro & Small Enterprises	4	9.5	4	3	0	0
11	Support to Entrepreneurs	5	12	4	4	0	0
Total		42	100	39	31	0	70

K = Knowledge C = Comprehension A = Application HA = Higher Than Application (Analysis, Synthesis, Evaluation)

$$C = \frac{b}{\Sigma b} \times 100$$



10. Distribution of Marks:**DETAILED TABLE OF SPECIFICATIONS FOR IME**

Sl. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE					Grand
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	Total
1	Management	1	0	0	1	1	0	0	0	1	0	3	0	0	3	5
2	Leader & Decisi	1	0	0	1	2	1	0	0	3	0	3	0	0	3	7
3	Cost	1	1	0	2	2	1	0	0	3	0	0	0	0	0	5
4	HRM	2	1	0	3	1	1	0	0	2	3	0	0	0	3	8
5	Laws	3	0	0	3	0	0	0	0	0	1	4	0	0	5	8
6	Product Manage	2	1	0	3	1	1	0	0	2	0	0	0	0	0	5
7	Market	2	0	0	2	2	0	0	0	2	0	0	0	0	0	4
8	Entrepreneurship	1	1	0	2	2	1	0	0	3	0	0	0	0	0	5
9	Forms of BO	2	1	0	3	0	0	0	0	0	1	4	0	0	5	8
10	MSME	2	0	0	2	0	0	0	0	0	2	3	0	0	5	7
11	Support to Entp.	3	0	0	3	1	0	0	0	1	0	4	0	0	4	8
	Total	20	5	0	25	12	5	0	0	17	7	21	0	0	28	70

K = Knowledge C = Comprehension A = Application

HA = Higher Than Application T = Total

Higher than Application (Analysis, Synthesis, Evaluation)

11. Suggested implementation Strategies: Modified syllabus may be implemented with effect from January, 2020 (Starting with the present batch (2018) of 2nd Semester students)

12. Suggested learning Resource:

a. **Book list :**

Sl. No.	Title of Book	Name of Author(s)	Publisher
1	Industrial Management	S.C. Jain H.S. Bawa	Dhanpat Rai & Co. (P) Ltd. New Delhi- 110006
2	Business Organisation and Entrepreneurship Development	S.S. Sarkar R.K. Sharma Sashi K. Gupta	Kalyani Publishers, New Delhi-110002
3	Entrepreneurial Development	S. S. Khanka	S. Chand & Co. Ltd. New Delhi-110055
4	Business Methods	R.K. Sharma Shashi K Gupta	Kalyani Publishers, New Delhi
5	Entrepreneurship Development and Management	Dr. R.K. Singhal	S.K. Kataria & Sons, New Delhi- 110002
6	Business Administration & Management	Dr. S. C. Saksena	Sahitya Bhawan, Agra
7			
8			

- b. List of Journals
- c. Manuals
- d. Others

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2: Course Title : THERMAL ENGINEERING-II

Subject Title	:	Thermal Engineering-II		
Subject Code	:	Me-602		
Hours Per Week	:	03		
Hours Per Semester	:	45		
Class Test	:	03		
Total	:	48		
Total Marks	:	100		
Theory	:	70		
Sessional	:	30		
Class hours		L	T	P
		3	1	3

Prerequisite: Applied Science, Thermodynamics, Thermal Engineering –I

Aim :The aim of the subject is to include study in detail the principle of Internal combustion Engines along with their thermodynamic cycle, Single stage air compressor and its operation and Gas turbine cycle

CO -----Outcome Based Course Objectives

On the completion of the course the students should be able to:

- 1) Explain the working principle of Internal Combustion Engine
- 2) Explain the thermodynamic cycles working on Otto, Diesel and Dual Cycle
- 3) Solve problems on SI and CI engines
- 4) Explain the functions of a Carburetor
- 5) Solve simple problems on Compressor
- 6) Compare the principle of operation of an open cycle with closed cycle gas turbine
- 7) Explain the principle of refrigeration system



COURSE CONTENTS

1.Internal Combustion Engine

- 1.0 Introduction- Definition of Internal combustion engine, Difference between IC engine and EC engine, Classification of IC engines
- 1.1 Main components of IC engine and operation
- 1.2 Cycle of operation- Otto, Diesel and Dual combustion cycle- Actual p-v diagram, Air standard efficiency and mean effective pressure, simple problem
- 1.3 Four-stroke diesel engine and two-stroke diesel engine –principle, working and valve timing diagram
- 1.4 Four-stroke petrol engine and two-stroke petrol engine –principle, working and valve timing diagram
- 1.5 Carburation of fuel, air fuel mixture, single jet and multiple jet carburetor, knocking in SI engine, Working of S.U electrical and A.C mechanical pump, Fuel filters
- 1.6 MPFI system,
- 1.7 Ignition systems- Battery and magneto ignition system, effect of advancing and retarding of ignition on engine performance, octane number, effect of compression ratio in different fuels i.e., ordinary petrol, high octane petrol, Electronic Ignition system
- 1.8 Fuel injection system- Air injection and airless injection, fuel pump, fuel injector, combustion in CI engine, Cetane number, Delay period and Diesel knock, CRDI system and new updated system
- 1.9 Cooling system of IC engine- Air cooling and water cooling, calculation of heat carried away by cooling water
- 1.10 Exhaust system- Exhaust manifold, Muffler, different types of muffler, heat carried away by exhaust gases
- 1.11 Governing of IC engine- Hit and miss, Quality and Quantity governing
- 1.12 Lubrication of IC engine- purposes of lubrication, properties of lubricant, S.A.E rating of lubrication system and common methods of lubrication
- 1.13 Testing of IC engines- Measurement of Brake power, Indicated power of single cylinder and multi cylinder engine, Mechanical efficiency, Indicated thermal efficiency, Brake thermal efficiency, Airstandard efficiency, Relative efficiency, Volumetric efficiency
- 1.14 Concept of Heat balance sheet for an engine
- 1.15 Simple problems on testing of I.C. engines and heat balance sheet



1.16 Troubles in IC engine and their remedies

2. Air compressors

- 2.1 Air compressor-Introduction, classification and terminology, Function of compressor
- 2.2 Single stage reciprocating air compressor- construction and working (with line diagram)
- 2.3 Expression for work done by single stage reciprocating compressor without clearance volume and with clearance volume by using p-v diagram
- 2.4 Multi stage compression – advantages of multistage compression
- 2.5 Two stage reciprocating compressor with intercooler
- 2.6 Simple problems on calculation of work done and power required.

3.0 Gas turbine and propulsion

- 3.1 Introduction-classification of gas turbines
- 3.2 Analysis of Constant pressure gas turbine- Closed cycle gas turbine-Schematic diagram-explanation
- 3.3 Open cycle gas turbine-schematic diagram-explanation
- 3.4 Comparison of open cycle and closed cycle gas turbines.
- 3.5 Methods of improving thermal efficiency of gas turbine- Intercooling, Reheating and Regeneration
- 3.6 Jet propulsion- Screw propeller, Turbojet and Ramjet-principle and working, Rocket propulsion- its principle & application.

4.0 Refrigeration Cycle

- 4.1 Introduction
- 4.2 Vapour Compression Refrigeration cycle and its components
- 4.3 Vapour Absorption Refrigeration cycle and its components
- 4.4 Applications of refrigeration cycle. Domestic refrigerator, Ice plant



REFERENCES

- 1.“Fundamental of thermodynamics” by Richard E Snnatag,ClausBorgnakke,Gordon J Vanwylen, Wiley Student edition, 6th Ed.,
- 2.“ Basic and applied thermodynamics” by P.K.Nag ,Tata McGraw hill, New delhi 2009
- 3.“Heat engines(Vol-I & Vol-II)”by Patel and Karmachandani
- 4.“Thermal Engineering “by R.S.Khurmi
- 5.“Thermal Engineering” by P.L.Balaney
- 6.“Thermodynamics applied to heat engines” byLewitt.
- 7.“Heat engines” by Pandya and shah
- 8.“A course in Thermodynamics & Heat Engines”Kothandaraman, Khajuria& Arora, Dhanpat Rai& Sons

Table Of Specification for Thermal Engineering II																	
Sl No	Hrs	Topic	Objective Type				Short Answer Type					Essay Answer Type				Total	
	45		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	97
1	20	Internal Combustion Engine	4	2	2	8	3	3	3	0	9	5	8	8	6	27	44
2	10	Air Compressor	2	2	1	5	1	3	0	0	4	0	3	4	4	11	20
3	10	Gas Turbine & Propulsion	2	1	0	3	2	1	3		5		3	12	0	14	22
4	5	Refrigeration cycle	2	1	0	3	0	2	3	0	5	0	0	3	0	3	11

Annexure -I Thermal Engineering -II								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total
1	Internal Combustion Engine	20	44.44	12	13	13	6	44
2	Air Compressor	10	22.22	3	8	5	4	20
3	Gas Turbine & Propulsion	10	22.22	3	4	12	3	22
4	Refrigeration Cycle	5	11.11	2	3	6	0	11

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2: Course Title: Thermal Engineering-II laboratory

CO— Outcome based objectives

After performing the experiment the students will be able to

1. Explain the difference between SI and CI engines
2. Prepare a heat balance sheet of an IC engine
3. Explain the Valve setting diagram of SI and CI engine
4. Illustrate the importance of Calorific value of a fuel
5. Explain the function of a calorimeter
6. Explain the principle of operation of Gas turbine

Course Details

1. Study the internal combustion engine and it's principles.
 - 1.1. Study the classification of I.C Engine.
 - 1.2. Study the difference between S.I and C.I engine.
2. To measure the power, efficiency , fuel consumption and preparation of heat balance sheet of S.I & C.I Engine.
3. Study of Valve Setting Diagram of S.I and C.I engine.
4. Calorific value of fuel.
 - 4.1. Understand the Calorific Value of fuel and it's importance .
 - 4.2. Know about the various types of Calorimeter.
 - 4.3. Perform test to determine the Calorific Value of various types of fuels.
5. Study of Gas Turbine Model
 - 5.1. Study Of Model.
6. Industrial Visit to power plants

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3: Course Title: Drawing, Estimating & Costing

Subject Title	: Drawing, Estimating & Costing
Subject Code	: Me-603
Hours Per Week	: 3(T)+3(Dr)
Hours Per Semester	: 45+45
Class Test	: 1+3
Exam Hours	: 4 hrs
Full Marks	: 100
Sessional Marks	: 50

Pre requisite: Engineering Drawing ,Machine Drawing, Applied Mathematics

Rationale

On the completion of the course the students should be able to:

1. Draw Jigs and Fixtures
2. Know the fundamentals of estimating and costing
3. Estimate the cost of production of machine or engine components
4. Calculate the depreciation cost of a machine
5. Estimate the machining time of a final product
6. Estimate the fabricating time of a simple component

Subject Content Details

Chapter I

1. Jigs and Fixtures:

1.1 Drawing of Jigs and Fixtures, such as Drill Jigs, Bushing and Tool Guides,

1.2 Lever Clamps , Locating Devices, Indexing Jigs, Milling Fixtures(Any Two)

2. Assembly Drawing

2.1 Valves , (Stop Valve, Non return Valve)



2.2 Engine parts(Stuffing box, Connecting Rod)

2.3 Machine tools (Tool post, tail stock)

(6 nos of Drawing Sheets to be submitted)

2. Introduction to Estimation and costing

- 2.1 Estimation - Definition, Importance and Aims
- 2.2 Qualities and functions of an Estimator
- 2.3 Source of errors in estimation
- 2.4 Constituents of Estimation
- 2.5 Costing - Definition and Aims
- 2.6 Standard cost and its Advantages
- 2.7 Difference between estimation and costing
- 2.8 Advantages of efficient costing

3.0 Elements of costs

- 3.1 Elements of cost- material, labour, expenses
- 3.2 Material - Direct material, indirect material and examples
- 3.3 Calculation of Material cost
- 3.4 Labour - direct, indirect labour and examples
- 3.5 Calculation of labour cost
- 3.6 Expenses - direct, indirect expenses and examples
- 3.7 Classification of expenses - factory, administrative, selling and distribution expenses and examples
- 3.8 Fixed and variable expenses and examples
- 3.9 Components of cost - prime cost, factory cost, office cost, total cost
- 3.10 Selling price
- 3.11 Block diagram to show the relationship between elements and components of cost
- 3.12 Simple problems on above
- 3.13 Allocation of on-cost - methods and simple problems

4.0 Indirect expenses and depreciation

- 4.1 Indirect expenses - depreciation, obsolescence, inadequacy, idleness, repair and maintenance
- 4.2 Depreciation - causes, methods of calculating depreciation
- 4.3 Simple problems on each method

5.0 Mensuration and Estimation of material cost

- 5.1 Area of regular plane figures
- 5.2 Volume and surface area of solids (formulae only)
- 5.3 Estimation of material costs of step block, spindle lathe center, Rivets, V block and different types of components

6.0 Estimation of Machining Time

- 6.1 Estimation in machine shop - Definition of cutting speed, feed, depth of cut
- 6.2 Estimation of time for various operations like Turning, Knurling, Facing, Drilling, Boring, Reaming, Threading, Tapping, Milling, Grinding, Shaping

7.0 Estimation of Welding & Fabrication Time Sheet metal

- 7.1 Estimate the material required for preparation of container open on one side Cylindrical drum
- 7.2 Estimation in welding shop - estimation of gas welding cost -Simple problems

References:

1. Drawing Estimating and Costing by Banga and Sarmah
2. Drawing Estimating and Costing by KP S Rao

Table Of Specification for Drawing, Estimating and Costing																	
Sl No	Hrs	Topic	Objective Type				Short Answer Type					Essay Answer Type					Total
			K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	
	90																140
1	45	Jigs and Fixtures	3	2	0	5	2	3	0	0	5	0	0	10	20	30	40
2	6	Introduction to Estimating and costing	1	2	0	3	0	1	2	0	3	0	3	4	0	7	13
3	8	Elements of Cost	2	2	0	4	0	2	4	0	6	0	4	4	2	10	20
4	8	Indirect expenses and depreciation	2	2	0	4	0	2	0	2	4	0	4	4	4	12	20
5	8	Mensuration and Estimating of material cost	2	2	1	5	0	3	2	0	3	0	3	3	6	12	20
6	8	Estimation of machining time	2	2	1	5	1	4	0	0	5	0	0	5	5	10	20
7	7	Estimation of welding and fabrication time	1	2	1	4	0	2	3	0	5	0	0	4	4	8	17



Annexure -I Drawing Estimating and Costing								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total 140
1	Jigs and Fixtures	45	50.00	5	5	10	20	40
2	Introduction to Estimating and costing	6	6.67	1	6	6		13
3	Elements of Cost	8	8.89	2	8	8	2	20
4	Indirect expenses and depreciation	8	8.89	2	8	4	6	20
5	Mensuration and Estimating of material cost	8	8.89	2	8	4	6	20
6	Estimation of machining time	8	8.89	3	6	6	5	20
7	Estimation of welding and fabrication time time	7	7.78	1	4	8	4	17

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4: Course Title : METROLOGY

Subject Title	:	Metrology		
Subject Code	:	ME-604		
Hours Per Week	:	03		
Hours Per Semester	:	45		
Class Test	:	03		
Total Class	:	48		
Total Marks	:	100		
Theory	:	70		
Sessional	:	30		
Class hours		L	T	P
		3	0	0

Pre requisite: Engineering Mechanics , Manufacturing Technology, Strength of Materials, Engineering Materials

Outcome based Course Objectives

On the completion of the course the students should be able to:

1. Illustrate the principle of operation and calibration of an instrument.
2. Know different measuring device for a particular application.
3. Explain the concepts of limits, fits and tolerance
4. Explain various device and tools for angular measurements
- 5 Know the various comparators with their working principles and applications
6. Explain the different devices used to measure screw threads, gears
- 7 Explain the different devices used to measure textures and surface finish
- 8 Explain the different techniques and devices used to measure a groove, bores, ring and plug gauges

COURSE CONTENTS



1.0 Metrology concepts and standards

- 1.1 Definition of Metrology
- 1.2 Significance of measurement,
- 1.3 Standards of measurements-line standard, wavelength standard
- 1.4 Factors in selecting the measuring instruments
- 1.5 Terms applicable to measuring instruments: Precision and Accuracy, Sensitivity and Repeatability, Range, Threshold, Hysteresis, calibration and magnification
- 1.6 Errors in Measurements: Classification of errors, Systematic and Random error.
- 1.7 Handling and care of Measuring instruments
- 1.8 Objects of Metrology - ISO and ISI specifications

2.0 Basic Precise and Non Precise Measuring instruments

- 2.1 Introduction
- 2.2 Thread measurements: Thread gauge micrometer
- 2.3 Angle measurements: Bevel protractor, Slip gauges, Sine Bar
- 2.4 Use, Sizes, Care of slip gauges and Sine Bar
- 2.5 Gauges: plain plug gauge, ring Gauge, snap gauge, limit gauge
- 2.6 Vernier caliper , Vernier height gauge , Vernier depth gauge
- 2.7 Outside Micrometer, Inside Micrometer
- 2.8 solving small problems using slip gauges, sine bar

3.0 Limits, Fits, Tolerances and Gauges

- 3.1 Limit: Maximum limit, Minimum limit, Basic size, Nominal size
- 3.2 Fit: Types of fits -Hole basis and Shaft basis system
- 3.3 Tolerance: Basic terminology, unilateral and bilateral tolerance
- 3.4 Interchangeability and selective assembly
- 3.5 Symbols
- 3.6 Solving problems on limit, fit and tolerance

4.0 Angular Measurements



- 4.1 Concept of Angular measurements
- 4.2 Construction and working of Bevel protector, Sine Bar, Angle Gauges,
- 4.3 Clinometer-different types of Clinometer
- 4.3 Autocollimator- principle and application
- 4.4 Use of Straight Edges and Rollers
- 4.4 Solving problems on angular measurement using sine bar

5.0 Comparators

- 5.1 Principle and operation of various comparators
- 5.2 Types-Mechanical, Electrical, Optical, Pneumatic comparators
- 5.3 Relative advantages and disadvantages of various comparators
- 5.4 Characteristics of a good comparator

6.0 Screw Thread Measurement

- 6.1 Terminology of screw thread
- 6.2 Measurement of external and core diameter
- 6.3 Testing of leads, thread angle and thread profile
- 6.4 Use of screw thread micrometer, tool makers microscope, optical profile projector

7.0 Gear Measurement

- 7.1 Terminology of gears
- 7.2 Measurement of chordal thickness, addendum using gear tooth vernier
- 7.3 Parkinson's gear tester

8.0 Surface Finish Measurement

- 8.1 Terminology
- 8.2 Primary and secondary texture, CLA, RMS and RA value
- 8.3 Use of Straight edges and surface plates (Wedge method and Level method)
- 8.4 Principle and operation of Stylus probe instruments



9.0 Machine tool metrology

- 9.1 Testing instruments for machine tools alignment testing
- 9.2 Checking Parallelism, Straightness, flatness, squareness ,alignment testing of machine tool as per IS standard procedure.
- 9.3 Test for level of installation

10.0 MISCELLANEOUS MEASUREMENTS

- 10.1 Checking size of a groove
- 10.2 Gauging Large bores with point gauge and by four ball method
- 10.3 Gauging Small bores by two and three spheres method
- 10.4 Measuring taper ring & plug gauge

Table Of Specification for Metrology																		
Sl No	Hrs	Topic	Objective Type				Short Answer Type					Essay Answer Type					Total	
			K	C	A	T	K	C	A	HA	T	K	C	A	HA	T		
	45																97	
1	4	Metrology Concept & Standards	1	1		2		1	1		2		2	2			4	8
2	5	Basic Precise and Non Precise Measuring Instruments		1	1	2		1	1		2		3	2	2		7	11
3	5	Limits Fits and Tolerances and Gauges		1	1	2		1		1	2		2	3	2		7	11
4	4	Angular Measurements		1	1	2		1	1		2		3	2			5	9
5	5	Comparators	1		1	2		1		1	2		2	3	2		7	11
6	4	Screw Thread Measurements		1	1	2		1			2		2	2	1		5	9
7	5	Gear Measurement		1	1	2		1			2		2		3		7	11
8	5	Surface Finish Measurement	1	1		2		1	1	1	3		2	2	2		6	11
9	4	Machine Tool Metrology	1	1		2			1	1	2		2	2			4	8
10	4	Miscellaneous Measurement		1	1	2		1	1		2		2	2			4	8



		Annexure -I Metrology							
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total	
1	Metrology Concept & Standards	4	8.89	1	4	3		8	
2	Basic Precise and Non Precise Measuring Instruments	5	11.11	0	5	4	2	11	
3	Limits Fits and Tolerances and Gauges	5	11.11	0	4	4	3	11	
4	Angular Measurements	4	8.89	0	5	4		9	
5	Comparators	5	11.11	1	3	4	3	11	
6	Screw Thread Measurements	4	8.89		4	4	1	9	
7	Gear Measurement	5	11.11		4	1	3	8	
8	Surface Finish Measurement	5	11.11	1	4	3	3	11	
9	Machine Tool Metrology	4	8.89	1	3	3	1	8	
10	Miscellaneous Measurement	4	8.89		4	4		8	

REFERENCES

1. **“Metrology& Measurement”** by Anand K Bewoor, Vinaykulakarni ,Tata McGraw hill New delhi 2009
2. **“Principles of Engineering metrology”** by RegaRajendraJaico publishers-2008
3. **“Engineering Metrology”** by R.K.Jain, Khanna Publishers, 1994.
4. **“Mechanical Measurements and Instrumentation “** by R K Rajput, pub-S K Kataria& sons

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5: Course Title: PROFESSIONAL PRACTICE IV

Subject code-Me -610

Class hours	L	T	P
	1	0	2

Rational :

To develop general confidence, ability to communicate and attitude in addition to basic technological concepts through Industrial visits , expert lectures, seminars on technical topics and group discussion.

Outcome Based Objectives:

The student will be able to :

- Acquire information from different sources.
- Prepare notes for given topic.
- Present given topic in a seminar.
- Interact with peers to share thoughts.
- Prepare a report on industrial visit, expert lecture.

Activities

15. INDUSTRIAL VISITS:

8

Structured industrial visits be arranged and report of the same should be submitted by the individual student to form part of the term work.(2 visits)Following are the suggested types of Industries/Fields -

- Automobile manufacturing /auto component manufacturing units to observe the working of SPM.
- Refrigeration and air conditioning manufacturing /service units /industries /workshops
- Automobile service stations for four wheelers.
- Co-ordinate measuring machine to observe its construction working specifications and applications.
- Auto Engine Testing unit to gather details regarding the testing procedures /parameters etc.
- Wheel balancing unit for light and/or heavy motor vehicles



- vii. Food processing unit.
- viii. Textile industry machinery manufacturing / servicing units.
- ix. Hydroelectric and Thermal power plants.
- x. Solar power stations
- xi. Engine testing, exhaust gas analysis and vehicle testing
- xii. PWD workshop

16. THE GUEST LECTURE/S**8**

From field /industry experts, professionals to be arranged (1 Hrs duration) minimum 1 nos from the following or alike topics. The brief report to be submitted on the guest lecture by each student as a part of Term work

- a) Electronic fuel injection systems.
- b) Exhaust gas analysis.
- c) Vehicle testing.
- d) Transducer application in automobiles.
- e) Environmental pollution & control
- f) Vehicle aerodynamics & design
- g) Earth moving machines
- h) Automobile pollution , norms of pollution control.
- i) Biotechnology
- j) Nanotechnology
- k) Rapid prototyping
- l) Programmable logic controllers
- m) TQM
- n) MPFI
- o) Hybrid motor vehicles
- p) Packaging Technology
- q) Appropriate technology
- r) Six sigma systems
- s) LPG/CNG conversion kit.

17. Group discussion**4**

The students should discuss in a group of six to eight students and write a brief report on the same as a part of term work. The topic for group discussion maybe selected by the faculty members. Some of the suggested topics are (any one)

- v. CNG versus LPG as a fuel
- vi. Petrol versus Diesel as a fuel for cars
- vii. Trends in automobile market
- viii. Load shading and remedial measures
- ix. Rain water harvesting
- x. Trends in refrigeration Technology
- xi. Disaster Management
- xii. Safety in day to day life
- xiii. Energy saving in Institute
- xiv. Nano technology

18. SEMINAR 8

Seminar topic shall be related to the subjects of fifth semester/topics from guest lectures . Students shall submit a report of at least 10 pages and deliver a seminar (Presentation Time – 10 minutes for a group of 2 students)

19. MINI PROJECTS (IN GROUP OF 4-5 STUDENTS) 6

- 1. Design/drawing of simple jigs/fixtures.
- 2. Thermocouple based temperature controller.
- 3. Pump on/ off timer
- 4. Models of jigs/ fixtures
- 5. Layout design of SSI units/ factory /workshop of the institute.

6. MODELS OF MATERIAL HANDLING ROUTE SYSTEMS OR MODULAR COURSE ON ANY ONE OF THE SUGGESTED OR ALIKE RELEVANT TOPIC BE UNDERTAKEN BY A GROUP OF STUDENTS (MIN 10):

- a) LPG/CNG conversion of vehicles

- b) Advance features in CAD-CAM
- c) Basics of PLC programming
- d) Die design
- e) Non traditional manufacturing methods
- f) Jigs & fixture design
- g) 3D modelling
- h) Finite element method
- i) Mechatronics
- j) Advanced computer programming
- k) Maintenance of home appliances
- l) Value stream mapping
- m) Piping Technology

20. STUDENT ACTIVITIES: 5

Students in a group of 3 to 4 shall perform **any two** of the following activities (Other similar activities may be considered) and write a report as a part of term work

ACTIVITIES :

- VI. Collection of data regarding loan facilities or other facilities available through different organizations/ banks to budding entrepreneurs
- VII. Survey and interviews of successful entrepreneurs in nearby areas.
- VIII. Survey of opportunities available in thrust areas identified by Government or DIC
- IX. Measuring Screw thread parameters on floating carriage dial micrometre and select the optimum diameter of wire.
- X. Survey of data regarding different types of pumps with specifications from manufacturers catalogue , local markets, end users (any other engineering products may be considered for survey)
- XI. Survey of farm implements used by farmers



Text Books:

1. Mark Ratner and Daniel Ratner :*Nanotechnology* – Pearson Education , New Delhi
2. YoramKorem :*Computer Control of Manufacturing System* – Mcgraw Hill Publication
3. Sunil Chopra, Peter Meindl :*Supply Chain Management* – Pearson Education , New Delhi

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6: Course Title: CAD , CAM & Robotics (Elective)

Subject Title	:	CAD, CAM& Robotics
Subject Code	:	Me-605
Hours Per Week	:	03
Hours Per Semester	:	45
Class test	:	3 hrs

1) INTRODUCTION :

1. Computers in industrial manufacturing
2. Definition of CAD & CAM, Product cycle
3. Automation & CAD/ CAM

2) FUNDAMENTALS OF CAD

2.1) Introduction

2.2) Conventional design process

2.3) Computer aided design process (Geometric Modelling, Engineering analysis, Design review & Evaluation, Automated Drafting),

2.4) Benefits of CAD in Engineering industry

3) HARDWARE IN CAD

3.1) Function of CAD workstation

3.2) Component of CAD workstation

3.3) Comparative study of various types of graphics terminal considering image generation techniques

3.4) Colour& animation capability

3.5) Use of input devices (keyboard, joystick, light pen, digitizers)

3.6) Use of output devices (plotter, printer)

3.7) Function of CPU (registers)

3.8) Types & purpose of storage devices



4) FUNDAMENTALS OF CAM

- 4.1) Introduction
- 4.2) NC machine, basic components of NC systems (program of instruction, machine control unit & machine tool)
- 4.3) Problems with NC systems
- 4.4) NC programming (Simple example)
- 4.5) CNC machine tool (general configuration, function, advantages)
- 4.6) DNC (configuration, type of DNC, benefit)
- 4.7) Adaptive control system (configuration & benefit)
- 4.8) Classification of CNC system (based on feedback system & based on motion control system)
- 4.9) Salient features of CNC machine components (feedback devices, spindle drives, axes feed drive, automatic tool changer, worktable, chip conveyer)

5) MANUAL PART PROGRAMMING

- 5.1) Axis identification
- 5.2) Co-ordinate system(absolute & relative co-ordinate referencing)
- 5.3) Zero point : Floating & Fixed (machine zero, job zero, zero shift)
- 5.4) Part programming format
- 5.5) Symbols preparatory function (absolute & incremental function, metric system , codes like G01, G02, G00, G71, G90, G03, G04 etc.)
- 5.6) Miscellaneous function (M code)
- 5.7) Tool information (T code, tool offset)
- 5.8) Speed & feed data (S & F data)
- 5.9) Interpolation (linear & circular)
- 5.10) Cutter radius compensation (G40, G41, G42)
- 5.11) Pre-set & programme dwell (G92 & G04)
- 5.12) Parametric sub routine
- 5.13) Simple part programme of turned components through turning centre (T70 Lathe) & any simple milling operation through machining centre (CNC Milling)

6) GROUP TECHNOLOGY

6.1 Introduction, Part families



6.2 Parts classification & coding (design & manufacturing attributes, classification & coding system , coding structure)

6.3 Discussion on MICLASS system

6.4 Group technology machine cell

6.5 Benefits of group technology

7) INDUSTRIAL ROBOTICS

7.1 Introduction

7.2 Specification of a industrial robot (physical configuration of a robot,basic robot motion,workvolume,precession of movement,speed of movement, weight carrying capacity, type of drive system)

7.3 End effectors

7.4 Robotic sensors (vision sensors, tactile & proximity sensors, voice sensor)

7.5 General considerations in robotic application

7.6 Application areas for industrial robot (material handling , welding, spray coating, processing operations, assembly & inspection)

Books: 1) CAD/CAM by Mikelle.Groovier& Emory W Zimmer

Published by Prentice Hall of India

2) CAD/CAM byR.Kumar published by Dhanpat Rai & Sons

3) CNC Technology by Samuel Raja & K Ravi Kumar published by Dhanpat Rai Publications

Table Of Specification for CAD CAM & Robotics																	
Sl No	Hrs	Topic	Objective Type				Short Answer Type					Essay Answer Type				Total	
			K	C	A	T	K	C	A	HA	T	K	C	A	HA		T
	45																97
1	2	Introduction	1	1		2		1	1	1	3						5
	4	Fundamentals of CAD		1	1	2			1	1	2		2	3			5
3	7	Hardware in CAD	1	2		3		2	1		3		3	3	3		15
4	10	Fundamentals of CAM	3	2		5	1	2	2		5	4	3	5			22
5	12	Manual Part Programming	1	2	2	5	1	2	2		5		10	5			25
6	4	Group Technology	1	1		2		2	2		4		1		2		9
7	6	Industrial Robotics		1	1	2			2	2	4		3	3			12



Annexure -I CAD CAM Robotics								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total
1	Introduction	2	4.44	1	2	1	1	5
2	Fundamentals of CAD	4	8.89		3	5	1	9
3	Hardware in CAD	7	15.56	1	7	4	3	15
4	Fundamentals of CAM	10	22.22	8	7	7		22
5	Manual Part Programming	12	26.67	2	14	9		25
6	Group Technology	4	8.89	1	4	2	2	9
7	Industrial Robotics	6	13.33	1	4	5	2	12

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7: Course Title: .Advanced Machining Methods (Elective)

Subject Title	:	Advanced Machining Methods
Subject Code	:	Me-606
Hours Per Week	:	3
Hours Per Semester	:	45
Total Marks	:	100
Theory	:	70
Sessional	:	30

On the completion of the course the students should be able to:

1. Appreciate the need of advanced machining methods
2. Acquire the knowledge of Spark Erosion Machine
3. Know the advantages of Ultra Sonic Drilling
4. Know about the Abrasive Jet Machining
5. Explain the basic technology of Chemical Machining including Electro Chemical machining
6. Know about the working principle of PAM LBM and, EBM

Course Contents

Chapter I Introduction

- 1.1 Need for Non conventional Machining Methods
- 1.2 Characteristics features of Advanced Machining Process
- 1.3 Basic principle of New Machining Methods
- 1.4 Advantages of non traditional machining process
- 1.5 Limitations of non traditional machining process
- 1.6 Classification of new machining methods
- 1.7 Abbreviations used for non conventional machining methods

Chapter –II- Spark Erosion Machining

- 2.0 Basic Principle of Spark Erosion

- 2.1 Tools materials used in Spark Erosion Machining
- 2.2 Die Electric Fluid
- 2.3 Servo System to provide controlled feed rate
- 2.4 Characteristics of EDM Process
- 2.5 Construction details of EDM
- 2.6 Description of process
- 2.7 Application and uses of EDM
- 2.8 Advantages and disadvantages of EDM
- 2.9 Wire cut EDM

Chapter –III- Ultrasonic Drilling (USD)

- 3.0 Basic Principle of the process
- 3.1 Different parameters of USD
- 3.2 Description of process
- 3.3 Hollow tools vs solid tools used in USD method
- 3.4 Applications of USD
- 3.5 Advantages and Limitations of Ultrasonic Machining
- 3.6 Characteristics of USD process

Chapter-IV---Abrasive Jet Machining (AJM)

- a. Process Description
- b. Tool material and Abrasive Particles used in AJM
- c. Mixing ratio, Importance of maintaining an optimum mixing ratio in an abrasive Machining Process
- d. Applications of AJM
- e. Advantages and limitations of AJM

Chapter –V Chemical Machining(Chemical Milling)(CHM)

- 5.0 Basic Techniques of CHM
 - Non selective metal removal
 - Selective Metal removal
- 5.1 Steps involved in Chemical Milling
- 5.2 Mechanism of metal removal
- 5.3 Applications
- 5.4 Advantages and limitations of CHM



Chapter –VI-- Electro Chemical Machining (ECM)

- 6.0 Principle of ECM
- 6.1 ECM process Details
- 6.2 Chemical reaction in ECM
- 6.3 Applications
- 6.4 Advantages and limitations of ECM
- 6.5 Comparison between EDM and ECM

Chapter VII---Electro Chemical Grinding(ECG)

- a. Description of the ECG process
- b. Electrolyte used in ECG process
- c. Metal Removed rate in ECG process
- d. Important points to be observed during the ECG process for successful results
- e. Advantages over conventional grinding
- f. Types of grinding wheels used in ECG
- g. Applications of ECG
- h. Advantages and Disadvantages of ECM

Chapter VIII-----Plasma Arc Machining(PAM)

- 8.0 Introduction
- 8.1 Description of the process
 - 8.2 Mechanism of metal removal
 - 8.3 Types of PAM
- 8.5 Application of the process
- 8.6 Advantages and limitation of the process.
- 8.7 Characteristics of PAM
 - 8.8 TIGwelding Comparison between Plasma Arc Welding and TIG welding

Chapter (IX) Laser Beam Machining(LBM)

- 9.0 Introduction
- 9.1 Laser Process
- 9.2 Description of the Process



9.3 Application of the process

9.4 Advantages and Disadvantages of the Process

Chapter X____(Electron Beam Machining(EBM)

10.0 Introduction of the process

10.1 Description of the process

10.2 Need for high vacuum in EBM

10.3 Applications of the EBM

10.4 Advantages and Disadvantages of EBM

10.5 Electron Beam Welding

10.6 Application of the EBM in Nuclear and Atomic Energy, Industries Aerospace industries and electronic industries

Table Of Specification for Advanced Machining Methods																		
Sl No	Hrs	Topic	Objective Type				Short Answer Type					Essay Answer Type				Total		
	45		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	97	
1	2	Introduction	2	2		4											4	
2	5	Spark Erosion Machining	2			2	2	1			3	2	4				6	11
3	6	Ultra Sonic Drilling	2	1		3	2				2	4	5				9	14
4	4	Abrasive Jet Machining	1	1		2	1				1	2	2				6	9
5	5	Chemical Machining Methods	1	1		2	2				2	2	4				6	10
6	5	Electro Chemical Machining	2	1		3	2				2	3	3				6	11
7	4	Electro Chemical Grinding	2			2	2				2	2	3				5	9
8	5	Plasma Arc Machining	2	1		3	2				2	2	3				5	10
9	5	Laser Beam Machining	1	1		2	2				2	2	4				6	10
10	4	Electron Beam Machining	1	1		2	1	2			3	4					4	9

Annexure -I Advanced Machining Methods								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total
1	Introduction	2	4.44	2	2			4
2	Spark Erosion Machining	5	11.11	2	4	5		11
3	Ultra Sonic Drilling	6	13.33	2	7	5		14
4	Abrasive Jet Machining	4	8.89	5	4			9
5	Chemical Machining Methods	5	11.11	3	7			10
6	Electro Chemical Machining	5	11.11	5	6			11
7	Electro Chemical Grinding	4	8.89	2	4	3		9
8	Plasma Arc Machining	5	11.11	2	5	3		10
9	Laser Beam Machining	5	11.11	1	3	6		10
10	Electron Beam Machining	4	8.89	1	2	6		9

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8: Course Title: POWER PLANT ENGINEERING (Elective)

Subject Title	:	Power plant engineering
Subject Code	:	Me-606
Hours Per Week	:	03
Hours Per Semester	:	45
Class test	:	03
Total	:	48
Full marks(Theory)	:	70
Sessional	:	30

On the completion of the course the students should be able to:

1. Know about power plant engineering and its importance
2. Appreciate and know the economics of power plant
3. Explain the working of thermal power plant
4. Know the various components of hydroelectric power plant and its importance
5. Explain the working principle of diesel power plant
6. Explain the working principle of gas turbine power plant
7. Know the working of nuclear power plant
8. Know the various environmental and safety aspects related to power plant.

COURSE CONTENTS

1.0 Introduction to Power plant

- 1.1 Introduction to power plant
- 1.2 Location of power plant
- 1.3 Choice of Power plant
- 1.4 Classification of power plant
- 1.5 Various factor affecting the operation of power plant
- 1.6 Performance and operating characteristics of power plant



2.0 Thermal power plant

- 2.1 Role of thermal power plant in current power generation scenario
- 2.2 Selection site for thermal power plant
- 2.3 General lay out of a thermal power plant
- 2.4 Advantages and disadvantages of thermal power plant

3.0 Hydro power plant

- 3.1 Introduction to Hydroelectric power plant
- 3.2 Selection of sites for hydroelectric power plant
- 3.3 General layout of Hydroelectric power plant and its working
- 3.4 Advantages and disadvantages of hydroelectric power plant

4.0 Diesel and Gas turbine plant

- 4.1 The layout of diesel power plant.
- 4.2 Components and the working of diesel power plant.
- 4.3 Advantages and disadvantages of diesel power plant.
- 4.4 Gas turbine power plant-Schematic diagram, components and its working

6.0 Nuclear power plant

- 5.1 Introduction
- 5.2 Thermal fission Reactors- PWR, BWR and gas cooled reactors
- 5.3 Advantages and Disadvantages of Nuclear power plant

7.0 Power plant safety

- 7.1 Plant safety concept
- 7.2 Safety policy to be observed in power plants
- 7.3 Safety practices to be observed in boiler operation



Reference:

1. Power Plant Technology by M M EI Wakil , Tata McGraw Hill
2. Power Plant Technology G D Rai, Khanna Publishers
3. Power Plant Engineering by G D Nagpal Khanna publishers
4. Power Plant Engineering By- Dr. P.C.Sarma S.K.Kataria & Sons
5. Power Plant Engineering by P.K.Nag ,

Table Of Specification for Power Plant Engineering																	
Sl No	Hrs	Topic	Objective Type				Short Answer Type					Essay Answer Type					Total
	45		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	97
1	3	Introduction to Power Plant	2			2	2				2		2			2	6
2	10	Thermal Power Plant	1	1		2		2	2		4	4	8	4		16	22
3	10	Hydroelectric Power Plant	1	1		2		2	2		4	4	8	4		16	22
4	10	Diesel & Gas Turbine Power Plant	1	1		2		2	2		4	4	4	8	1	17	23
5	8	Nuclear Power Plant	1	1		2		2			2	4	4	4		12	16
6	4	Power Plant Safety	1			1		1	1		2	2	4			6	9

Annexure -I Power Plant Engineering								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total
1	Introduction to Power Plant	3	6.67	4	2			6
2	Thermal Power Plant	10	22.22	5	11	6		22
3	Hydroelectric Power Plant	10	22.22	5	11	6		22
4	Diesel & Gas Turbine Power Plant	10	22.22	5	7	10	1	23
5	Nuclear Power Plant	8	17.78	5	7	4		16
6	Power Plant Safety	4	8.89	3	5	1		9

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