Book No - 2

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION BHOPAL

THREE YEARS DIPLOMA PROGRAMME IN MACHANICAL ENGINEERING

Under Multipoint Entry & Credit System

DETAILED SYLLABUS

BESIC TECHNOLOGY COURSES	APPLIED TECHNOLOGY COURSES	DIVERSIFIED COURSES
1. M-401 Mechanical Drafting	1. M-501 Machines Tools Technology.	1. M-601 Advance Design and Drafting.
2. M-402 Manufacturing Process	2. M-502 Theory of Machine Design of Machine Elements.	2. M-602 Fabrication Technology.
3. M-403 Materials Technology	3. M-503 Plant Maintenance & Safety.	3. M-603 Refrigeration and Air Conditioning.
4. M-404 Metrology & Instrumentation	4. M 504 Industrial Engineering.	4. M-604 CAD/CAM
5. M-405 Strength of Materials.	5. M-505 Industrial Management.	5. M 605 Tool Engineering.
6. M-406 Thermal Engineering.	6. M-506 Process Planning Estimating & Costing.	6. M-606 Automobile Engineering.
7. M-407 Fluid Mechanics & Hydraulic Machines.	7. M-507 Project.	7. M-607 Power Plant Engineering.
8. M-408 Basic Electrical & Electronics.		

M 508 metrology & Ind.

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DIRECTORTAE OF TECHNICAL EDUCATION, BHOPAL (M.P.)

DEVELOPED BY

M. P. BOARD OF TECHNICAL EDUCATION, BHOPAL

IN COLLABORATION WITH

TECHNICAL TEACHERS TRAINING INSTITUTE (W. R.) BHOPAL.

M.P. BOARD OF TECHNICAL EDUCATION,
BHOPAL.

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THREE YEARS DIPLOMA PROGRAMME IN

MECHANICAL ENGINEERING

UNDER

MULTIPOINT ENTRY AND CREDIT SYSTEM

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DETAILED SYLLABUS

BASIC TECHNOLOGY COURSES FOR MECHANICAL ENGINEERING

M 401 MECHANICAL DRAFTING
M 402 MANUFACTURING PROCESS
M 403 MATERIALS TECHNOLOGY
M 404 METROLOGY AND INSTRUMENTATION
M 405 STRENGTH OF MATERIALS
M 406 THERMAL ENGINEERING
M 407 FLUID MECHANICS AND HYDRAULIC MACHINES
M 408 BASIC ELECTRICAL AND ELECTRONICS.

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SPONSORED BY:-

DIRECTOR OF TECHNICAL EDUCATION BHOPAL (M.P.)

DEVELOPED BY:-

CURRICULUM DEVELOPMENT CENTRE

M.P. BOARD OF TECHNICAL EDUCATION BHOPAL

IN COLLABORATION WITH

TECHNICAL TEACHERS TRAINING INSTITUTE (W.R.)

BHOPAL.

P R E F A C E

In Madhya Pradesh most of the Polytechnics offer straight joacketed Diploma programmes in Civil, Mechanical, Electrical and Electronics & Tele Communication Engg. Curriculum is is the most crucial input in a technical education, hence, initiating to develop a need based curriculae for establishing relevance of Polytechnic output to the needs of industry, is the demand of the time.

At present 10+ and 12+ science stream/technical stream students in different proportions join a three year diploma programme in all Polytechnics. 10+ students are admitted to first year and 12+ students in Second year of three year diploma programme. These students do not have any option in selection of courses (subjects) and have no apportunity for taking alternative courses appropriate to their capability.

The National policy on Education, threfore, rightly recognised the need for a flexible structure which would allow students to enter the system at different points depending on their entry levels, and take up combination of courses according to needs, thereby facilitating the production of man power for a spectrum of technologies and occupations enhancing the efficiency of the system.

It is, in this context, that the Directorate of Technical Education, Madhya Pradesh and M.P. Board of Technical Education explored the feasibility of restructuring polytechnic education in Madhya Pradesh under World Bank Scheme by introducing the Multi Point Entry and Credit System(MPECS). This Scheme of flexible structure has been introduced at S.V. Govt. Polytechnic, Bhopal from July, 1990.

Considering the nature of the scheme, the courses (subjects) offered in this new scheme have been clustered under the following groups.

(1) FOUNDATION COURSES are meant for preparing adequate base of science, Maths and language and they are to be undertaken only by students who have passed 10+.

(Contd..2)

(2) HARD CORE COURSES are the courses which are to be taken both by 10+ and 12+ students.

(3) In the SOFT CORE COURSES there is a choice for the students to select the courses of their choice.

(4) BASIC TECHNOLOGY courses are the bridge courses between Science subjects and applied Technology courses.

(5) APPLIED TECHNOLOGY courses are the terminal courses through which the desired knowledge and skills are developed in the students, to perform his job function in the chosen field of technology.

(6) DIVERSIFIED courses are included to provide an opportunity for some more detailed knowledge in specific areas in the same or related discipline.

The curriculum development centre of the M.P. Board of Technical Education therefore undertook the task of preparing the syllabus/curriculum of the various courses of Diploma programme in Mechanical, Electrical and Construction Technology and Management started under Multi Point Entry and Credit System in collaboration with the CDC Centre of Technical Teachers Training Institute, Bhopal. The first workshop for preparing the syllabus of the above three disciplines was conducted at TTTI, Bhopal from 26-11-90 to 1-12-90 in which teachers from various Polytechnics and particularly from S.V. Government Polytechnic, Bhopal actively participated. The Board of Studies of the respective disciplines haye approved the prepared syllabus, and the syllabus is being printed with the intention that the implementation of MPECS should continue unabated.

Where ever required a component of safety and environment has been included in the syllabus and proper care has been taken in :-

(a) Maintaining sequence of topics.
(b) Allotting HRS for each topics.
(c) Avoiding overlapping of the content.
(d) Relevance of the content.
(e) Prerequisite of the content.

(Contd...)

The comments and healthy critisism from faculty members are however welcome, so that this prepared syllabii can be reviewed and revised periodically.

We are highly grateful to the Director Technical Education and prof. C. A. Keshwani, Additional Director of Technical Education, Bhopal for their valuable guidance, encouragement and active co-operation in organising the above workshop.

Words of obligation are due, to prof. S.A. Balu, Principal, TTTI, Bhopal and the CDC faculty of TTTI, Bhopal. It is out of their valuable suggestions and long term experience in curriculum development that this syllabus is in the hands of the user.

We aspire to improve this in times to come.

Sd/-
Secretary,
M.P. Board of Technical Education,
Bhopal.

L I S T P A R T I C I P A N T S.

POLYTECHNIC FACULTY.

(1)	Shri B.B.Bhargava.	S.V.Government Polytechnic, Bhopal.
(2)	Shri U.K.Shrivastava.	S.V.Government Polytechnic, Bhopal.
(3)	Shri T.Chatterjee.	Government Polytechnic, Jabalpur.
(4)	Shri B.L.Khare.	Govt. Women's Polytechnic, Sagar.
(5)	Shri B.P. Sinha.	S.V.Government Polytechnic, Bhopal.
(6)	Shri S.K.Saxena.	S.V.Government Polytechnic, Bhopal.
(7)	Shri R.M. Pathak.	Government Polytechnic, Jabalpur.
(8)	Smt. S.Ekbote.	S.V.Government Polytechnic, Bhopal.
(9)	Shri [illegible]	S.V.Government Polytechnic, Bhopal.
(10)	Shri R.[illegible]	Shri Vaishnav Polytechnic, Indore.
(11)	Shri R.P. [illegible]	Government Polytechnic, Ujjain.
(12)	Shri M.[illegible]	Government Polytechnic, Jabalpur.
(13)	Shri B.[illegible]	S.V.Government Polytechnic, Bhopal.

C.T.T.I. FACULTY.

(1)	Prof. V.M.Kamse.	Head of the Department C.D.C.
(2)	Dr. N.S.Kuppuan.	
(3)	Prof. G.V.L. Rao.	
(4)	Prof. H.R.Ramanna.	
(5)	Dr. K.C.Sabharwal.	
(6)	Prof. S.B.L. Shrivastava.	
(7)	Prof. P.C.Jain.	
(8)	Prof. M.K.Shrivastava.	

CURRICULUM DEVELOPMENT CENTRE.

(1)	Shri Ashok Ratnaparkhi.	Joint Director.
(2)	Shri K.K.Jain.	Deputy Director.
(3)	Shri C.P.Bhargava.	Deputy Director.

* * *

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION, BHOPAL.

-REVISED ON 15.10.92.

SCHEME OF STUDIES & EXAMINATION OF DIPLOMA IN MECHANICAL ENGINEERING.

BASIC TECHNOLOGY (MFECS.) w.e.f. 1992

S.No.	Code No.	Course	Pre-requisite.	Hrs./Week Th.	Hrs./Week Pr.	Credits	Sessional Term work	Sessional Lab. work	Progressive Assessment I	Progressive Assessment II	Board Exam. Paper	Theory Dur.	Theory Marks.	Pract./Viva Pr.	Pract./Viva Dur.	Pract./Viva Marks	Remarks.
1.	M-401	Mechanical Drafting	202	3	6	6	20	20	10	10	1	4 Hrs.	100	1	(Viva)	50	
2.	M-402	Manufecturing Process.		4	2	5	20	20	10	10	1	3 Hrs.	100	1	3 Hrs.	50	
3.	M-403	Materials Technology.	-	4	2	5	20	20	10	10	1	3 Hrs.	100	1	3 Hrs.	50	
4.	M-405	Strength of Material.	201	4	2	5	20	20	10	10	1	3 Hrs.	100	1	3 Hrs.	50	
5.	M-406	Thermal Engg.	-	4	2	5	20	20	10	10	1	3 Hrs.	100	1	3 Hrs.	50	
6.	M-407	Fluid Mechanics & Hydraulic Machines.	-	4	2	5	20	20	10	10	1	3 Hrs.	100	1	3 Hrs.	50	
7.	M-408	Basic Electrical & Electronics.	-	3	2	4	20	20	10	10	1	3 Hrs.	100	1	3 Hrs.	50	
		Total Credits.		35	140	140	70	70	7	-	700	7	-	350			

NOTE: All courses are compulsory.

(1) Sessional Marks : 280
(2) Progressive Asst.Marks: 140
(3) Theory paper Marks. : 700
(4) Practical Marks : 350

Total:- 1470

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : MECHANICAL DRAFTING

COURSE CODE NO : M-401

PRE-REQUISITE : 202

RATIONALE.

This course in Mechanical Drafting has been prepared with a view to developing elementary drafting skillin the students. Looking to the professional needs of the technicians, more emphasis is laid on the use of I.S. Code of practice and reading and interpretation of drawings. The topics on Multiview Representation, Dimensioning and Tolerancing, Free hand sketching and Sections of M/c Parts are included to build foundation for production Drawing. The topic of Pipe Drafting will help the students to understand the importance and functions of piping system, in industry. Tracing and Blue Printing will develop in them the skill of preserving important drawings.

'Computer Graphics' is a modern concept in Mechanical Drafting and knowledge of Elementry level in Display Technology, D.D.A. and Dimensional Transfer scaling is considered essential for the technicians level.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : MECHANICAL DRAFTING.

COURSE CODE NO : M-401

SCHEME OF STUDIES.

S.No.	Topic	Theory periods.	Practical periods.
1.	Projections and Multiview Representation.	3	6 (2 plates)
2.	Sectional Views	3	6 (2plates)
3.	Auxiliary Views.	3	6 (2 plates)
4.	Dimensioning, Tolerancing, Machining and welding symbols.	6	6 (2 plates)
5.	Production Drawing.	10	42 (6 plates)
6.	Pipe Drafting.	4	6 (1 plate)
7.	Gear Drawings.	4	6 (1 plate)
8.	Reproduction and Preservation of drawings.	3	6 (1 tracing & its reproductions plates)
9.	Graph and charts.	6	6 (2 plates)
10.	Computer Graphics	6	6 (1 plate)
	TOTAL	48	96 (20 plates)

G.Total

Credits - 6

(9)

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)
COURSE : MECHANICAL DRAFTING.
COURSE CODE NO : M-401

C O N T E N T S

Theory : 48 Hours.
Tem/Practical : 96 Hours.
Total :144 Hours.

TOPIC NO. 1 : PRODUCTION AND MULTIVIEW REPRESENTATION: Projection, orthographic projection. First and Third angle projection, superfluous view, Choice of views, Auxillary views- full and partial, conversion of pictorial views in to orthographic views, conventional representation as per IS 696.

TOPIC NO. 2 : SECTIONAL VIEWS :

Full section, half section, partial or broken section, revolved section, removed section, offset section. Sectioning conventions, section lines. Hatching procedure for different materials as per IS code 686-1972. Sectional views of assembled parts choosing from IC engine parts, steam engine parts, valves, couplings, clutches, brackets, bearings etc. (Use 1st and 3rd angle projections both.)

TOPIC NO. 3 : AUXILIARY VIEWS :

The use of auxiliary views, Types, construction of symmetrical and unsymmetrical auxiliary views.

TOPIC NO. 4: DIMENSIONING, TOLERANCING, MACHINING AND WELDING SYMBOLS:

Types of dimension (size and location) Dimensioning terms and notations. (Use of I.S. Code 696 & 2709) general rules for dimensioning and practical hints on dimensioning, systems of dimensioning. Dimensioning of cylinder, holes, arcs of circle, narrow space, angles, counter sunk hole, screw threads, taper etc. Application of tolerances. (use I.S. Code 696). Machining marks, finish marks, countersinking, counter-boring, spotfacing, figures and notes for same. Representation of characteristics machining (circularity, angularity etc.) (Ref. IS 696). Representation of welded joints, welding symbols, Tolerance of forms and positions. Procedure of drawing fits, limits, size, tolerance, clearance etc.

TOPIC NO. 5 : PRODUCTION DRAWING :

Detailed drawing, Assembly drawing, scale, finish, tolerances, processors, notes etc. Title block, Tool list, Guage list, style list, parts list zoning, revision, panel

(Confd.....

preparation of production drawing for pattern shop. Forging shop, machine shop, preparation of assemblydrawing from detailed drawing. Exploded views, sectional pictorial views, assembly drawing of plummer block, flange coupling, stepped pulleys, foot step bearing, Universal coupling, stuffing box, eccentric of steam engine, connecting rod, piston of I.C. Engines, stop valves, feed check valves, Dead weight safety valve for boiler. Preparation of detailed drawing from assembly drawings and assembled picturial views, Interpretation of production drawings.

TOPIC No. 6 PIPE DRAFTING :

Various symbols used in pipe line work as per IS code of practice, C.I. Flanged joint, socket and spigot joint, gland and stuffing box, Expansion joint, pipe fittings, typical pipe bends, pipe supports and accessories. Piping diagram for a small pump house.

TOPIC NO. 7 GEAR DRAWING :

Gear terminology such as pitch, pitch circle diameter, module, addendum, dedendum, root circle diameter, hole depth, Blank diameter etc. Construction of cycloidal, involute teeth-profiles, pinion and rack meshing, spur gear meshing.

TOPIC NO. 8 RE-PRODUCTION AND PRESERVATION OF DRAWINGS:

Tracing, Blue printing, Brown print, white print, ammonia printing, xerography, photographic reproduction. Micro films. Indexing, folding and codification methods. (Use IS code of practice 696 - 1972)

(1 tracing plate and its reproduction)

TOPIC NO. 9 GRAPH AND CHARTS :

Introduction, classification of charts, graphs and diagrams, Quantitative and qualitative charts and graphs. Drawing and curve, Titles, legends, notes etc. procedure for making a Graphical Representation in Ink. Logarithmic Graphs, Semilogarithmic Graphs, Bar charts, Area (percentage) charts, Pie chart, Polar charts, trilinear chart, pictorial chart, Alignment charts (Nomographs) - Forms and construction, construction of functional scale, parallel scale charts for equations of the Form ($f(t) + f(u) = f(v)$), ($f(t) \times f(u) = f(v)$) Three-scale Alignment chart, Graphical construction of a Z-chart, Four variable Relationship- Parallel scale Alignment chart.

TOPIC NO. 10 COMPUTER GRAPHICS :

Introduction to computer graphics Geometric modeling - Three types of commands, Methods of Representing objects in Geometric modeling.

Automatic Drafting - Creating hard copy engineering drawing direct from CAD base, Graphic features of CAD helpful in automatic drafting.

Graphic terminal and other hardware for computer graphics their function and use.

(a) Three types of grapher terminals.

(b) Operator input devices - cursor control, input functions, digitiser, key-board, terminals.

(c) Plotters and other output devices. Faurilia--rity with a simple set of commands for generating simple orthographer views.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : MECHANICAL DRAFTING.

COURSE CODE NO : M- 401

SUGGESTED TERMS-WORK

S.No.	TOPIC	NO. OF SHEETS.
1.	Projections and Multiviews Representation.	2
2.	Sectional Views.	2
3.	Auxiliary views.	2
4.	Dimensioning Tolerancing, Machining and Welding Symbols.	2
5.	Production Drawing.	6
6.	Pipe drafting.	1
7.	Gear drawing.	1
8.	Reproduction and preservation of drawings.	1 Tracing & its reproductions
9.	Graphs and charts.	2
10.	Computer Graphics.	1
	TOTAL	20 plates.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : MECHANICAL DRAFTING.

COURSE CODE NO : M-401

SUGGESTED BOOKS.

1. Fundamentals of Engineering Drawing By-Warren J Luzadder (Prentice-Hall)
2. Mechanical Drawing By-Giesecke, Michell Specer, Hill (Collier Macmillan Internal Edition)
3. Engineering Graphics. By-Giesecke/Mitchell/ Spencer/Hill/ Loving (Macmillan)

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MECS)

COURSE : MANUFACTURING PROCESS

COURSE CODE NO : M-402

PRE-REQUISITE : 203

RATIONALE

Manufacturing Processes are advancing very fast with the expansion of technology. This course will provide basic insight in the students regarding methods of manufacturing processes. The course gives the opportunity for exhaustive study of metal casting, mechanical working of metals and metal joining. The abilities developed by studying this course will be directly helpful to all the technicians, in what over field they are employed.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MECS)

COURSE : MANUFACTURING PROCESS

COURSE CODE NO : M-402

SCHEME OF STUDIES.

S.No.	Topic.	Theory	Practical	Total
1.	Introduction to manufacturing Processes.	3	2	5
2.	Metal casting.	18	16	34
3.	Mechanical working.	28	6	34
4.	Metal joining.	15	8	23
	TOTAL:-	64	32	96

Credits - 5

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : MANUFACTURING PROCESS

COURSE CODE NO : M 402

1. INTRODUCTION TO MANUFACTURING PROCESSES :

Definition, Distinction between manufacturing processes as used in engineering industries and other process oriented industries; classifiation of basic manufacturing processes, i.e. mechanical working, casting, metal joining processes, metal cutting processes, Examples of each of the above listed manufacturing processes, Factors which influence selection of production process for particular applications.

2. METAL CASTING :

2.1 INTRODUCTION, listing of different casting processes, advantages and limitations of casting as a production process.

2.2 Pattern making :- Definition of pattern, types of patterns and their details, Materials, Allowances, Tools required, colour code for patterns.

2.3 Moulding - Definition, Moulding, methods types of moulds, moulding materials, Moulding sand and its composition, Sand properties, Testing parameters of sand, and their effects, sand preparation, sand conditioning, characteristics and defects of moulds.

-Cores and core making, core boxes,

2.4 FURNACES - Cupola, Crucible, Pit and Electric arc furnaces their salient features, advantages and limitations, preparing furnaces for melting, safety aspects.

2.5 CASTING PROCESS of runners, risers and gate.

Cleaning of casting,

Special casting methods,- Need for special casting methods, Die casting, centrifugal casting, Investment (lost wax) casting, continuous casting, casting defects - causes and analysis area of application casting process.

3. MECHANICAL WORKING : INtroduction- hot and cold working.

HOT WORKING : Principle of mechanical working, importance, Hot and cold working, structural changes during process, Pre-heating of stock, Defects in ingots and rectification, Advantages and disadvantages of hot working, Equipment required for hot working of metal, Different hot working methods.

COLD WORKING : Basic Principles of cold working, Effect of cold working on grain structure, strength, hardness. Type of cold working processes- Forging, Press working, Rivetting, Cold Rolling, Drawing, spinning. Residual stress in cold working. Comparison of hot and cold working processes. Advantages and disadvantages of cold working processes.

Preheating Principles, Equilibrium diagram its use for determining preheating and tempreature range.

Effect of overheating of metal. Factors which decide stocks used in hot working of a given product functions of soaking pit.

METAL ROLLING : Principal of metal rolling, Basic components of a simple rolling process equipment. Types of deformations during rolling, Differentiation between a bloom and a billet as applied to rolling, Roller material, Selection and desirable properties, Principle of thread rolling description with sketches, Manufacture of seamless tubes by rolling, Types of rolling Mill.

METAL DRAWING : Basic principle of drawing of metals, Differentiate between the drawing and deep drawing of metals, Principle of wire drawing, Basic equipments required for wire-drawing, Process of wire drawing Die details.

METAL SPINNING : Process of metal spinning, Principle of deep drawing and example.

EXTRUSION - Definition; classify the methods of extrusion, their limitations, advantages and disadvantages. Tube extursion, impact extrusion, Application of extrusion processes.

FORGING :- Die forging, Differentiate between the cold die and hot die forging, advantages of forming by forging, Common defects and reason of forged parts. Limitations of forging progressive forging, Press forging, upset forging, Die meterial, Applications of forging processes in engineering.

PRESS WORK : Definiciondf Press working of metals, Principle of press working, Descriotion of a simple press working unit; Press working operations-Punching, shearing, Drawing, Bending, Slitting, Curling, Notching, Trimming,
Differentiate press and press brake, Double action press-description and its field of application, Die and punch, Types of Dies, Specifications of a press, safety precautions to be observed for working on a press.

TOPIC : 4 :METALING JOINING

Introduction,classification of metal joining processes-soldering,Brazing and welding,welding [illegible] weldability of metals, Metallurgy of welding and welding

Classification- Plastic, Fusion and Forge

Resistance welding - Spot,seam,Butt, Projection,Percussion techniques

Gas welding [illegible] gas cutting - Principle of operation and technique, gas cutting.

Arc welding - Carbon arc;metal arc,inert gas arc- TIG,MIG [illegible] atomic hydrogen,electro-slag,plasma arc welding processes. [illegible] Flux and their uses.

Special welding techniques-thermit,ultra sonic,electron beam, explosive and Friction welding technique. Welding of different metals, Defects in welds,testing and inspection.

Accident prevention in gas fusion welding and in arc welding.

Equipments,tool, used in metal arc welding-specification and functions.

Soldering- Types,tools, Working principle,consummables, application.

Brazing-[illegible]s,tools,working principles,Consummables, application. Adhesive joining- various materials used as chloroform adhesive such as: Glue,Quickfix,Areldite, [illegible] working principle,adventages, disadvantages and limitatio[illegible] [illegible] – 23)

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGARMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : MANUFACTURING PROCESS

COURSE CODE NO : M 402

LIST OF EXPERIMENTS.

S.No.	Practical details.	Shop	Time allotted	REMARKS.
1.	Carpentry practice on Sawing, planing, chiselling and simple Joinery work.	Carpentry/ Pattern shop.	6 hrs.	
2.	Making a split/solid pattern from wood.	Pattern shop.	3 hrs.	
3.	Making a core - box.	-do-	3 Hrs.	
4.	Tempering of sand, Practice of green and dry sand making.	Moulding shop/ & Foundry.	3 Hrs.	
5.	Practice of core making and baking.	-do-	3 Hrs.	
6.	Practice of open mould in a two box, using split pattern and solid pattern. Locating the core.	-do-	3 Hrs.	
7.	Demonstration of casting of metal in pit furnace.	-do-	3 Hrs.	
8.	Simple forging practice (Making a square bar out of a given round bar, making of a chisel) and bolt.	Blacksmithy Shop	9 Hrs.	

1.	2.	3.	4.	5.
9.	Practice of upsetting of a round on power hammer.	Blacksmithy shop.	3 Hrs.	
10.	Practice of sheet cutting with the help of straight and bent snips. Making small rectangular prism and cylinder.	Tin smithy shop.	6 Hrs.	
11.	Practice of making of washer of any size on a flypress.	-do-	3 Hrs.	
12.	Practice of piercing, notching and circle cutting with the help of a Metal master machine.	-do-	3 Hrs.	
13.	Practice of sawing filing and fitting of small rectangular pieces preparation of edges for welding.	Fitting.	9 Hrs.	
14.	Linear measurement of jobs with the help of calliper micrometer and simple measuring tools.	-do-	3 Hrs.	
15.	Demonstration and practice of bead laying (welding) on a flat piece.	Welding.	2 Hrs.	

1.	2.	3.	4.	5.
16.	Practice of welding of corner edge and Tee joint.	Welding		3 Hrs.
17.	Welding 'V' butt joint.	-do-		3 Hrs.
18.	Practice of joining wires and rods of different size on spot welding machine.	-do-		2 Hrs.
19.	Practice of making gas flames with nozzles and making simple joints.	-do-		2 Hrs.
20.	Demonstration and practice of plain turning & step turning on any given piece of bar.	M/c. Shop.		3 Hrs.
21.	Practice of Knurling grooting and boring on a lathe turning between centre and using chuck.	-do-		3 Hrs.
22.	Simple drilling practice on flat pieces.	-do-		3 Hrs.
23.	Shaping of a rectangular Job.	-do-		3 Hrs.

NOTE:- The teacher is free to select the number of practical covering all the topics depending upon the availability of time.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : MANUFACTURING PROCESS.

COURSE CODE NO : M - 402

LIST OF BOOKS FOR REFERENCE.

1. Process and materials of manufacture - Lindberg.
2. Workshop Technology - Hazara & Choudhary.
3. Materials and Manufacturing Process - Dalela.
4. Manufacturing Processes - Yankee.
5. Manufacturing Processes - S.E.Rusinof.
6. Welding Engineering. - B.E.Rossi.
7. Foundry Engineering. - P.L.Jain.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : MATERIAL TECHNOLOGY.

COURSE CODE NO : M-403

RATIONALE.

The knowledge of materials, their properties and behaviour is essential for people associated with Engineering activities. Materials Technology plays an important role in design and production of a product from the point of view of reliability and performance of the product.

The curriculum of the subject emphasizes upon understanding the properties and behaviour of materials in correlatiin with their structure and external environmental effects. The range of materials available for engineering use is quite vast, hence only the basic groups of materials such as ferrous, non-ferrous non-metallic materials alongwith their general characteristics and application have been stressed.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : MATERIALS TECHNOLOGY

COURSE CODE NO : M - 403

SCHEME OF STUDIES.

S.No.	Topic	Theory Hrs.	Practical Hrs.	Total Hrs.
1.	Engineering requirement of materials.	01	-	01
2.	Mechanical properties of materials and their testing.	04	10	14
3.	Structure of solid materials.	04	-	04
4.	Structural Imperfections.	02	-	02
5.	Permanent reformation.	04	-	04
6.	Practical metallography.	02	08	10
7.	Phase Diagram and phase Transformation.	05	-	05
8.	Iron-Carbon system.	03	-	03
9.	Heat treatment of steels.	06	12	18
10.	Ferrous Metals and Alloys.	08	02	10
11.	Non-Ferrous metals and Alloys.	05	-	05
12.	Non-metallic materials.	08	-	08
13.	Plastics.	03	-	03
14.	Powder Metallurgy.	04	-	04
15.	Metal Preservation.	02	-	02
16.	Selection of materials.	01	-	01
17.	Modern trends in Materials Technology.	02	-	02
	TOTAL	64	32	96

Credits - 5

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : MATERIALS TECHNOLOGY.

COURSE CODE NO : M - 403

C O N T E N T S

1. ENGINEERING REQUIREMENTS OF MATERIALS :
Introduction to engineering materials, classification of engineering materials and their properties.

2. MECHANICAL PROPERTIES OF MATERIALS AND THEIR TESTING :
Mechanical properties of materials, Destructive and non-destructive testing.

3. STRUCTURE OF SOLID MATERIALS :
Classification, Amorphous and crystalline states, unit cells and crystal structure (B.C.C., F.C.C. and H.C.P.) Allotropy.

SOLIDIFICATION OF METALS :
Process, Nuc-leation of metal crystal, Ingot solidification, Dendritic growth and its effect on properties, Methods of preventing dendritic growth. Growth of single crystals-column crystal, Equiaxed grains segregation of impurities Grain and Grain Boundaries.

4. STRUCTURAL IMPERFECTIONS :
Types of imperfections, Impurity atoms, Point defects, Line defects, screw and mixed dislocations, surface defects.

5. PERMANENT DEFORMATION :
Types, Mechanism of plastic flow, slip phenomenon in single crystals Dislocation theory, Twinning, Annealing, Recovery Recrystallization and grain growth.

6. PRACTICAL METALLOGRAPHY: Preparation of specimen, selecting the specimen, Mounting the specimen, Grinding and polishing, Etching, and etching reagents, The metallurgical microscope, Use and care of microscope. Micro-examination, sulphure printing. (2 + 8 = 10)

7. PHASE DIAGRAMS AND PHASE TRANSFORMATION :

Basic definition of phases, solid solutions- types, formation examples, characteristics, Factors affecting the formation of solid solutions.

Equilibrium or phase diagrams :- Plotting of equilibrium diagrams, Interportation, Phase rule and lever rule and its application. Isomorphour binary equilibrium diagrams.

Thermal equilibrium diagrams :- Uses, their construction and interpretation Eutective type solid-solubility type and partial (limited) solubility type.

8. IRON-CARBON SYSTEM : The complete Iron-carbon diagram and its interpretation. The solidification and cooling of various carbon steels, structures produced, correlation of mechanical properties with carbon content.

9. HEAT TREATMENT OF STEELS :

Objective of heat treatment, Description of processes Annealing, hardening, Normalising and tempering.

Hardening processes :- Surface Hardening, Flame hardening, case hardening, methods, their scope, limitations and advantages, Quenching mediums and its effect on hardness. Hardening defects due to improper quenching, Hardenability, joining test and interpretation of its results. T.T.T. curves-interpretation and use Martempering and Aus-tempering process, use and their representation on TTT- curves.

10. FERROUS METALS AND ALLOYS:

Classification, Types of cast Irons- their micro-structure, formation, properties and uses, Alloy cast-irons-various alloying elements used, their effects on properties and uses. Classification composition and uses of palin carbon steels, effect of impurities, Alloy steels - various elements used for alloying, their effects on properties and uses of alloy steels. Alloy steel classification

Tool steels :- Typical compositions, requirments of tool steels, High speed steel, High carbon steel.

Standardization of steels.

Designation of steels as per B.I.S. codes.

11. NON-FERROUS METALS AND ALLOYS :

Copper- its properties and uses

Copper base alloys-brasses and bronzes, their classification, composition, properties and uses. Designation of copper alloys as per B.I.S. Aluminum- its properties and uses, Aluminium alloys- their composition, classification properties and uses.

Designation of Al-alloys as per B.I.S. Zinc, Nickel and lead- their alloys, properties and uses (only commonly used important alloys) Bearing alloys-their composition and field of application.

12. NON-METALLIC MATERIALS :

Ceramic-types, characteristics and applications,

Refractories- desir ble properties, classification, special feature of acid, basic and neutral, refractories.

Gauses of failure

Natural and synthetic abrasive materials-composition properties and uses, Glass, Fibre glass, glass wool-composition, properties and uses.

RUBBERS- Properties and uses, vulcanisation, Adhesive-terms used, types, desirable qualities-principle of adhesion-setting of adhesive-surface preparation, selection of adhesive commercial names of commonly used adhesives.
Thermal insulation and electrical insulation materials- Desirable qualities- Effect of moisture and temperature, types of insulation materials and their applications.
Lubricants-Functions, properties, types and uses. Commercial names of lubricants their specific applications and characteristics.

13. PLASTICS : Characteristics, classification commonly used thermo setting and thermoplastics- their properties and uses.
Ingradients for processing plastics.
Plastic processing methods- different methods.

14. POWDER METALLURGY :
- Introduction and application
Description of process, manufacture and blending of metal powders. Compacting, presintering and sintering, Advantages and comutations design considerations.

15. METAL PRESERVATION :
Corrosion- meaning, variousmechanism effect of corrosion, methods of minimising corrosion.

16. SELECTION OF MATERIALS :
- Selection requirements, Fabrication of charecteristics.

17. MODERN TRENDS IN MATERIALS ENGINEERING :
- New materials like FRP, Composites, synthetic Rubbers, Synthetic wood.
- Super conductivity.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : MATERIALS TECHNOLOGY

COURSE CODE NO : M- 403

LIST OF EXPERIMENTS.

1. Study and use of metallurgical microscope.
2. Preparation of mico specimen.
3. To study microstructural characteristics of Grey Cast Iron, White cast iron and malleable cast iron.
4. To study microstructure of carbon steel.
5. To study of effect of normalising, annealing on the hardness and micro-sturcture of high carbon steel.
6. To study the effect of carbon and temperature on hardening of steel.
7. To study the effect of temperature on the properties during tempering of steel.
8. To study the effect of quenching media on hardness of steel.
9. To study the carbonising and case hardening ofsteels.
10. Joining hardenability test and its industrial use.
11. To study the microstructure of some important brasses and bronzes.
12. To observe the microstructural characteristics and other properties of various cast irons and prepare a report there of for industrial use.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : MATERIALS TECHNOLOGY

COURSE CODE NO : M-403

LIST OF REFERENCES

1. A text book of material Science and Metallurgy by O.P.Khanna.

2. Material Science and processes - S.K. Hazra Choudhry

3. Material Science - Leuttin- Lakhtin
Pub. MIR Publisher, Mascow.

4. Materials for Engineers -MH.A. Kempsty

5. Introduction to material Science and
Engineering - K.M. Ralls
- T.H.Courtney
- John Wulff.
Pub. Wiley Eastern N. Delhi.

6. Physical Metallurgy principles- Reed Hill
Pub. Affiliated East- West Press Pvt. Ltd.
New Delhi.

7. Engineering Metallurgy
- R. Higgins.
(ELBS.)

8. Material Science - B.S.Narang
Pub. CBS Pub. & Distributors - Delhi.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : METROLOGY AND INSTRUMENTATION

COURSE CODE NO : M - 404

R A T I O N A L E.

This subject has earned its importance in the curriculum due to major activities of inspection department. Today in almost all factories search is going on for answers to the problems of production, meterials, design, improved machines, better way of making and assembling parts. Many of these answers are provided by Metrology through accuracy in production, high standards of inspection, new and improved use of instrument etc. Metrology, therefore, is a fast growing, changing and increasingly significant field.

The subject is based on two sequential steps i.e. introducing concepts, and providing practice in applying/ interpreting these concepts.

After going through this subject the technicians would be able to develop skill in using, selecting and servicing the instrument. Also by actually using the equipment, the technician will appreciate the suitability of method or instrument for any measurement and to develop the general technique of measurement.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : METROLOGY AND INSTRUMENTATION

COURSE CODE NO : M - 404

PRE-REQUISITE : 203

SCHEME OF STUDIES.

S.No.	TOPIC	THEORY HRS.	PR.HRS.	TOTAL HRS.
1.	Inspection.	03	-	03
2.	General Measurement concept.	04	-	04
3.	Linear Measurement.	06	06	12
4.	Angular Measurement.	06	04	10
5.	Straightness, Flatness, Squareness and Roundness Testing.	08	04	12
6.	Surface Roughness.	07	02	09
7.	Screw thread measurement.	04	02	06
8.	Gear measurement.	04	04	08
9.	Limit Gauges.	06	04	10
10.	Transducers.	04	-	04
11.	Temperature Measurement.	04	02	06
12.	Pressure Measurement.	04	02	06
13.	Flow Measurement.	04	02	06
	TOTAL	64	32	96

CREDITS - 5

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : METROLOGY AND INSTRUMENTATION

COURSE CODE NO : M- 404

PRE-REQUISITE : 203

C O N T E N T S.

TOPIC 1. INSPECTION :

Meaning and application of inspection, Daily life example of inspection, concept of inspection as applied to daily life and industries. Effect of absence of inspection in an industry. Classification of inspection function, meaning and advantages of each concept of inspection applied to metrology. Definition/meaning of precision, accurancy and error. Differentiation between precision measurement in industry, Meaning of standard inspection and specifications, Relationship between cost and accuracy, Interchangeability and selective assembly.

TOPIC 2. GENERAL MEASUREMENT CONCEPT : Limits, fits and tolerance definition, selection of fit, calculation of fundamental deviation, limit of sizes, selection of limits, tolerances and allowances.

TOPIC 3. LINEAR MEASUREMENT : STANDARDS OF LENGTH, classification and use of slip gauges, wiringing process, gauge block calibration precautions to be observed while using gauge blocks, classification of linear measuring instrument- direct and indirect, construction and working of vernier caliper, micrometers-outside and inside and depth, vernier height gauge, dial vernier and dial height gauge- Identification of parts, finding least count, precautions of each type, types of errors, Dial gauge types, construction, principle, accuracy and precautions to be observed in handling, field of application, comperators-

principle, type, working, use field of application of Mechanical, Electrical, Optical and Pnumatic comparators- Selection for specific work, Measuring Machines-type, application limitations, working principle. Interferrom meters type, working principle, application.

TOPIC 4. ANGULAR MEASUREMENT : Classification- direct and indirect, protractor- vernier and optical, universal- working use and limitation, precautions, Angle blocks-setsize, accuracy, calibration, method of measuring unknown angle and checking known angle. Sinebar- common types, use in actual practice for finding out known and unknown angle. Spirit levels- types, use field of application, sensitivity, clinometer types, working principle, accuracy, field of application, Angle Dekkar-type, principle of working method, field of application.

TOPIC 5. STRAIGHTNESS, FLATNESS, SQUARENESS & ROUNDNESS TESTING : Concept of squareness, flatness, squareness and roundness, straight edge method- light gap and feeler gauge method, wedgemethod, precision level method, Auto collimeter method. Squarness-Indicator method, Square tester, Autocollimeter method Determination of straightness, flatness, squarness of a given piece use of V-block and dial indicator for determining roundness.

TOPIC 6. SURFACE ROUGHNESS : Definition of primary and secondary texture, real surface, geometrical surface, effective surface, real profile, geometrical profile, effective profile, reference line, lay, traversing length, sampling length, mean time, centre line of profile 'M' and 'E' system of surface assessment- Salient features, merits and demerits of each basic unit of indicating surface roughness- CL No., R.M.S., Ten point height. Interpretation of units graphically and mathematically. Types of surface measuring instrument, Method of surface measurement- Stylus, stylus skid, stylus pressure, Mechanical

amplification. Tomlinson mechanical surface finish recorder-working principle. Electrical amplification, principle of current-generating type and voltage variation type stylus instrument. Profilographits units, advantages, working principle, Surface inspection by comparison methods.) (a) Touch inspection (b) Visual inspection (c) Scratch inspection (d) Microscope inspection-Limitations of each.

TOPIC 7. SCREW THREAD MEASUREMENT : Types of screw threads, threads nomenclatures, Errors in screw thread pitch errors (Progressive and periodic) Instrument, equiment required for measuring pitch, effective diameter and angle-procedure, advantages, limitations and precautions of each method. Limit gauges for screw thread measurement-Procedure, advantages and limitation of each gauge. Precautions observed while using a limit gauge.

TOPIC 8. GEAR MEASUREMENT : Types of gears, gear nomenclature, Gear elements requiring measurements. Necessity of measuring gear elements accuracy. Types of gear tests. Different method of inspecting gear tooth from. Measurement of chordal thickness and constant chord using vernier tooth caliper. Gear tooth profile check-involute testing M/c-principle and use. Electricity Tests-Principle and use. Parkson gear tester principle and use.

TOPIC 9. LIMIT GAUGES : Definition of gauge and gauging, Necessity of gauging in industrial practice. Gauges types-according to use (shop, inspection and reference gauge), type fixed limit, indicating and combination), specific use ((Screw pitch, gauge, template, feeler gauge-and their uses, application, indentification, selection and precautions,. Working tolerance of gauges. Maximum and minimum metal conditions of tolerances. Calculation of maximum and minimum metal conditions from given tolerances, tolerance frames and their use, selection and specification as per Is 2251, 3455, 3484. Wear allowances and its selection for design Taylor's principle for design of 'Go' and 'No' Go' gauges. Application of principle, deviation. Calculation

of gauge dimensions from formula given in IS 3455 and selection of parameters necessary for calculation.

TOPIC 10.TRANSDUCERS : Meaning, Function. Primary and secondary transducers. Classification-mechanical,electrical,active, passive. Advantages of electrical transducer. working principle and application of resistance type, inductance type, capacitance type and piezo electric type. Transducers for pressure, temperature and flow measurement.

TOPIC 11.TEMPERATURE MEASUREMENT : Principles on which temperature measuring device work-Example of each type Temperature range. Various instruments/devices used,Bimetal thermometer, pressure spring thermometer,resistance therometer, thermistor working principle,range,application,materials used and their characteristics, application. Comparison of resistance thermometer and thermister. Thermo couple-Principle,material, working compensating lead, working range, methods of measuring output i.e. mill voltmeter, potetiometer- application,comparison of various thermocouple. Pyrometer-radial and optical-working principle, construction,advantages, limitations,application in industrial situation. Types of error in temperature measurement (instrument error, thermal probe error)-reasons and effects of these errors way of reducing error.

TOPIC 12.PRESSURE MEASUREMENT : List of devices used (Monometer, elastic gauges and transducers),differential and inclined manometers. Elastic gauge diagram, pressure capsules, bellows,pressure spring. Transducers-principle, types, applications and limitations. Selection of instruments.

TOPIC 13.FLOW MEASUREMENT : Flow measuring devices- type (volumetric meters and rate of flow meters)- Functions, types and applications. Volumetric meters (Bellow type, rotating impeller and rotating lobe)- Working principle, applications and limitations of each. Rate of flow meters-(obstruction meters, velocity probes)-classification of each type, comparison.Relative merits and demirts of each, working principle, construction, limitation and application of each type.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : METROLOGY AND INSTRUMENTATION

COURSE CODE NO : M- 404

LIST OF EXPERIMENTS.

1. Measurement of a gap by means of slip gauges.
2. Measurements of diameter and height of a circular spigot.
3. Comparing methods of internal measurement.
4. Comparing methods of external measurement.
5. Comparing methods of angular measurements.
6. Checking a sine bar.
7. Comparing methods of external taper measurements.
8. Comparing methods of internal taper measurements.
9. Given a set of slip gauges, straightedge to be tested and surface plat, the student will test the straightness error in the given strightedge.
10. Given the surface plate, spirit level and straight edge the students will test the flatness of surface plate in the laboratory.
11. Check an engineers square in the laboratory provided with parallel set, slip gauges and plate and determine the squareness error.
12. Examination of the surface texure of the work piece or mechined surface by a microscope when specimen of corresponding standard surface is provided.
13. Determination of effective diameter of a screw with the help of screw thread micrometer and three wire and hand micrometer. Compare these two methods.
14. Determination of screw plug core diameter with the help of two Vee shaped steel pieces and a micrometer.
15. Determination of out-side diameter of a screw by a micrometer.

16. Determination of core diameter of an internal screw gauge with the help of a pair of precision wedge parallels and outside micrometers.

17. Preparation of a cast of internal screw thread with sulpher and graphits.

18. Setting of a roller type of adjustable thread gauge and inspection of given make screw of given nominal size.

19. (a) Inspect the gear tooth form by direct measurement.
    (b) Inspect the gear tooths spacing by any one method.

NOTE: The experiments for instrumentation topics can be designed depending upon the type of instruments available in the Laboratories.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECs)

COURSE : METROLOGY & INSTRUMENTATION

COURSE CODE NO : M- 404

LIST OF BOOKS.

S.No.	Name of book.	Author	Publisher.
1.	Engineering Metrology.	R.K.Jain.	Khanna Publishers Delhi.
2.	Inspection & gauging.	Kennedy.	The Industrial Press, 93, Wortinstreet, NEW YORK.
3.	Engineering Metrology.	K.J.Hume	Macdonal & Co.Ltd; LONDON.
4.	Practical Metrology.	K.J. Hume & C.H.Shard.	--do-
5.	Handbook of Industrial Metrology.	A.S.T.M.E.	Prentice Hall of India.
6.	Metrology & Gauging.	S.A.J.Parsons.	Macdonald & Evass Ltd; LONDON.
7.	Industrial Instrumantation.	D.P.Eckman.	Wiley Easter Ltd; NEW DELHI.
8.	Measurement Techniques in Mechanical Engineering.	R.J.Sweeny.	Jon Wiley & Sons, New York. Addison Wesley Publishing, LONDON.
9.	Mechanical Measurement.	Becjwith & Buck.	Addison-Wesley Publi.-London.
10.	Instruments for Measurement centred.	W.C.Holzbock	Rainold Publishing Co-operation.
11.	Mechanical and Industrial Measurement.	R.K.Jain.	Khanna Publishers New Delhi.
12.	DS: 2986, 5979, 5876, 5939		

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : STRENGTH OF MATERIALS

COURSE CODE NO : M - 405

R A T I O N A L E.

The technicians from Mechanical Engineering discipline are expected to know much about this subject so as to fulfill his job functions efficiently. The knowledge is very essential for those who are engaged in Design, Maintenance, Shop-floor, Inspection and quality control and production departments.

The course includes the study of behaviour of Engineering materials and stresses produced in the structure due to various types of loading system.

The course subject is intentionally kept in MPECS system so that the students of Mechnical Engineering discipline, should know the proper use of materials for common engineering problems.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : STRENGTH OF MATERIALS.

COURSE CODE NO : M 405

PRE-REQUISITE : 201

SCHEME OF STUDIES

S.No.	Topic	HRS. Theory.	Lab/Tutorial.	Total
1.	simple stresses and strains.	10	04	14
2.	Mechanical Properties and testing of materials.	04	12	16
3.	Shear force and bending moment.	08	02	10
4.	Bending stresses in beams.	06	02	08
5.	Shear stresses in beams.	06	02	08
6.	Deflection of beams.	06	04	10
7.	Torsion of shaft.	05	-	05
8.	Springs.	03	-	03
9.	Colums and struts	05	02	07
10.	Stress in frames.	03	-	03
11.	Thin Cylinders and Spheres.	04	02	06
12.	Principal planes and principal.	04	02	06
	TOTAL	64	32	96

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPENCS)

COURSE : STRENGTH OF MATERIALS.

COURSE CODE NO : M-405

CONTENTS.

TOPIC 1. SIMPLE STRESSES AND STRAINS.

Introduction, Types of loads and deformation, types of stresses and strain. Hooke's Law, stress- strain diagram for ferrous and non-ferrous materials. Modulus of elasticity, (E) rigidity (N) and bulk modulus (K) of materials. stresses in bars of varying cross sedtions, composite sections and compound sections. Thermal stresses and strains, thermal stresses in composite sections. Poisson's ratio, volumetric strain, Relation between E, N and K. strain energy, Resilience, proof resilience, Modulus of resilience, Suddenly applied loads and Impact loads.

TOPIC 2. MECHANICAL PROPERTIES AND TESTING OF MATERIALS.

Definition of various mechanical properties. Necessity of testing of materials, different types of tests such as destructive and non-destructive tests. Tensile test, compression test, hardness test, Impact test, Fatigue test, Endurance limit, Banding test, Shear test.

TOPIC 3. S.F. AND B.M. DIAGRAMS:

Definitions, types of loading, types of beams, shear force and bending moment, sign conventions, S.F. and B.M. diagrams for centilever, simply supported and overhanging beams with point or concentrated loads, uniformly distributed loads and combination of point and U.D.L. point of centriflexure, Numerical problems.

TOPIC 4. BENDING STRESSES IN BEAMS :

Theory of simple bending, Assumptions made in simple bending theory, position of Neutral axis and neturel surface moment of resistance, Modulus of section of symmetrical sections such as rectangular, circularal and I Sections, Bending stresses in symmetrical sections, simple problems. Reinforced concrete beams, Beam of uniform strength.

TOPIC 5. SHEAR STRESSES IN BEAMS:

Introduction, shear stress equation, assumptions made, distribution of shear stresses over various sections, such as rectangular, circular and I, L & T sections. Simple numerical problems.

TOPIC 6. DEFLECTION OF BEAMS:

Introduction, Strength and stiffness of beam, curvature of bent beam, Derivation of equation for slope and deflection of beam in case of centilever and simply supported beam loaded with point loads, U.D.L. and combination. Simple numerical problems. Importance of deflection and practical applications.

TOPIC 7. TORSION OF SHAFT : Definition of torsion, relation between stress, strain and angle of twist, assumptions made strength of solid and hollow circular shaft, Polar moment of inertia Calculation of shaft diameter on the basis of strength and stiffness for the given horsepower transmitted Torsional Rigidity. Maximum torque comparison of solid and hollow shaft, size of a shaft for a given torque.

TOPIC 8. SPRINGS: Definition, Types and use of springs, leaf spring, helical and spiral springs. Stiffness of a spring and max. shear stress, Defection of spring, spring classification based on size, shape and load.

TOPIC 9. COLUMNS AND STRUTS : Definition crippling load, Different and conditions, slenderness ratio, equivalent length, Euler's theory Rankine's formule, Radius of gyration, Rankine constant, for different materials. Limitation of Rankine formula, simple problems D.I.S. code for columns.

TOPIC 10. STRESSES IN FRAMES :

Definition of frame, perfect, deficient and redundent frame. Assumptions made in finding stresses in members struts and tie members. Method of joint, method sections and graphical method, Bows notation, solution of problems using three methods.

TOPIC 11. THIN CYLINDERS AND SPHERES : Hoop stress, longitudinal stress, strength of cylindrical and spherical shells, volume strain, change in volume, cylindrical vessels subjected to internal pressure. Simple numerical problems.

TOPIC 12. PRINCIPAL PLANES AND PRINCIPAL STRESSES :

Stresses on inclined plane subjected to direct, shear or combination of stresses in two mutually perpendicular planes. Principal planes and principal stresses, analytical and graphical methods.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : STRENGTH OF MATERIAL

COURSE CODE NO : M- 405

LIST OF EXPERIMENTS.

1. Study of universal testing m/c.
2. Study of hardness tester.
3. Study of Impact testing m/c.
4. Tensile testing of Mild steel rod on U.T.M.
5. Compression testing of C.I./wood on U.T.M.
6. Hardness testing of Ferrous and Non-Ferrous metals.
7. Izod/Charpy testing of material.
8. Fatigue testing of material on Fatigue testing m/c.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : STRENGTH OF MATERIALS.

COURSE CODE NO : M- 405

LIST OF BOOKS.

1.	Strength of materials	by B.C.Punmia.
2.	Strength of materials	by R.S.Khurmi.
3.	Strength of materials	by Sadhu Singh.
4.	Strength of materials	by K.D. Saxena.
5.	Strength of materials	by S.Ramamuruthan.
6.	Strength of materials.	by I.B.Prasad.
7.	Strength of materials	by Ryder
8.	Laboratery Experiments in Strength of materials	by B.P.Sharma.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MTECS)

COURSE : THERMAL ENGINEERING.

COURSE CODE NO : M- 406

PRE-REQUISITE : NIL.

R A T I O N A L E.

Thermal Engineering incorporates the basic principles of Thermodynamics and its application. The course of Thermodynamics and its applications are extremely important to mechanical engineers and has wide application in industries and power plants. It lays the foundation for other important courses to be taught later to the Mechanical Engineering students.

Its principles are used in the designing of energy converting devices such as steam engines, Internal combustion engines, steam and gas turbines, Non-conventional energy resource, refrigeration and air conditioning heat transfer and Nuclear power plants.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : THERMAL ENGINEERING.

COURSE CODE NO : M - 406

SCHEME OF STUDIES.

S.No.	Topic	HRS. Theory	Lab/Tutorial	Total
1.	Dimensions and systems of Units.	02	02	04
2.	Basic concept of Thermodynamics.	08	-	08
3.	First law of Thermodynamics.	05	-	05
4.	Second law of thermodynamics.	06	04	10
5.	Ideal gases and gas processes.	06	04	10
6.	Thermodynamic cycles	06	02	08
7.	Two phase system.	08	04	12
8.	Steam Generators.	05	04	09
9.	Steam Turbine.	04	02	06
10.	I.C.Engines.	06	08	14
11.	Air compressors.	04	02	06
12.	Heat Transfer.	04	-	04
	TOTAL	64	32	96

CREDITS - 5

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN TECHNICAL ENGINEERING (MPECS)

COURSE : THERMAL ENGINEERING.

COURSE CODE NO : M- 406

C O N T E N T S.

1. Dimensions and systems of units.

2. BASIC CONCEPTS OF THERMODYNAMICS:

Definition and importance of Thermodynamics, Thermodynamic system open, close and Isolated system, Boundary and surroundings Forms of energy. Point and path functions, properties of system intensive and extensive properties thermodynamic state, Thermodynamic process, Cycles Thermodynamic definition of work, Heat and work as energies intrensition, Thermal, mechanical, chemical and thermodynamic equilibrium Zenith law of T.D., Quesi-static process- work done during Quasi-static process.

3. FIRST LAW OF THERMODYNAMICS:

Concept of heat reservoir, Hot source and Heat sink, Statement of first law-mathematical representation, Application of first law to open and closed system. Concept of internal energy and its calculation, Relationship between heat transfer, work transfer and change in internal energy. Differentiate between shaft work, flow work and P.D. work. Steady flow energy equation and its application to various units such as Boiler, Nozzle, Turbine, Compressor Enthalpy.

4. SECOND LAW OF THERMODYNAMICS: Limitations of First law, Statements of second law- Kelvin Planck and clauss is statements concept of heat pump, refrigerator and heat engine Thermal efficiency, Parameters affecting Thermal efficiency, Means of increasing efficiency, COP. Equivalance of Kelvin Planck and claussius statements. Thermodynamics Reversible and irreversible processes. Factors which makes a process irreversible. Reversible cycle. Carnot cycle, Its efficiency and limitations; carnot theorem claussium Inequality, concept

of Entropy, Principle of increase of entropy, Determination of increase of entropy, statement of Third law of Thermodynamics.

5. IDEAL GASES AND GAS PROCESSES:

Definition of an ideal gas, Gas law, Characteristics gas equation, specific and universal gas constants specific heat constant pressure and specific heat constant volume. Ideal gas processes- Isobaric, Isochoric, Isothermal, Isentropic, polytropic and throtling process as applied to open and closed systems. Representation of these processes on P.V., T.S. and H.S. diagrams. Computation of change in enthalpy, entropy and internal energy. Net heat transfer and work done.

6. THERMODYNAMIC CYCLES :

Air-standard cycles- definition and purpose, -standard efficiency, carnot, otto, diesel dual and Brayton cycles, their representation on P.V & T.S. diagrams. Derivation of air standard efficiency and their comparision and limitations, Rankince cycle- Modified Rankine cycle- their representation on P.V. T.S. and H.S. planes Derivation of expression for thermal efficiency.

7. TWO PHASE SYSTEM :

Pure substence, phase, pahse changes, steam as a two phase system, steam formation and its representation on temp-enthalpy plane, properties changes, representation of wet, dry and saturated and superheated steam on Pv, T-S and h-s planes. Dryness fraction of steam, Methods of determination of dryness fraction- separating and throttling calorimeter. Use of steam tables and Mollier's diagram.

Determination of change in properties such as entropy, enthalpy, internal energy and work and heat transfer in the following processes- Isobaric, Isocloric, Isothermal, Isentropic, Polytropic, Throttling. Representation of various processes on p-v, T-S and H-S planes.

8. STEAM GENERATORS :

Definition, classification, working of babcock and wilcox Boiler and Lancashire, Boiler mountings and accessories.

9. STEAM TURBINE:

Classifiction, working principle, difference between impulse and reaction turbine, compounding of steam turbine, velocity diagram(introductory and its use. Governing of steam turbine.

10. INTERNAL COMBUSTION ENGINES :

Introduction, classification, I.C.engine components and their function, working of two-stroke and four-stroke cycle engines and their comparison. Indicator diagram, Calculation of IHP, BHP, Thermal efficiency, mechanical efficiency and relative efficiency, Governing, cooling and lubrication of I.C. engines.

11. AIR COMPRESSORS :

Industrial uses of compressed air, classification of compr e-ssors and their field of application, Description of reciprocating compressor, work done in single stage reciprocating compressor volumetric, Isothermal and Isentropic efficiencies of reciprocating air compressor. Advantages of isothermal compression. Multistage compression and its advantages, Inter cooling necessity and advntages.

12. HEAT TRANSFER :

Modes of heat transfer, Fourier's law of heat conduction, temperature gradient, Expression for determination of heat transfer across a flat plate, thermal conductivity and thermal resistance, Newton's law for heat transfer by convection, Free and forced convection, Heat transfer

by radiation, stefan. Boltz Man law of thermal radiation-

Define the terms- absorptivity, reflectivity and transmissivity, Black body, Emissive power, Grey body.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : THERMAL ENGINEERING

COURSE CODE NO : M- 406

LIST OF REFERENCE BOOKS.

1. Thermal Engineering -P.L. Ballaney
Pub: Khanna Publisher's New Delhi.

2. A course in Thermodynamics and Heat Engines
- Kothanandran, Khajuria and Arora.

3. Tretise on Heat Engineering
- Vasandani & Kumar.
Pub: Metropolitan Book Co. Ltd; N.Delhi.

4. Thermodynamics
- G.T.Van Wylen.
Pub. John Wiley & son.

5. Thermodynamics and Heat Engines
Vol- I.

- R.Yadav.
Pub: Central Book Depot, Allahabad.

6. Heat Power- Kshitish Chandra Pal.
Pub:Orient Longman, H'derabad.

7. I.S. 2986 - 1966

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : THERMAL ENGINEERING

COURSE CODE NO : M 406

LIST OF PRACTICALS / EXPERIMENTS

1. Study of Lancashire boiler.
2. Study of Babcock & Wilcox boiler
3. Study of separating and Thorttling Calorimeter.
4. Study of steam turbine.
5. Study of different types of I.C. Engines (four stroke and two stroke, S.I. and C.I.)
6. Study of various systems of I.C. engines.
   (a) Fuel supply system.
   (b) Cooling system.
   (c) Ignition system.
   (d) Governing system.
   (e) Lubrication system.
7. Study of
   (a) Fuel pump
   (b) Fuel injector
   (c) Carburettor
8. Study of two stage reciprocating - air compressor.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : FLUID MECHANICS & HYDRAULIC MACHINES.

COURSE CODE NO : M - 407

RATIONALE.

This course is intended to introduce basic principles of fludi mechanics. It is further extended to cover the application of Fluid Mechanics by the inclusion of fluid machinery especially water turbine and water pumps. To day the principles of Fluid Mechanics find wide applications in many situations directly or indirectly.

The use of fluid machinery, turbines, pumps in general and in power stations is getting an accelerated fill up. Thus there is a great relevance for this course for mechanical technicians.

The mechanical technicians have to deal with large variety of fluids like water, air, steam, ammonia and oven plastics. The major emphasis is given for the study of water. However the principles dealt with in this course will be applicable to all incompressible fluids.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : FLUD MECHANICS & HYDRAULICS MACHINES.

COURSE CODE NO : M - 407

PRE-REQUISITE : 201

SCHEME OF STUDIES.

S.No.	Topic	Duration in Hrs. Theory	Practical/Tut.	Total
1.	Fundamentals of fluid flow.	04	-	04
2.	Pressure and its measurement.	06	04	10
3.	Basic equation of fluid flow	06	06	12
4.	Flow through orifice and mouth pieces.	06	04	10
5.	Flow through notches and weirs.	06	04	10
6.	Flow through pipes.	06	04	10
7.	Impact of jets.	06	02	08
8.	Water turbines.	08	04	12
9.	Water pumps.	08	04	12
10.	Model Analysis.	04	-	04
11.	Hydel Power stations.	04	-	04
	TOTAL	64	32	96

CREDITS - 5

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : FLUID MECHANICS & HYDRAULIC MACHINES.

COURSE CODE NO : M - 407

C O N T E N T S.

TOPIC 1. FUNDAMENTALS OF FLUID FLOW : Definition of fluid- ideal and practical compressible and incompressible fluids, fluid properties density, specific weight, specific gravity, dynamic and kinematic viscosity, types of flow- laminar and turbulent, steady and unsteady, uniform and non-uniform. Continuity equation. Simple numerical problems on continuity equation.

TOPIC 2. PRESSURE AND ITS MEASUREMENT : Concept of pressure, intensity of pressure, pressure head, gauge pressure, vacuum pressure, absolute pressure. Manometers- piezometer, U-tube manometer, inclined manometer, differential manometer, inverted U-tube manometer Pressure gauges. Simple numerical problems on differential manometers.

TOPIC 3. BASIC EQUATION OF FLUID FLOW : Various forms of energies applicable to fluid flow, potential energy, kinetic energy pressure energy, total energy of fluid flow. Concept of datum pressure, velocity and total head of a fluid particle in motion. Bernoulli's theorem, general steady flow energy equation and derivation of Bernoulli's theorem, assumptions made in deriving bernoull's theorem, Practical application of Bernoulli's equation-Venturimeter orifice-meter, pitot tube, flow nozzle- their construction, working and limitation. Simple problems on venturimeter, orifice meter, pitot tube.

TOPIC 4. FLOW THROUGH ORIFICES AND MOUTH PIECES : Definition and types of orifices, Vena contracta, coefficient of contra--tion, velocity, discharge and resistance. Torricell's theorem. Experimental determination of C_c, C_v, and C_d. Head loss due to sudden exlargement contraction and obstruction in pipe. Mouth pieces- types and their uses. Simple numerical problems discharge through orifices and pressure calculations for mouth pieces, Time of emptying vessel by orifice (cylindrical, conical, flow from one vesal to another large orifices.

TOPIC 5. FLOW THROUGH NOTCHES AND WEIRS :
Weirs and notches- definition, classification, Flow over rectangular weir with and without velocity of approach, calibration of rectangular weir, Different formulae for large rectangular weir: Time required to empty a reservoir with rectangular weir. V-notch. Advantages of triangular notch over rectangular notch. Trapezoidal notch. Broad-crested and submerged wires. Practical applications of weirs. Spillway and siphon spillway ogee weir.

TOPIC 6. FLOW THROUGH PIPES : Laminar and turbulent flow, Reynold number, differentiation of laminar and turbulent flow on the basis of Reynold number, loss of head due to friction in pipes Darcy's formula and chezy's equation. Hydraulic gradient and total energy line flow through long pipes, pipes in series and parallel, simple problems based on above formulae water hummer and its effect surge tank.

TOPIC 7. IMPACT OF JETS: Impact of jet on flat and curved plates- stationary and moving, work done by pelton runner, velocity diagrams, Simple numerical problems on axial, radial flow.

TOPIC 8: WATER TURBINES : Meaning, classification - Impulse and reaction turbine. Comparison, Description and working of Pelton, Francis and Kaplan turbines. Selection of turbines operating characteristics.

TOPIC 9.WATER PUMPS:

Centrifugal and reciprocating- principle, construction, working, classification and layout. Comparison of centrifugal and reciprocating pumps. Specific speed selection of pumps. Use of air vessels in reciprocating pump, Indicator diagram, Horse power calculation in case of reciprocating pump. Horse power calculation in case of centrifugal pump. Operating characteristics.

TOPIC 10.MODEL ANALYSIS :

Geometric, Kinetic and dynamic similarity. Simple problems.

TOPIC 11.HYDEL POWER STATION :

Schematic diagram, function of various elements, advantage over other power stations.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)
COURSE : FLUID MECHANICS AND HYDRAULIC MACHINES.
COURSE CODE NO : M 407

LIST OF EXPERIMENTS.

1. To measure the pressure of water in pipe by-
   (a) Piezometer (b) Different types of manometers.
2. To verify Bernoulli's equation.
3. To determine discharge through a given Venturimeter.
4. To determine discharge through a given orifice meter.
5. To determine discharge through a pitot tube.
6. To determine Cc, Cv, and Cd for different types of orifices and mouth pieces.
7. To determine loss of head due to :-
   (a) sudden enlargement.
   (b) sudden contraction.
   (c) friction in pipes.
8. To determine discharge through different types of notches.
9. Study of Pelton wheel, Francis turbine, and Kaplan turbines.
10. To determine performance characteristics.
11. Study of reciprocating pump.
12. To determine h.p. of reciprocating pump.
13. Study of centrifugal pump.
14. To determine operating characteristics of centrifugal pump.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : FLUID MACHENICS & HYDRAULIC MACHINES.

COURSE CODE NO : M - 407

REFERENCE BOOKS.

1. A text book of hydraulics, fluid mechanics and Hydraulic machines by Khurmi (S.Chand & co.)

2. Fluid mechanics by M.Manohar.

3. Hydraulic & Hydraulic machines by Dr. Jagdish Lal.

4. Hydraulic & Hydraulic machines by Priyani.

5. Fluid mechanics with engineering applications by R.L. Draughtbery & A.C. Jugersoll (McGraw Hils)

6. Journal of experiments in hydraulic laboratory by V.N. Rao & Hasan (New heights)

7. Fluid mechanics by Dr. M.L.Mathur (std. Publications)

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : BASIC ELECTRICAL AND ELECTRONICS.

COURSE CODE NO : M - 408

PRE-REQUISITE : NIL.

RATIONALE.

A Mechanical Engineering Diploma holder in his job in a modern industry, has to interact with many electrical and electronic gadgets in operation of various machine tools and machine-control- systemend basic knowledge about Electrical and Electronics Engineering relevant to his job requirement of operation and maint. in a modern industry will give him a new confidence to perform his job efficiently.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : BASIC ELECTRICAL AND ELECTRONICS.

COURSE CODE NO : M - 408

PRE-REQUISITE : NIL.

SCHEME OF STUDIES.

S.No.	Topic Name	Theory Hrs.	Practical Hrs.	Total Hrs.
1.	D.C.Circuits.	03	04	07
2.	D.C.Machines.	06	04	10
3.	A.C.Circuits.	08	04	12
4.	Transformers.	06	04	10
5.	Three phase A.C.Machines.	10	04	14
6.	Single phase motors.	04	04	08
7.	Electrical Measuring instrument.	03	02	05
8.	Electronics.	08	06	14
	TOTAL	48	32	80

CREDITS - 4

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : BASIC ELECTRICAL AND ELECTRONICS.

COURSE CODE NO : M - 408

C O N T E N T S.

TOPIC. SUB-TOPICS.

1. D.C. CIRCUITS.
   Review of concepts of Elect. Engineering voltage current, Power, Resistance D.C.Ckts, Kirchoff's Law, Resistance law.

2. D.C. MACHINES:
   (i) Constructional feature of D.C. Machines. Armeture windings. E.M.F. equation.
   (ii) D.C.Motors and their load characteristics. series, shunt, compound)
   (iii) Different types of starters, methods of speed control of D.C.Motors.

3. A.C.CIRCUITS:
   (i) A.C.Current, wave forms RMS, Average values Form factor. Power, power factor.
   (ii) R.L. & C. in A.C. Ckt.
   (iii) 3 phase/star A.C. and delta connections differents types of A.C.supply & voltages used in common industrial application (1PH, 3 PH- 3 wire, 3 ph.- 4 wire).

4. TRANSFORMERS: Principle of operation emf. equation, Transformation ratio Diff. types of transformers and their uses- Distribution transfermer.
   Instrument transformer, transformers in electronic circuitory cooling of transformers.

5. THREE PHASE A.C. MACHINES: Constructional features of induction motors, cage type and slip ring type Principle of operation of 3 ph. Motor slip and slip frequency. Starting and speed control of induction. ph. motors.DOL/Stardelta/Auto transformers Starter-Applications of induction motors. Construction and applications of alternator synchronous motors.

6. SINGLE PHASE MOTORS: Principles of operation, Production of starting torque in split phase, capacitor start, capacitor run motors, shaded pole motors- Universal motor Application of motors.

7. ELECTRICAL MEASURING INSTRUMENTS : Am meters Voltmeters wattmeters, working principles of MI and M.C. type instruments and induction instruments. Use of M.I., MC and dynomometer Inst. for measurement of Electrical parameters, their connections in Ckt. multimeters.

8. ELECTRONICS : Semi conductor devices, Diode, Transistor, SCR. and their applications. Rectifier Ckts, H.W., F.W. Filters in power supply Ckts.

AMPLIFIER : Amplifier action of transistor input- output impendances and their use in control ckts.

S.C.R. : Controlled rectification and its application in motor control and process control ckts.

Block diagrams of motor control, circuits.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : BASIC ELECTRICAL & ELECTRONICS.

COURSE CODE NO : M - 408

LIST OF EXPERIMENTS.

1. Study of D.C. machine.
2. Study of D.C. Motor starters.
3. Speed control of D.C.motor by (1) shunt field control
   (2) Armetur voltage control.
4. Study of Induction motor-slip Ring & cage type.
5. Study & connection of different types of starters- of A.C. motor, D.O.L/Star Delta-Manual, Star Delta-Semi Automatic/ Stardelta Automatic.
6. Study of single phase motor of different type their starting and connection to supply.
7. Connections of various measuring instruments in a motor Ckt. and measure A,V & W.
8. Study of a HW & F.W. rectifier elect. measure imput, output voltages with the help of a multimeter.
   use of multimeter to be encouraged in all practical use for measurement of R.A.V. in A.C. & D.C. ckts.
9. Study of various electronic components/devices.
10. Study of model of a control- system involving A.C.Supply, error signal, feed back signal, error correction, motor control circuit (if available)

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : BASIC ELECTRICAL & ELECTRONICS.

COURSE CODE NO : M - 408

LIST OF REFERENCE BOOKS.

1.	Electrical Technology.	B.L. Theraja.
2.	Electrical Technolggy.	S.L. Uppal, Khanna Pub.
3.	Electrical measurement.	J.B.Gupta, Dhapat Rai & Sons Pub.
4.	Elementry Elec. Engineering.	H. Partab.
5.	Electrical Mechines.	S.K.Battacharya. (Tata Mcgraw Hill)
6.	Basic Electronics.	

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

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THREE YEARS DIPLOMA PROGRAMME IN

MECHANICAL ENGINEERING

UNDER

MULTIPOINT ENTRY AND CREDIT SYSTEM

-.

DETAILED SYLLABUS :

<u>APPLIED TECHNOLOGY FOR MECHANICAL ENGINEERING</u>

1. M 501 MACHINE TOOLS TECHNOLOGY.
2. M 502 THEORY OF MACHINE AND DESIGN OF MACHINE ELEMENTS.
3. M 503 PLANT MAINTENANCE AND SAFETY
4. M 504 INDUSTRIAL ENGINEERING
5. M 505 INDUSTRIAL MANAGEMENT
6. M 506 PROCESS PLANNING, ESTIMATING AND COSTING.
7. M 507 PROJECT

-.

SPONSORED BY -

DIRECTOR OF TECHNICAL EDUCATION, BHOPAL (M.P.)

DEVELOPED BY -

CURRICULUM DEVELOPMENT CENTRE

M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL

IN COLLABORATION WITH

TECHNICAL TEACHERS TRAINING INSTITUTE (W.R.) BHOPAL.

P R E F A C E

In Madhya Pradesh most of the Polytechnics offer straight-jacketed Diploma programmes in Civil, Mechanical, Electrical and Electronics & Tele Communication Engg. Curriculum is is the most crucial input in a technical education, hence, initiating to develop a need based curriculae for establishing relevance of Polytechnic output to the needs of industry, is the demand of the time.

At present 10+ and 12+ science stream/technical stream students in different proportions join a three year diploma programme in all Polytechnics. 10+ students are admitted to first year and 12+ students in second year of three year diploma programme. These students do not have any option in selection of courses (subjects) and have no apportunity for taking alternative courses appropriate to their capability.

The National policy on Educacion, threfore, rightly recognised the need for a flexible structure which would allow students to enter the system at different points depending on their entry levels, and take up combination of courses according to needs, thereby facilitating the production of man power for a spectrum of technologies and occupations enhancing the efficiency of the system.

It is, in this context, that the Directorate of Technical Education, Madhya Pradesh and M.P. Board of Technical Education explored the feasibility of restructuring polytechnic education in Madhya Pradesh under World Bank Scheme by introducing the Multi Point Entry and Credit System(MPECS). This Scheme of flexible structure has been introduced at S.V. Govt. Polytechnic, Bhopal from July, 1990.

Considering the nature of the scheme, the courses (subjects) offered in this new scheme have been clustered under the following groups.

(1) FOUNDATION COURSES are meant for preparing adequate base of science, maths and language and they are to be undertaken only by students who have passed 10+

(Contd..2)

(2) HARD CORE COURSES are the courses which are to be taken both by 10+ and 12+ students.

(3) In the SOFT CORE COURSES there is a choice for the students to select the courses of their choice.

(4) BASIC TECHNOLOGY courses are the bridge courses between science subjects and applied Technology courses.

(5) APPLIED TECHNOLOGY courses are the terminal courses through which the desired knowledge and skills are developed in the students, to perform his job function in the chosen field of technology.

(6) DIVERSIFIED courses are included to provide an opportunity for some more detailed knowledge in specific areas in the same or related discipline.

The curriculum development centre of the M.P.Board of Technical Education therefore undertook the task of preparing the syllabus/curriculum of the various courses of Diploma programme in Mechanical, Electrical and Construction Technology and Management started under Multi Point Entry and Credit System in collaboration with the CDC Centre of Technical Teachers Training Institute, Bhopal. The first workshop for preparing the syllabus of the above three disciplines was conducted at TTTI, Bhopal from 26-11-90 to 1-12-90 in which teachers from various Polytechnics and particularly from S.V. Government Polytechnic, Bhopal actively participated. The Board of Studies of the respective disciplines have approved the prepared syllabus, and the syllabus is being printed with the intention that the implementation of MPECS. should continue unabated.

Where ever required a component of safety and environment has been included in the syllabus and proper care has been taken in :-

(a) Maintaining sequence of topics.
(b) Allotting HRS for each topics.
(c) Avoiding overlapping of the content.
(d) Relevance of the content.
(e) Prarequisite of the content.

(Contd...)

The comments and healthy critisism from faculty members are however welcome, so that this prepared syllabii can be reviewed and revised periodically.

We are highly grateful to the Director Technical Education and prof. C. A. Keshwani, Additional Director of Technical Education, Bhopal for their valuable guidance, encouragement and ective co-operation in organising the above workshop.

Words of obligation are due, to prof. S.A. Balu, Principal, TTTI, Bhopal and the CDC faculty of TTTI, Bhopal. It is out of their valuable suggestions and long term experience in curriculum development that this syllabus is in the hands of the user.

We aspire to improve this in times to come.

Sd/-
Secretary,
M.P. Board of Technical Education,
Bhopal.

L I S T O F P A R T I C I P A N T S.

POLYTECHNIC FACULTY.

(1)	Shri B.B. Bhargava.	S.V. Government Polytechnic, Bhopal.
(2)	Shri U.K. Shrivastava.	S.V. Government Polytechnic, Bhopal.
(3)	Shri T. Chatterjee.	Government Polytechnic, Jabalpur.
(4)	Shri B.L. Khare.	Government Women's Polytechnic, Sagar.
(5)	Shri B.P. Sinha.	S.V. Government Polytechnic, Bhopal.
(6)	Shri S.K. Saxena.	S.V. Government Polytechnic, Bhopal.
(7)	Shri P.M. Hastak.	Government Polytechnic, Jabalpur.
(8)	Smt. S. Ekbote.	S.V. Government Polytechnic, Bhopal.
(9)	Shri R.K. Gawande.	S.V. Government Polytechnic, Bhopal.
(10)	Shri R.C. Chouksey.	Shri Vaishnav Polytechnic, Indore.
(11)	Shri R.R. Gangane.	Government Polytechnic, Ujjain.
(12)	Shri M.G. Rawal.	Government Polytechnic, Jabalpur.
(13)	Shri B.K. Saxena.	S.V. Government Polytechnic, Bhopal.

A.I.T.I. FACULTY.

(1) Prof. V.M. Karse — Head of the Department C.P.C.

[redacted]

(3) Prof. G.N.N. Rao.
(4) Prof. M.R. Ramanna.
(5) Dr. K.C. Sabharwal.
(6) Prof. S.P.L. Shrivastava.
(7) Prof. P.C. Jain.
(8) Prof. M.K. Shrivastava.

CURRICULUM DEVELOPMENT CENTRE.

(1) Shri Ashok Ratnaparkhi. — Joint Director.
(2) Shri K.K. Jain. — Deputy Director.
(3) Shri C.P. Bhargava. — Deputy Director.

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M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL REVISED ON 15.10.92.

SCHEME OF STUDIES & EXAMINATION OF DIPLOMA IN MECHNICAL ENGINEERING (MTECS)

APPLIED TECHNOLOGY. W.E.F.1992.

S.No.	Code No.	Courses	Pre-requisite.	Hrs./Week Th.	Hrs./Week Pr.	Credits	Sessional Term work	Sessional Lab work	Progressive Assessment. I	Progressive Assessment. II	Board Exam Theory paper	Board Exam Theory Dur.	Board Exam Theory Marks.	Pract./Viva Pr.	Pract./Viva Dur.	Pract./Viva Marks.	Remarks.
1.	M-501	Machine Tool Tech.	M402	3	4	5	20	20	10	10	1	3 Hrs.	100	1	3 Hrs.	50	
2.	M-502	Th.of M/c.&Design of M/C.elements.	M405	5	2	6	20	20	10	10	1	3 Hrs.	100	1	3 Hrs.	50	
3.	M-503	Plant Maintenance & Safety.	-	4	2	5	20	20	10	10	1	3 Hrs.	100	1	3 Hrs.	50	
4.	M-504	Industrial Engg.	-	4	2	5	20	20	10	10	1	3 Hrs.	100	1	3 Hrs.	50	
5.	M-505	Industrial Management.	-	4	-	4	20	-	10	10	1	3 Hrs.	100	-	-	-	
6.	M-506	Process Planning Estimating &Costing	-	4	-	4	20	-	10	10	1	3 Hrs.	100	-	-	-	
7.	M-507	Project.	90 Credits.	-	5	5	-	50	-	-	-	-	-	1	(Viva)	50	
8.	M-508	Metrology & Instrumentation. (Previous code No.M404)	-	4	2	5	20	20	10	10	1	3 Hrs.	100	1	3 Hrs.	50	
			Total Credits. 39				140	150	70	70	7	-	700	6	-	300	

REMARKS: (1) The students will not be allowed to take these courses unless he clears all the foundation courses.

(2) Course code No M-505 is common with Mechanical & Electrical.

(1)	Sessional Marks	: 290	Total Marks considering Applied Catagory and diversified category :
(2)	Prof.Asstt.Marks.	: 140	
(3)	Theory paper marks.	: 700	
(4)	Practical Marks.	: 300	
	Total	1430	

(1.	Sessional Marks	: 290 + 80 = 370	Total
(2)	Prof.Asst.Marks.	: 140 + 40 = 180	Courses : 10
(3)	Theory paper Marks.	: 700 +200 = 900	Total
(4)	Practical Marks.	: 300 +100 = 400	Credits : 47
	Total:	1430 +420 = 1850	

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : MACHINE TOOL TECHNOLOGY

COURSE CODE NO : M 501

PRE-REQUISITE : M 402

RATIONALE.

The course "Machine Tool Technology" is of vital importance to practicing engineers and technicians, The course not only gives the opportunity of exposing the fundamentals, but also the latest developments. The focus has been to improve effectiveness of the course by introducing various industrial applications.

The accent at technical level should be upon practical and demonstration. Indeed equal emphasis has been placed on this by allocating most of the available time for this course to the practicalsin the workshop. The study of this course will enable the students to acquire the capability of solving complex problems in the field of manufacturing.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHNICAL ENGINEERING.

COURSE : MACHINE TOOLS TECHNOLOGY

COURSE CODE NO : M 501

SCHEME OF STUDIES.

S.No.	Topics.	Theory Hrs.	Practical HRS.	Total
1.	Introduction.	01	-	01
2.	Metal cutting Theory.	18	15	33
3.	Lathe, Turret, copying automatic lathes, & Boring machine	13	18	31
4.	Milling Machines & Processes.	15	21	36
5.	Grinding machines and finishing processes.	13	15	28
6.	Unconventional Machining.	05	-	05
7.	Special purpose Machines.	07	06	13
8.	Jig and Fixtures.	05	-	05
9.	Machine Tool and Machine Tool Drives.	08	06	14
10.	Installation and testing of Machine Tools.	05	03	08
	TOTAL	48	64	112

CREDITS - 5

(79)

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : MACHINE TOOL TECHNOLOGY.

COURSE CODE NO : M 501

PRE-REQUISITE : M 402

C O N T E N T S.

TOPIC 1. INTRODUCTION : Concept of Machine tool technology, need, area of use etc.

TOPIC 2. METAL CUTTING THEORY : Stages in cutting, factors affecting cutting, types of chips, built up edge (BUE) formation conditions and effect upon surface finish, Definition of cutting force, feed force, radial force power requirement for each type of force, Total geometry and influence of tool angles, Desirable properties of cutting tool materials and their influences on the choice of tool materials.
Primary and secondary function of cutting fluids and properties of cutting fluids commonly used, Types of cutting fluids. Cutting variables, tool wear and tool life, tool life specifications, Taylor's tool life equation and cutting speed calculation,, Economy of metal cutting.

TOPIC 2. LATHE, TURRET, COPYING, AUTOMATIC LATHES & LATES : Basic difference between centre lathe, turret and capston lathes, constructional details and specification. Working principles and features of Mechanical Hydraulic and Electrical copying system, rate of production, skill requirement, accuracy and cost of production.

Working principles and types of automatic lathes, tool layout in automatics, work holding and tool holding devices and tooling used for capston and turret lathes, operation planning and tool layout for internal, external threading.

BORING MACHINE.

Types of horizontal and vertical boring machines, Constructional features and working control features, Jig boring machine, its construction operation and application.

TOPIC 3. MILLING MACHINES AND MILLING PROCESSES:

Definition of milling, classification of milling machines, Principle parts and their functions, types of table movement in universal milling machine, specifications of milling M/c. Conventional and climb milling and different milling operations and applications, milling cutters and tool angles, specifications and cutter materials, Use of arbor, collect and adopters machine attachments, Methods of mounting the cutter, work holding devices, dividing heads, direct simple, angular and differential indexing, Selection of cutters, Speed feed, Procedure for setting up operations and inspections, Maintenance of milling.

TOPIC 4. GRINDING MACHINES AND FINISHING PROCESSES

Definition of grinding and cutting action in grinding, Types of abrasive materials and their properties, Bending materials, Grinding wheel classifications and standard marking system, conditions for selection of

grinding wheels. Balancing of grinding wheels, Glazing and loading, Methods of dressing and truing. Principles of working of grinding machines and functions of main parts, Types of grinding process. Functions of tool and work holding devices, feed arrangement, table drive in surface and cylindrical grinders.

Types of lubricants and coolents used in grinding, Grinding defects, their remedy and safety practices.

Definition of micro finishing, honing, Lapping super finishing methods, Equipments involved, Materials used, Tolerances obtained and limitations, Applications of honing and Lapping processes.

TOPIC 5: UNCONVENTIONAL MACHINING:

Need for unconventional methods, limitation of conventional machining, Scope of the Electro-Chemical-Machining process and limitations, Scope and limitation of ultra sonic machining process.

TOPIC 6: SPECIAL PURPOSE MACHINES:

(a) Difference between forming and generation of gears, Principle of gear shaping, hobbing and shaving, Principle of machining, Rate of production, accuracy and limitations.

(b) Thread production - Use of dies for threading, thread rolling and thread milling.

(c) Broaching Machines - Definition of broaching, types of broaches, Broaching machines, their working principles, advantages and limitations.

Machining Centres, Transfer lines.

TOPIC 7: JIGS AND FIXTURES :

Definition and functions of jigs and fixtures, Location of components by dowel pins and buttons, Bushes and restrainer screws, Design criteria for simple jigs and fixtures, Selection criteria for method of preparation of jigs and fixtures.

TOPIC 8: MACHINE TOOLS AND MACHINE TOOL DRIVES:

Definition and classification of machine tools, Requirements of machine tools, Elements of machine tools and their purposes.

Drive systems - Stepped and step-less, drives, Advantages and limitations of the gear box drive, function of feed box, types of feed gear boxes and advantages, working principles of straight line motion, control systems - Multihandle, single lever and preselective control systems.

TOPIC 9: INSTALLATION AND TESTING OF MACHINE TOOLS :

Need for levelled concrete foundation and effect of foundation on accuracy of the product and life of the machine, Effect of weight of machine, soil bearing capacity and loading pattern upon foundation.

Industrial Safety - Selection of proper lifting devices for levelling of machines after grouting, Instruments and aids required for testing the accuracy of machine, load testing and product testing Understanding of test charts and check list.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : MACHINE TOOL TECHNOLOGY.

COURSE CODE NO : M - 501

PRE-REQUISITE : M - 402

LIST OF PRACTICAL.

S.No.	Workshop Practical Details.	Shop	Time	REMARKS.
1.	Demonstration of formation of chips on a lathe, continuous, discontinuous and fractured by changing variables like rake angle, speed feed and depth of cut.	MACHINE SHOP.	3 Hrs.	
2.	Demonstration of Built up Edge on the finished tool point by changing speed and depth of cut while machining on a mild steel bar.	-do-	3Hrs.	
3.	Measuring of angles of a single point tool with reference to main plane with the aid of tin templates.	-do-	3 Hrs.	
4.	Grinding of single point (H.S.S.) tools.	-do-	3 Hrs.	
5.	Demonstration of preparing soluble oil cutting fluid and its use for imporving the surface.	-do-	3 Hrs.	

1.	2.	3.	4.	5.
6.	Practice of measurements of tool life using tool with standard tool and data.	-do-	3 Hrs.	
7.	Practice of taper turning and screw cutting on a centre lathe.	-do-	6 Hrs.	
8.	Practice of making the pins or rivets of any size on a capstan lathe.	-do-	3 Hrs.	
9.	Demonstration of making a flanged bush on a capstan lathe including setting.	-do-	6 Hrs.	
10.	Practice of drilling, boring and reaming on a lathe.	-do-	3 Hrs.	
11.	Practice of mounting cutters on the milling m/c and setting of m/c.	-do-	3 Hrs.	
12.	Practice of up milling and downmilling operation with slab mill cutter.	-do-	6 Hrs.	
13.	Practice of cutting the spur gear on milling machine.	-do-	6 Hrs.	
14.	Practice on a shaper square block on a shaper and milling machine (comparision of surface produced).	-do-	6 Hrs.	
15.	Practice of making a 'V' groove on a square block (Made in the pressures practical i.e. No.14) on a slotter and miller respectively.	-do-	6 Hrs.	
16.	Practice of grinding of a press only turned bar on a universal grinder.	-do-	6 Hrs.	
17.	Surface grinding or tapping on a flat surface.	-do-	3 Hrs.	
18.	Practice of cutting a helical gear on a milling m/c.	-do-	6 Hrs.	
19.	Performance test of a lathe by making a long mandral.	-do-	3 Hrs.	

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : MACHINE TOOL TECHNOLOGY

COURSE CODE NO : M - 501

PRE-REQUISITE : M - 402

LIST OF BOOKS

S.NO.	Title	Author Publisher.
1.	Manufacturing processes.	Young.
2.	Manufacturing Science and Technology Vol. I and II.	Suresh Dalela.
3.	Workshop Technology Vol.I and II.	Hazra Choudhary.
4.	Workshop Technology Vol.I & II.	Raghuvanshi.
5.	Manufacturing process.	Rousnoff.
6.	Workshop Technology Vol. I & II.	Chapman.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : THEORY OF MACHINES & DESIGN OF MACHINE ELEMENTS.

COURSE CODE NO : M - 502

PRE-REQUISITE : M - 403 AND M - 405

RATIONALE.

The work of Mechanical and Production Engineer is not only to supervise run and plan production processes, but also includes fault diagonsis and prevention of breakdowns. This can only be done, if he is familar with the working of basic mechanism used on shop floors and in machines, how they fail and what are the loads coming on different members and different joints of the machines.

The aim of the course is to provide acquiantance of the basic mechanism and machines to the students, This will enhance their capability of fault diognosis and of taking corrective measures, which in turn will reduce the down time.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : THEORY OF MACHINES & DESIGN OF MACHINE ELEMENTS.

COURSE CODE NO : M- 502.

PRE-REQUISITES : M 403 & M 405

SCHEME OF STUDIES.

S.No.	Topic.	Duration in Hrs. Theory	Practical	Total.
1.	Simple Mechanism.	06	-	06
2.	Velocity and acceleration of points and links.	10	02	12
3.	Crank effort diagrams and flywheel.	08	02	10
4.	Friction.	08	02	10
5.	Power transmission by Belt, Ropes, a chain drives and gear. Drives	10	02	12
6.	Governors.	06	02	08
7.	Cams and followers.	06	02	08
8.	Balancing of Machine Parts.	04	02	06
9.	Vibrations.	04	04	08
10.	Introduction to M/c. Design.	02	-	02
11.	Design of M/c.elements subjected to direct and shear loads.	04	04	08
12.	Design of M/c.elements subjected to bending and twisting and combined bending and twisting.	06	06	12
13.	Design of rivted joint.	02	02	04
14.	Design of simple welded joints.	02	02	04
15.	Design of threaded joints.	02	-	02
	TOTAL:	80	32	112.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : THEORY OF MACHINES & DESIGN OF MACHINE ELEMENTS.

COURSE CODE NO : M - 502

PRE-REQUISITE : M 403 AND M 405

C O N T E N T S.

TOPIC 1. SIMPLE MECHANISM:
Introduction of theory of mechines, Definitions- Statics, dynamics, Kinematics, Kinetics, Kinematic pair, Kinematic chain, Mechanism, Machine inversions, Relation between no. of links, no. of joints and no. of pairs. Four-Bar chain and its inversion. Slider crank chain and its inversions.

TOPIC 2. VELOCITY AND ACCELERATION OF POINT AND LINK: Angular and linear velocity, relative and absolute velocity, velocity in links. Instantaneous centre locating instantaneous centre of rotation, velocity determination of four bar mechanism by relative velocity method. Acceleration of link-Centripetal and tangential, Total relative and absolute acceleration, velocity and acceleration diagrams for four bar and other mechanisms. Klein's construction for single slider crank mechanism. Analytical method of calculating the velocity and acceleration of piston in a reciprocating engine mechanism.

TOPIC 3. CRANK EFFORT DIAGRAMS AND FLYWHEEL: Dynamics of reciprocating engine mechanism. Inertia force due to reciprocating mass, piston effort, crank effort, turning moment on Crank shaft. Analytical and graphical methods of construction of turning moment diagrams for steam and I.C.engines. Fluctuation of energy and speed. Coefficient of fluctuation of energy and speed. Flywheel and its functions. Calculation of moment of inertia, weight of flywheel for steam and I.C.Engines.

TOPIC 4. FRICTION:

pivot- and collars friction. House power lost assuing uniform pressure and uniform wear. Clutch-need, classification and construction and working of single and multiplate clutches, Horse power transmitted by single and multiplate clutches. Brakes-need, types, Braking force, braking torque. Bond brakers, Block brakers, Internally expanded brakes, Dynamometer-meaning, need, types. Simple numerical calculation on above items.

TOPIC 5. POWER TRANSMISSION:

Drives-meaning, classification, Belt, chain and rope and gear drives. Flat and 'V' belt, Ratio of tensions. slip. Length of belt calculation for open and cross belt drives. H.P. transmitted. Effect of centrifugal force, centrifugal tension, Total tension, Maximum stress in belt. Maximum H.P. transmitted. Velocity for maximum H.P. condition. V-Belt drives Advantages and disadvantages over of V-Belt drive. Gears-meaning, need and classification. Function of idler. Calculation of velocity ratio of gear train-Simple and compound Epicyclic gear train. Motor car gear box.

Rope drives- types, Ratio of tensions, Designation of ropes as per B.I.S.

Chain drives:- Classification, Designation of chain drives as per B.I.S.

TOPIC 6. GOVERNORS: Function, comparison with flywheel. classification-Watt, Porter, Proell and Hartnell-their construction and working. Sensitivity, Stability, power and effort.

TOPIC 7. CAMS AND FOLLOWERS : Need, Classification. Motion of follower. Displacement, velocity and acceleration diagrams- uniform velocity, uniform acceleration, Simple harmonic motion. Camprofile for radial, offset knife edged follower.

TOPIC 8. BALANCING OF MACHINE PARTS: Concept. Static and dynamic balancing of rotating parts. Simple numerical problems on static balancing of several masses in single plane- graphical and analytical method.

TOPIC 9. VIBRATIONS: Introduction, Elements of vibration. System classification and explanation of the types of vibration according to the actuating force on the body like undamped vibration, Free damped vibration, Forced undamped vibration and forced damped vibration. Classification and explaination of the types of vibration according to the number of degrees of freedom. Natural frequency of free vibrations: Define critical speed of shaft.

TOPIC 10. INTRODUCTION TO MACHINE DESIGN: Machine and machine elements, Bolt, Nut, Axle, Shaft, Bearing, coupling, clutch, Belt, Rope, chain, gear etc. Specific purpose of- Piston, connecting rod, Crank shaft, turbine blade etc. Factors influencing design of machine elements- strength, stiffness, light weight, wear resistance, minimum size, availability, processibility, safety, compliance with standards. Basic design procedure. Selection of mechanism, drive, material, shape and size. Preliminary design, applying checks, revision of design, final design. Factors influencing selection of materials. Type of failures, types of forces. Types of loading. Safe design stress and factor of safety.

TOPIC 11. DESIGN OF MACHINE ELEMENTS SUBJECTED TO DIRECT AND SHEAR LOADS :

Introduction, Members subjected to direct loads-belt, bolt column, rod, cotter and knuckle joints, Members subjected to shear loads rivet, cotter knuckle pin, root of threaded bolt, coupling bolt, key. Function, Application and design of knuckle and cotter joint.

TOPIC 12. DESIGN OF MACHINE ELEMENTS SUBJECTED TO BENDING MOMENT; TWISTING MOMENT AND COMBINED BENDING & TWISTING MOMENT.

Introduction to pure bending, fundamental equation of pure bending viz:

$$\frac{M}{I} = \frac{f}{Y} = \frac{E}{R}$$

Machine elements subjected to pure bending viz-levers, beams axles, pulley-arms, Girders, Cover plates, Leaf springs etc.

Design of bell crank lever, leaf spring, Pulley - arms and axles.

Introduction to twisting moment, fundamental equation of twisting movement. Design of shafts, Keys, Helical spring, flange coupling and straight-sided splines.

Design of machine element subjected to combined bending and twisting movement -crank - pin- Overhanging shaft, design of C-clamp and connecting rod of an I.C. Engine.

TOPIC 13. DESIGN OF RIVETED JOINT:

Types of fastening- temporary and permanent, Types of riveted Joint-lap and butt joint, Definition of common terms like pitch, back pitch, efficiency, margin, Types of failure of riveted joints.

Derivation of equations for checking the failure of a riveted joint, Design of a lapjoint & butt joint for a given tensile load, Efficiency of riveted joint.

TOPIC 14:DESIGN OF SIMPLE WELDED JOINTS:

Definition of welding, advantages of welding over riveting, types of welded joints, Strength of the butt weld, Types of fillet joints and strength of fillet joint, Problem solving.

TOPIC 15:DESIGN OF THREADED JOINTS:

Types of threads and their proportions. Types of bolts, Proportion of nut and bolt dimensins, Design of bolt, Designation of threads as per I.S. Codes.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : THEORY OF MACHINES & DESIGN OF MACHINE ELEMENTS.

COURSE CODE NO : M - 502

PRE-REQUISITE : M403 and M405

REFERENCE BOOKS.

1. Theory of Machines by J.M.Shah and H.M.Jadhwani.
2. Theory of Machines by Abdulla Shariff.
3. Theory of Machines by D.R. Malhotra and H.C.Gupta (Technical India Publication)
4. Theory of Machines by P.L.Ballani.
5. Machine Design Sharma and Agrawal.
6. Machine Design R.K. Jain.
7. Machine Design Shigley.
8. Theory of Machines Thomas Bevan.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : PLANT MAINTENANCE AND SAFETY

COURSE CODE NO : M 503

PRE-REQUISITE : M 403 - Materials Technology.
M 404 - Metrology & Instrumentation.

RATIONALE.

Maintenance of machine prolongs the life as well as performance of a machine. Well maintained machines minimise the break downs and production held ups. The importance of maintenance in planning and scheduling production (by keeping downtime to a minimum and to increase productivity) is to meet the production targets.

In an industry, safety may be considered from mechanical side (equipment, tools etc.) as well as workers' side. More emphasis is given on the motivation towards safe work practices. Safety engineering, safety management and safety organisation have been kept in this course to provide engineering aspects of safety, Accident reporting, Factory Act and Regulations, Fire prevention and protection, concept of occupational health and safety awareness.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : PLANT MAINTENANCE AND SAFETY.

COURSE CODE NO : M 503

PRE-REQUISITE : M 403 - MATERIALS TECHNOLOGY.
M 404 - METROLOGY AND INSTRUMENTATION.

SCHEME OF STUDIES.

S.No.	Name of Topic	Theory Hrs.	Practical Hrs.	Total Hrs.
1.	Introduction to plant maintenance.	06	02	08
2.	Fundamentals of basic maintenance practices.	06	04	10
3.	Organisational structure of maintenance department	10	-	10
4.	Fault tracing, Trouble shooting and remedies.	04	08	12
5.	Maintenance cost.	05	-	05
6.	Maintainability	04	02	06
7.	Wear and its effects.	03	04	07
8.	Lubrication and lubricating systems.	06	04	10
9.	Safety Engineering.	06	04	10
10.	Safety management.	08	04	12
11.	Safety organisation.	06	-	06
	TOTAL:	64	32	96

CREDITS - 5

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : PLANT MAINTENANCE AND SAFETY.

COURSE CODE NO : M 503

PRE-REQUISITE : M 403 - MATERIALS TECHNOLOGY.
M 404 - METROLOGY AND INSTRUMENTATION

CONTENTS.

1. INTRODUCTION TO PLANT MAINTENANCE: Introduction to maintenance, its need and scope, classification, primary and secondary functions of the maintenance department. Duties, functions and responsibilities of plant maintenance department. Nature of maintenance problems in case of (a) roteting parts (b) reciprocating parts, Economic aspects and development trends in maintenance.

2. FUNDAMENTALS OF BASIC MAINTENANCE PRACTICES : Different maintenance practices, Procedure of corrective or break down maintenance, scheduled maintenance, preventive maintenance and predictive maintenance, methods of keeping record for condition of equipment, maintenance and replacement of parts, standard data for maintenance form Time standards (time to complete the maintenance job), lubrication standards.

3. ORGANISATIONAL STRUCTURE OF MAINTENANCE DEPARTMENT: General duties and responsibilities of maintenance department, general organisation of maintenance department in large and small scale industries, controls in maintenance department by using suitable planning and scheduling procedures, machines, equipment, reference cards, maintenance records and lubrication plans for machines use of lubrication plans and inspection, plant maintenance benefits, procedure, schedules and lubrication, store keeping of consumable and non-consumable materials, spare parts, inventory and control, Methods of storing different classes of materials.

4. FAULT TRACING,TROUBLE SHOOTING AND REMEDIES: Sequence of activities in fault finding, methods and procedures of repair, various measures to prevent repeation of similar faults. Various remedial actions.

5. MAINTENANCE COST: Definition, classification of maintenance cost for control, procedures for obtaining cost data, maintenance cost control, productivity index, factors effecting the maintenance productivity index, use of control indices.

6. MAINTAINABILITY : Definition, object and application. Factors in maintainability, maintenance indices, primary expressions of quantitative measurement of equipment maintenance characteristics, mathematical expressions concerning maintainability.

7. WEAR AND ITS EFFECT: Definition of wear and types of wear, causes of wear, effects of wear on performance, wear reduction and component replacement.

8. LUBRICATION AND LUBRICATING SYSTEMS: Need,properties of lubricant, selection criteria,principle of lubrication, centralised and decentralised lubrication systems,Boundary layer of hydrodynamic lubrication use of greases and oil. Methods of preserving Lubricants, procedure for their issues, Handling of lubricants, safety measures.

9. SAFETY ENGINEERING:
   - Safety principles and practices.
   - safe layout
   - Engg. aspects of safety:
   - Machine tools/Equipment's safety, guarding/interlocking/ vibration-damping etc.
   - Safety during manufecturing processes like welding, Grinding, Machining, handling of chemicals etc.

- Regular Plant inspection and safety Audit, Hazard Analysis.
- Safety of electrical installations and general electrical safety practices.
- Machine maintenance, Lubrication/Oiling.
- Safety during meterial handling in shops.

10. SAFETY MANAGEMENT:

Accidents:

- Menereich' Experiments, Accidents causes/body part affected, Accidents classified (minor, reportable, fatal, dangerous occurances)
- Accident Reporting and Statistics.
- Factory Act & Regulations: Salient points.
- Electric Regulations: Salient points.
- Safety Measurement and analysis of accidents.
- Enquiry Committees and implementation of recommendations.

-Fire Prevention & Protection :

- Fire potential areas.
- Fire fighting measures: equipments, training, requiremtnes, regular drill.
- First Aid.

-Concept of Occupational Health :

- Industrial Hygiene, First Aid.
- Occupational disease & control measures.
- Managing Noise/Dust/Fumes/Heat Stress/Ventilation.
- Personal Protective Equipments for head, face, eye, ear, respiratory orgen and other body parts and training to workers.

11. SAFETY ORGANISATION :

- Safety Organisation, Safety Committees.
- Safety Stewards System.
- Safety Procedures & SYstems, Management Instructions.
- Training and Exposures to Safety.
- Supervisor's special role.
- Regular safety communications.
- Participation of employees in safety Activities/ programmes.
- Safety Awareness, Posters, Safety guidelines in shops and at ventage points.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.
COURSE : PLANT MAINTENANCE AND SAFETY.
COURSE CODE NO : M 503
PRE-REQUISITE : M 403 - MATERIALS TECHNOLOGY.
M 404 - METROLOGY AND INSTRUMENTATION.

LIST OF EXPERIMENTS.

1. Demonstration and operation of protective equipments.
2. Demonstration of operation of Fire Extinguisher equipments.
3. Measurement of wear on flat surfaces by -
   (a) Microscope and steel string method.
   (b) Optical method.
   (c) Hydrostatic method.
4. Measurement of wear on cylindrical surfaces by -
   (a) Verrier caliper
   (b) Micrometer.
   (c) Dial indicator and V block.
5. Measurement of wear of gears by thickness gauges and gear tooth vernier gauge.
6. Estimation of time in minutes for dismentling and removing piston of pump
7. Demonstration and operation of grease gun in lubricating various components of any available machine or engine.
8. Study of various tools and gauges used in mechanical maintenance.
9. Visit of large/medium/small scale industries for collecting information regarding the safety measures taken during material handling, handling of electrical devices, fire, accidents, processes etc.
10. Visit of large/medium/small scale industries for collecting information in respect of (a) keeping record for condition of equipment maintenance and replacement of parts, if any (b) lubrication plan etc.

(100)

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.
COURSE : PLANT MAINTENANCE AND SAFETY.
COURSE CODE NO : M 503
PRE-REQUISITE : M 403 - MATERIALS TECHNOLOGY
M 404 - METROLOGY AND INSTRUMENTATION.

LIST OF SUGGESTED TEXT BOOKS / REFERENCE BOOKS.

1. Accident Prevention Manual for Industrial operations by Frank E.McElroy,P.E., C.S.P. Editor in cheif National Safety Council, Chicago, U.S.A.
2. Accident Prevention Manual for Administration and programs by Frank E.McElroy,P.E.,C.S.P. Editor in chief, National Safety Council, Chicago, U.S.A.
3. Commentary on-Factories Act with M.P.-Rules by Krishanlal Sethi The lawyers Home, Indore-7 .....Rs. 120/-
4. Industrial Accident Prevention by H.W.Heinrich McGrew Hill Book Company, INC.
5. An Introduction to Safety Engineering And Management by N.V.Krishnan CPS Publishers Pvt.Ltd. CALCUTTA - 700 001.
6. Maintenance of Industrial Equipment by B.Gelberg. G.Peklis.
7. A Guide to efficient Maintenance Management. by H.V.Mstwatt.
8. Modern Maintenance management by Miller and Blood.
9. Maintainability- by Benjamin S.Blanshard, E.Edward Lowery.
10. Maintenance Engineering Hand Book by MORROW.
11. Repair of Industrial Equipment by B.G. lberg, G.Peklis.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : INDUSTRIAL ENGINEERING.

COURSE CODE NO : M 504

PRE-REQUISITE : M 402

RATIONALE.

Industrial Engineering is such a subject which can significantly contribute towards the cost-saving and help in increasing the productivity. Adequate opportunities have been planned for the technician to apply theory to solve practical/ simulated industrail problems.

The course is kept under Applied Technology with a view to appreciate the changes and alternation proposed by Industrial Engineering for shop floor-methods and process.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : INDUSTRIAL ENGINEERING.

COURSE CODE NO : M- 504

PRE-REQUISITE : M 402

SCHEME OF STUDIES.

S.No.	Topic.	Duration in Hrs. Theory	Pract./Lab.	Total
1.	Introduction.	02	-	02
2.	Productivity.	03	-	03
3.	Work study.	04	-	04
4.	Method study.	08	06	14
5.	Principles of Motion economy.	02	02	04
6.	Material handling and Plant layout.	06	-	06
7.	Micro-Motion study.	02	02	04
8.	Work measurement.	08	06	14
9.	Job evaluation, wages and incentives.	06	02	08
10.	Statistical quality control.	08	04	12
11.	Control charts for variables.	05	02	07
12.	Contro charts for attributes.	04	04	08
13.	Acceptance sampling.	04	04	08
14.	Reliability.	02	-	02
	TOTAL:	64	32	96

CREDITS - 5

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.
COURSE : INDUSTRIAL ENGINEERING.
COURSE CODE NO : M -504
PRE-REQUISITE : M- 402

TOPIC 1. INTRODUCTION:
Definition of Industry and Industrial Engineering, scope and role of industrial engineering, fields of application.

TOPIC 2. PRODUCTIVITY:
Production and productivity, production systems and their impact on productivity, its significance and benefits of higher productivity. Long term and short term factors affecting productivity, Productivity cycle.

TOPIC 3. WORK STUDY: Introduction, its relation with productivity, aims, objectives and application of work study, basic procedure and techniques of work study. Human factors in work study. Role of manager, supervisor and workers. Working conditions, environment of industry affecting work-study.

TOPIC 4. METHOD STUDY:
Definition, objectives, basic procedures of method study. Recording techniques, operation process chart, flow process chart, Man-Machine chart, Flow diagrams, string diagrams, two hand process charts, Questioning technique procedure to develop, install and maintain new method.

TOPIC 5. PRINCIPLES OF MOTION ECONOMY: Meaning, Basic rules, design of efficient work-place-layout, classification of human body movements and their preferred order.

TOPIC 6. MATERIAL HANDLING AND PLANT LAYOUT:
Importance and its effect on productivity, Requirements of good material handling system Classification and selection of material handling equipment. Requirements of good layout. Effect of bad layout. Factors affecting plant

layout,Types of layout, advantages and limitations of each type of layout, section of layout, Factors affecting the plant location.

TOPIC 7.MICRO-MOTION STUDY:

Definition and objectives, Techniques of micromotion study,Therbligs and their symbols, use of therbligs, SIMO chart and its application.

TOPIC 8.WORK MEASUREMENT:

Definition, Basic procedure and technique of work measurement. Stop watch time study, Types of stop watch study, Factors considered in selecting a job for time study, Qualified and representative workers,procedure of stop watch time study,job element and their need of identification, General rules for break down of job into elements,work cycle, methods of time measurement, performance rating, its meaning, standard rating, Rating of operators, conditions for operators variation at work-place Rating scale,rating factors, calculation of basic time. Allowances- Purpose, types. Calculation of standard time synthesis method- meaning, data, complication, advantages and limitations.

PMTS-Definition,principle and use,calculation of standard time.

MTM- Meaning, tables and use. Application of MTM analysis for LH-RH charts,Calculation of standard time.

WORK/ACTIVITY SAMPLING-Definition, statistical basis determination of number of observations for given accuracy Sources of error,Application and calculation of standard time.

TOPIC 9.JOB EVALUATION,WAGES AND INCENTIVES- Definition,need and scope of job evaluation. Job evaluation systems and their comparative merits and demerits and limitations.

WAGE- Definition,wage components,wage fixation,Real,minimum and fair wage. Financial and non-financial incentives and their examples. Wage plans-Halsey, Taylor, Differential plan, Gantt task and bonus plan,100% Premium plan.

TOPIC 10.STATISTICAL QUALITY CONTROL: Definition of quality and total quality, three stages of quality, quality control and SQC, difference between inspection and quality control, concept of variability natural variation, its importance to quality control, classification of quality characteristics, Basic tools of S.Q.C. and their application, Frequency distribution, measures of central tendency and dispersion, their need and calculations.
Normal Curve - Definition, characteristics, calculation of area under normal curve and its application, statistical tolerancing- their calculation and application. Process capability-meaning, calculation and use.

TOPIC 11.CONTROL CHARTS FOR VARIABLES:
Statistical basic for control charts for variables, Construction of $\bar{X}$ and R charts - their interpretation, use of $\bar{X}$ and R chart in establishment of process capability.

TOPIC 12.CONTROL CHARTS FOR ATTRIBUTES : Limitation of $\bar{X}$ and R charts, Meaning and use of attributes, their advantages. Calculation, construction, interpretation and application of p-chart, C-chart, pD-chart. Need of calculating the revised values of mean, and control limits and their calculation.

TOPIC 13.ACCEPTANCE SAMPLING: Meaning, different techniques, Procedure involved, sampling, inspection-meaning and comparision with 100% inspection. Factors affecting sampling and their effects. Single and double sampling plans, use of IS codes.
O.C.CURVE- Meaning, terms used, their definition, construction and use of O.C. curves. Selection of sampling plans.

TOPIC 14.RELIABILITY: Definition, quality control and reliability factors affecting reliability of product. Measures to ensure reliability of product, Effect of product reliability marketing.
M.T.B.F. and M.T.T.F. - Definition, programme for reliability.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : INDUSTRIAL ENGINEERING.

COURSE CODE NO : M - 504

PRE-REQUISITE : M - 402

LIST OF PRACTICALS.

1. Preparation of flow process chart for existing and improved process.
2. Preparation of Man and Machine chart for existing and improved process.
3. Preparation of L.H. and R.H. charts for existing and improved process.
4. Use of decimal minute watch.
5. Performance rating.
6. Establishing standard time for given operation using time study techniques.
7. Use of she wharts bowl and actual production for frequency distribution.
8. Preparation of $\bar{X}$ and R charts.
9. Preparation of p-chart and C-chart.
10. Proof of sampling techniques.
11. Acceptance sampling by attributes (single and double sampling plans)
12. Determination of the percentage utilisation of equipment (work-sampling)

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : INDUSTRIAL ENGINEERING.

COURSE CODE NO : M- 504

PRE-REQUISITS : M- 402

REFERENCE BOOKS.

1.	Introduction to Industrial Engineering (by Phillip Hicks.)	McGraw Hills.
2.	productivity means property.	Asian Productivity Organisation, Tokyo.
3.	Introduction to work study.	International labour office.
4.	Work study.	M.D. Schmid & Subramaniam.
5.	Motion & time study.	Ralph M. Barnes, John Willey, New York.
6.	Work study.	Dalela.
7.	Wage Administration.	D.K. Roy, N.P.C. Pub.
8.	Quality Assurance Engineering.	M.D. Schmid & Subramaniam
9.	S.Q.C.	E.L. Grant.
10.	S.Q.C.	R.C. Gupta.
11.	Industrial Engineering & Management	O.P. Khanna.
12.	Industrial Engineering.	Saxena.
13.	Material handling Equipment	N. Rudenki Place Pub.
14.	Learning package in Industrial Engineering.	C.D.C., T.T.T.I. Bhopal.
15.	Laboratory manual Industrial Engineering.	C.D.C., T.T.T.I. Bhopal.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : INDUSTRIAL MANAGEMENT.

COURSE CODE NO : M- 505 / E- 505

PRE-REQUISIT. : NIL.

R A T I O N A L E.

Many diploma passouts are engaged in shop floor supervisory work. It has been found necessary to impact to the diploma student at the final year level certain concepts, principles, procedures and 'understanding' of management technique so that he is brought to a fairly high level of competency in 'Supervisor ship'. If he supplements this background with a minimum of experience there can be no reason as to why he would'nt make as effective supervisor. Both mechanical and Electrical students have been earmarked for this course since the shop-floor provides to majority of the opportunity available for employment.

The course has two faces: a coinage of 'Behavioural Science' where the student is exposed to the principles of Group behaviour, to factors which help motivate the workers, the influences which arise out of an organisation structure, and finally an idea of how communication transfer is effected from the highest to lowest level.

The second face to the course deals what is now-a-days popularly known as the 'Mathematical Approach towards Management'. Of-course the use of mathematics-statistics in particular- in planning and controlling production, inventory and project work.

Contd.....

Modern management concepts like CPM and PERT value Analysis, Inventory control and economic batch size determination, operation - research form the topic concerned under the mathematical approach. It is now realized in all industry that these techniques pay back well-on implementation. Detailed coverage of those areas will not only prepare the student needing in the future but would also help him to pay his role in the introduction of these techniques.

The whole course has been introduced through a chapter on 'Systems Thinking' It is felt that considerable time is spent in problem identification and alternative selection when a young engineer encounters problematic situations on the shop floor. A systematic frame of thinking and a proper problem solving attitude is excellent equipment for the young shop floor engineer.

It is hoped that this course will evoke considerable interest in the diploma student and will help him to get jobs earlier.

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NOTE:- This course is common to E - 505 of DEE programme.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : INDUSTRIAL MANAGEMENT.

COURSE CODE NO : M - 505

PRE-REQUISITE : NIL.

SCHEME OF STUDIES.

S.No.	Topic	Class Hours.	Lab/ Tutorial	Total
1.	What is management.	02	-	02
2.	System Thinking.	03	-	03
3.	Materials Management.	10	-	10
4.	Production planning and control.	08	-	08
5.	Value analysis.	02	-	02
6.	Project planning by Network.	10	-	10
7.	Industrial Relations.	06	-	06
8.	Supervision and Leadership.	06	-	06
9.	Organisational Dynamics.	08	-	08
10.	Operation Research.	06	-	06
11.	Computers in MANAGEMENT.	03	-	03
	TOTAL:	64	-	64

CREDITS - 4

NOTE:- This course is common to E 505 of DEE programme.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.
COURSE : INDUSTRIAL MANAGEMENT.
COURSE CODE NO : M 505
PRE-REQUISITS : NIL.

C O N T E N T S.

TOPIC 1. WHAT IS MANAGEMENT:
Management definition, activities Theories- Decision, quantitative, Mathematical, Behavioural Sciences.

TOPIC 2. SYSTEM THINKING:
System defition, parameter, production system Non-production system, objective, system design, procedure, system variables, different types of model under system thinking.

TOPIC 3. MATERIAL MANAGEMENT:
Introduction, function, purchase system, correlation stock turn over, order quantity, Lead time purchase cycle, Inventory, need of inventory control, Economic order quantity simple numerical problems on E.O.Q., Safety stock, function of Inventory control and different techniques of Inventory control A.B.C. analysis, simple treatment only.
Stores Management-Definition and importance, Storing procedure and store records.

TOPIC 4. PRODUCTION PLANNING AND CONTROL:
Production system, concept of planning, meaning of PPC, classification, characristics of each type, function of PPC, place of PPC in the organisation, production and consumption rate, Batch and mass production, Batch size, Buffer stock, Production cost components, concept of production scheduling. Loading and scheduling difference, Gantt chart scheduling, advantages and preparation of GANTT chart, Interpretation updating, critical ratio scheduling. Gap phasing and Lap phasing.

TOPIC 5. VALUE ANALYSIS: (112)

Concept of Cost and Concept of value, objectives, components and types of value, V.A. procedure and V.A. Test. DARA SIRI method, Value improvement procedures.

TOPIC 6. PROJECT PLANNING BY NET WORK :

Net work definition, objectives, different techniques, activities, events, Network formation. PERT & CPM., representation of activities and event on network, rules for drawing network diagram, Fulkerson's rule, Dependency of activities, Dummy activities duration, EST, LST, EPO, LPO, Free float, total float, and Network analysis on tabular form, updating of Network, control through updating. Main power loading and calculation on load smoothing.

TOPIC 7. INDUSTRIAL RELATION:

Scope, definition, need, objective and function of personnel management,. Job analysis, Job description and its constituents, man power as resources, recruitment, selection, training and terminal behaviour of man in an organisation, communication in Industry its need and importance, classification, technique and barriers in communication and their effects Grivances, its meaning, factors responsible for grievances, process and condition for handling of grievances, strikes and lockouts, conditions, conciliation and adjudication machinery workforce, human need, motivation, meaning and its benefits, factors responsible for lack of motivation, techniques to boost the motivation in workers, moral - definition, scope and important factors responsible for high moral, ideal working conditions, employer and employee relations, job satisfaction, social and economic values, factors influencing job satisfaction.

TOPIC 8. SUPERVISION AND LEADERSHIP:

Meaning and Role of supervisor in an industry, need of supervision, older workers and their supervision, concept of Leadership, Qualities of a good leader managerial style- motivational power and employees relations, effectiveness of leadership system.

TOPIC 9. ORGANISATIONAL DYNAMICS:

Organisation structure, characteristic and principle of organisation Modern organisation approach, Types of organisation, meaning and signification of various types, organisation charts, resistance to change, employee's and attitude, factors for reducing the resistance to change.

TOPIC 10. OPERATION RESEARCH:

Definition and concept of OR, methods of O.R., Linear programming problem formulation and Graphical methods Simplex method of Linear programming.

TOPIC 11. COMPUTERS IN MANAGEMENT:

Role of computers in Management, introduction to computer system, Personal computer and its uses- introduction to management information system (MIS)

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : INDUSTRIAL MANAGEMENT.

COURSE CODE NO : M-505

PRE REQUISIT : NIL.

LIST OF REFERENCE BOOKS.

1. Learning package on Industrial Management
   - T.T.T.I., Bhopal.
2. CPM and PERT- Principles and application
   - L.S.Srinath.
3. Modern Production Management
   -Buffa.
   Pub. Willey International.
4. Essentials of Management- Kuntz
   Pub. McGraw Hill.
5. Industrial Engineering and Management
   - O.P. Khanna.
   Pub: Khanna Pub., New Delhi.
6. Industrial organization and management
   - Ahuja.
7. Value Analysis - Miles.
8. Manpower Management - R.S.Diwedi.
   -Prentice Hall of India, New Delhi.
9. Personnel Management and Industrial Relations.
   - R.S. Davar.
10. Production and operations Management
    - Ray Wild.
    Pub. CASSELL.
11. Management of operations
    - Jack R. Meredith.
    Pub. John Wiley & Sons.
12. Production and Operations Management
    -Contemporary policy for managing operating
    Pub. Tata McGraw Hill.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : PROCESS PLANNING, ESTIMATING AND COSTING.

COURSE CODE NO : M - 506

PRE REQUISIT : M 402

R A T I O N A L E.

An engineer is supposed not only to design and produce a product in any industry but also to give weightage for the economic factors. Knowledge of different manufacturing processes only may not suffice the need in field but also to select the best process suiting to the technical and economic requirement of the situation alongwith the right type of equipment selection. Estimation of material and man-power requirement and factors affecting the cost of product are other areas which are quite important from the production point of view. The curriculum of this course of process Planning, Estimating and costing has been designed to take care of these requirement.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.
COURSE : PROCESS PLANNING, ESTIMATING AND COSTING.
COURSE CODE NO : M 506
PRE REQUISITE : M 402

SCHEME OF STUDIES.

S.No.	Topic.	Theory Hrs.	Practical/Tut. Hours.	Total.
A.	PROCESS PLANNING.			
1.	Introduction to process planning.	01	-	01
2.	Classifying operations.	02	-	02
3.	Selecting and planning the process of manufacture	06	-	06
4.	Determining the manufacturing sequence.	04	-	04
5.	Selection of Equipment.	06	-	06
6.	Classification of Tooling.	03	-	03
7.	Operation Routing.	02	-	02
B.	ESTIMATING AND COSTING.			
1.	Elements of costs and their allocation.	05	-	05
2.	Profit.	01	-	01
3.	Budget.	02	-	02
4.	Overhead allocation.	04	-	04
5.	Actual cost estimation-process materials and man-power.	05	-	05
6.	Machine shop-Process,Materials and manpower.	06	-	06
7.	Welding shop-Process,materials and manpower.	04	-	04
8.	Forging shop : Process, Materials and manpower.	04	-	04
9.	Foundry shop Process,Materials and manpower.	04	-	04
10.	Sheet metal shop Estimation.	03	-	03
11.	Detailed cost Estimation.	02	-	02
		TOTAL:64	-	64

CREDITS - 4

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.
COURSE : PROCESS PLANNING, ESTIMATING AND COSTING.
COURSE CODE NO : M - 506
PREREQUISIT : M - 402

C O N T E N T S.

1. PROCESS PLANNING :

1. INTRODUCTION TO PROCESS PLANNING :

-Process Engineering, its scope and relation with product engineering and manufacturing, Production system tapes and characteristics.

2. CLASSIFYING OPERATIONS :

Basic process operations, principal process operations, Major operations, Auxiliary process operations, supporting operations.

3. SELECTING AND PLANNING THE PROCESS OF MANUFACTURE :

Function, Fundamental Rules for the manufacturing process, Basic design of product, influence of process Engineering on product Design, Rechecking specifications, How materials selected affect process cost, using materials more economically, Material cost Balance sheet, Eliminating operations, combined operations, selecting the proper tooling, Availability of equipment, Make or Buy decisions.

4. DETERMINING THE MANUFACTURING SEQUENCE :

Operation classifications and the manufacturing sequence, Determining the major process sequence, purpose of major process sequence.

5. SELECTION OF EQUIPMENT :

Relationship between process selection and Machine selection, knowledge required to select equipment, sources of information for process Engineer, special purpose versus General-purpose equipment, Basic factors in machine selection, cost factors, design factors, Approaches to selection among alternatives, cost analysis of proposals, comparative cost analysis.

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6. CLASSIFICATION OF TOOLING :

Sources of Tooling, Tooling, Tools, Tool holders, Work piece holders, Moulds Patterns, Core boxes, Dies, Templates, Gauges.

7. OPERATION ROUTING :

Routing uses, Routing Descriptions.

B. ESTIMATING AND COSTING.

TOPIC 1. ELEMENTS OF COSTS AND THEIR ALLOCATION:

Definition and objectives of costing, desirable conditions for a costing system, Advantages of costing, Elements of cost prime cost, Indirect expenses, Analysis of total cost, Direct material cost, direct labour cost, direct expenses, overheads, Indirect materials, Indirect labour, Administrative and selling expenses, Fixed cost and variable cost.

TOPIC 2. PROFIT :

Profit, Methods of increasing profit, effects of the methods on production, Market and sales.

TOPIC 3. BUDGET:

Definition, Departmental budget and purpose of budgetary control.

TOPIC 4. OVERHEAD ALLOCATION :

Definition and classification of overheads, Methods of overheads allocation viz-direct material cost, direct labour cost, man hour rate and machine hour rate, Selection of appropriate method, limitation of various methods.

TOPIC 5. ACTUAL COST ESTIMATION - PROCESS MATERIALS & MAN-POWER :

Terminology associated with estimation, Calculation of volume, weight and cost of materials.

TOPIC 6. MACHINE SHOP-PROCESS, MATERIALS AND MAN-POWER :

Terminology used in machine shop estimation, use of standard table to determine time elements for various machining process, Use of formulas to calculate actual machining time for different operations of machine tools, Calculation of production operation time per product per cycle, Batch production time, Man-power requirement and labour cost per batch.

TOPIC 7. WELDING SHOP-PROCESS, MATERIALS AND MAN-POWER :

Gas and Arc. welding terminology, production operation time, labour cost, material cost, cost elements, Batch production cost.

TOPIC 8. FORGING SHOP-PROCESS, MATERIALS AND MAN-POWER:

Forging-gross and net weight, forging losses, Material cost, labour cost and batch production cost.

TOPIC 9. FOUNDARY SHOP - PROCESS, MATERIALS AND MAN-POWER :

Pattern cost, production time for costing, Material cost of costing, Moulding cost, batch production time.

TOPIC 10. SHEET METAL SHOP ESTIMATION:

Sheet metal shop labour cost, material cost, production time in piece work, batch production and mass production.

TOPIC 11. DETAILED COST ESTIMATION :

Detailed cost estimation.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : PROCESS PLANNING ESTIMATING AND COSTING.

COURSE CODE NO : M - 506 PRE-REQUISITE M402

S.NO.	TITLE.	NAME OF AUTHOR.	PUBLISHER.
1.	Cost control.	G.R. Sharma.	National Productivity Council.
2.	Engineer's guide to costing.	-	Institute of cost & Works accounts.
3.	Mechanical estimating and costing.	T.R.Banga and SC Sharma.	Khanna Pub.
4.	Mechanical estimating and costing.	R.L.Shrimali & P.C.Jain.	Jain Pub.House.
5.	Mechanical Estimating and costing.	Resource persons of T.T.T.I., Madras.	Tata McGraw Hill Pub.Co. Ltd;
6.	Machineshop Estimation.	Nordoff.	
7.	Learning Package in costing and Estimating.		T.T.T.I.,Bhopal Publication.
8.	Process Engineering for manufacturing.		Eary and Johson Pub.Prentice Hall.
9.	Fundamentals of process Engineering.	- Kavan.	
10.	Product Design and Process Engineering.	- Benjamin W.Nicbel - Alon & Ropy	Pub McGraw Hill

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : PROJECT.

COURSE CODE NO : M- 507

PRE-REQUISIT : 90 CREDITS.

R A T I O N A L E.

The necessity of the project work has been emphasised on group work. Proper group functioning is a prerequisite for maximising out put from a problem-solving group in work environment. Proper organisationof project work should be able to simulate such a situation so that the students are able to effectively work in groups and thus gain confidence to effectively take up responsibilities in their careers. The student will prepare a final project report.

TOPIC - A.

1. SPECIMENS ON MINOR PROJECTS.

To prepare a write up or feasible report containing not more than 1500 words, using appropriate diagrams & illustrations, and in simple language to be understood by non-technical readers, about an engineering topic, such as.

Suggested topics :

* Feasibility of nonconventional sources of energy for a particular application.
* Solar heaters (Gober gas plant).
* Technicians role in a village feasibility of certain projects.

2. Prepare a comparative study report about alternative materials available for a particular application.

Suggested topics :

* Electrical conductors.
* Cutting tools for high speed, machining.
* Furniture making.
* Cooking utensile.

3. Prepare a technical paper to be read to the rest of the class, about the process of conversion of raw material into a finished product.

Suggested topics :

* Rubber tyres.
* Production of Mechanical Engineering products.
* Lubricating Oils.
* Production of plastic buckets.
* Production of stainless steel products.
* Detergents.
* Products involving special welding or casting processes.

4. Prepare a survey of the equipment, available for a particular Engineering situation Make a comparative study and suggest a suitable choice.

Suggested topics:

* Material handling equipment.
* Machine tool for a given product.
* Measuring instruments.

TOPIC "B"

1. Prepare a simple machine or component as per given drawing specification.

Suggested jobs :

* A simple drilling machine model.
* A punching machine.
* An inexpensive hardness tester.
* Simple materials testing equipment.

2. Reclaiming a worn out component or equipment and putting it to use.

Suggested jobs :

* A worn out cum shaft bearing assembly.
* A rejected I.C. engine used in a motor cycle.
* Re-conditioning a discarded pump.

3. Construction of simple laboratory equipment/teaching aids.

TOPIC "C"

MAJOR PROJECT :

One project to be completed by a group of not more than 4 students.

1. Design and make type projects.

Suggested Projects :

* Lab. equipment to demonstrate and verify the principle of conservation of momentum either linear engular with an accuracy of ± 5%
* A lathe tool dynamometer to measure outting forces.
* A working model of a variable speed drive, which when given a fixed r.p.m. input, will be able to give a stepless variable output r.p.m., within the range of 3 times the input to 1/3 times the input.
* A sheet metal cutting machine, useful to a village blacksmithy in preparing articles like hand pump funnels containers etc.
* A wood working machine, hand or pedal operated to be useful in a village situation.
* Equipment to provide hotwater in your hostel, using solar energy.
* A suitable hand operated press for producing ornamental tiles.
* A device to utilise energy from the wind, for drawing water from a well for irrigating a small farm.
* A Design and development of a hand operated grinder/ juicer.
* Design and development of special furniture, e.g. for hospitals, handicapped persons etc.
* Material handling equipment to suit the needs of a local industry.
* Design and development of jigs/fixture for a live production situation.

2. Investigation projects.

Suggested themes :

* Selection of a suitable machine tool to produce a given component with specified tolerances, economically.
* Analysing the causes and suggesting remedial steps for a machine which is functioning erratically.
* Causes of bearing failure in a given situation.
* Investigation into the cutting forces set up on a lathe for different feeds, speeds and materials.
* Determining the most economical, running conditions for an I.C. engine.
* Investigation into the different methods of measurement of flow/tem./pressure with a view to suggest a suitable method for a live situation.
* Installing, commissioning and fault rectification of a test/ measuring set up or a machine.

3. Feasibility studies

Suggested prodeucts :

* Packaging material.
* Household utensils.
* Furniture.
* Match boxes.
* Wire nails.
* Vulcanising unit.
* Time piece components.
* plastic buckets.
* Aluminium anoidised tiffin boxes.
* Rexine bags. Folder etc.
* Washing soap
* Instrument boxes for schools.

GENERAL OBJECTIVES OF PROJECT WORK.

The student will.

1. Participate effectively in group work.
2. Analyse, Synthesise and evaluate at technician level while dealing with engineering situations.
3. Apply his knowledge in practical situations.
4. Be able to plan ahead.
5. Be able to take appropriate decisions.
6. Maintain good Human relations, by possessing social skills and tolerance.
7. Be able to arrive at creative solutions to problems.
8. Demonstrate self reliance and self discipline.
9. Understand and accept his own strengths and limitations.
10. Adopt readily to changing environments.
11. Have a sense of purpose and pride of achievement.
12. Demonstrate his initiative.
13. Reliably work independently.
14. Be able to seek, select, use and present information.

* * *

SUGGESTED INSTRUCTIONS TO STUDENTS ON PROJECT WORK.

PROJECT WORK :

The following points concerning project should be noted :

1. A record of all calculations, drawings and designs must be kept.

2. Student will work either siggly or in groups of 2,3 or 4.

3. A written report must be available to the supervisor at the end of the course. This report should be neatly written and produced in a suitable folder which bears the name of the polytechnic, the title of the project, the name of the contributors and the dates of the work. Although the reports will obviously vary from project to project, they should in general confirm to the following pattern :

   (a) Summary. A summary of the report which should not exceed one page in length.

   (b) Index. The report should be logically indexed.

   (c) Introduction. This should introduce the reader in the objectives of the exercise.

   (d) Main body. This will vary considerably from project to project and will contain all design calculations, drawings, results etc.

   (e) Conclusion. This will state the main conclusions of the exercise.

   (f) Bibliography. A list of all reference used.

In general, you will find that a well presented brief concise and logical report will score a higher assessment than a badly presented, long winded, muddled and illogical report.

4. The examiners will look for the following points when assessing your project :

(a) The way in which you have applied existing knowledge to your project.

(b) Mental skill in mainpulation of formulas etc.

(c) The quality of physical skills in the manufacture and assembly of apparatus and test pieces etc.

(d) Analysis of test results to produce a conclusion.

(e) The ability to produce a complete project from all the individual elements.

(f) Skill in evaluating between, for instance, various design alternatives.

(g) The way in which the initial specifications are interpreted and translated into a finished project.

(h) The quality of the creative aspect of the design to meet the given specifications.

(i) The quality of the written content of the report.

(j) The quality of the graphical content of the report.

The assessment of your project will count towards your final diploma, and the accompanying marking grid shows how the marks are alloted in your particular case.

Remember that this is your project. The supervisor is there to give guidance if and when it is necessary. He will start you off on the right lines but will only intervene at the later stages if asked.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION, BHOPAL.
SCHEME OF STUDIES & EXAMINATION OF DIPLOMA IN MECHANICAL ENGINEERING (MPECS)
w.e.f. August/September, 1992.

(6) DIVERSIFIED COURSES.

S.No.	Code No.	Course.	Pre-requisite.	Hours/Week Th.	Hours/Week Pr.	Credits	Sessional Progressive Assessment. Term work	Sessional Progressive Assessment. Lab. work	Sessional Progressive Assessment. I.	Sessional Progressive Assessment. II.	Board Exam Theory paper	Theory Dur.	Theory Marks.	Pract./Viva Fr.	Pract./Viva Dur.	Pract./Viva Marks.	REMARKS.
1.	M-601	Adv.Design & Drafting.	M401) M502)	2	4	4	20	20	10	10	1	3 Hrs.	100	1	(Viva)	50	
2.	M-602	Fabrication Technology.	-	2	4	4	20	20	10	10	1	3 Hrs.	100	1	3 Hrs.	50	
3.	M-603	Refrigeration & Air Conditioning.	M406	3	2	4	20	20	10	10	1	3 Hrs.	100	1	3 Hrs.	50	
4.	M-604	CAD/CAM.	301	2	4	4	20	20	10	10	1	3 Hrs.	100	1	3 Hrs.	50	
5.	M-605	Tool Engineering	M501	3	2	4	20	20	10	10	1	3 Hrs.	100	1	3 Hrs.	50	
6.	M-606	Automobile Engg.	-	3	2	4	20	20	10	10	1	3 Hrs.	100	1	3 Hrs.	50	
7.	M-607	Power Plant Engineering.	M406	3	2	4	20	20	10	10	1	3 Hrs.	100	1	3 Hrs.	50	
				Total:		08											

Remark : Only two to be offered.
: The students will not be allowed to take up these 5 & 6 level courses unless he clears all foundation courses.
: Total credits for diversified course = 8

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

DETAILED CURRICULUM

COURSE TITLE : ADVANCE DESIGN AND DRAFTING.

COURSE CODE NO : M - 601

PRE-REQUISITE : M - 401 AND M - 502
(MECH. DRAFTING & DESIGN OF .....ELEMENTS)

CATEGORY : DIVERSIFIED COURSE

DIPLOMA PROGRAMME IN

MECHANICAL ENGINEERING

(Under Multi Point Entry And Credit System)

Developped by

STATE CURRICULUM DEVELOPMENT CENTRE
M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL

In Collaboration with

TECHNICAL TEACHERS TRAINING INSTITUTE, BHOPAL.

Sponsored by

DIRECTORATE OF TECHNICAL EDUCATION, BHOPAL.

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P R E F A C E

The curriculum of the Course Advance Design and Drafting of Diversified Courses category was developed in a workshop organised by state Curriculum Development centre at the Govt. Polytechnic, Ujjain from .. 06-04-92 to 08-04-92.

The curriculum includes objectives at knowledge, comprehension and application levels, so that a proper understanding of the concepts, principles, rules and relationships can be imparted effectively to the students. To reinforce the theoretical concepts, demonstrations have also been suggested at some places.

Comments and healtty oriticism from faculty members are, however, welcome so that, if required, the prepared curriculum can be revived and revised periodically.

We are highly grateful to the Director of Technical Education, Bhopal for their valuable guidance, encouragement and active co-operation in the curriculum development work.

Thanks to the principal and staff of Govt. Polytechnic, Ujjain for getting the workshop arranged and taking active part in preparing the curriculum. Thanks are also due to the principal and C.D.C. faculty of T.T.T.I., Bhopal for their valuable guidance and suggestions as and when asked for.

We always aspire to improve this.

Secretary,
M.P. Board of Technical Education,
Bhopal (M.P.)

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : ADVANCED DESIGN & DRAFTING.

COURSE CODE NO : M 601

PRE-REQUISITE : M 401 & M 502
(Mech. Drafting & Design of ..... Elements)

RATIONALE.

A technician engaged in design and drafting section of an industry is expected to have the basic skill and understanding of reading and interpreting production drawings, with reference to available and required production facilities understand design factors and tolerances, handle simple design problems, check accuracy of estimates, ensure proper filing and reference system for drawings and designs etc.

The proposed course is aimed at providing opportunities to students to prepare them for handling simple design problems related to V-Belt drives, Spur gears, pressure vessels, levers, springs, power screws etc. This course will also help sutdents in preparing production drawings for various machine parts enabling them to become more acceptable to industries.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPECS)

COURSE : ADVANCED DESIGN & DRAFTING.

COURSE CODE NO : M - 601

PREREQUISITE : M 401 & M 502
(Mech. Drafting & Design of M/s Elements)

SCHEME LIST OF STUDIES

S.No.	Name of Topic	Contact Hourse		
		Theory Hrs.	Lab/Tutorial Hrs.	Total Hrs.
1.	2.	3.	4.	5.
1.	Review of Design & Drafting.	02	-	02
2.	Design of shaft	02	-	02
3.	Design of belt & Rope Drive	03	06	09
4.	Design of spur gear	03	08	11
5.	Pressure vessel & piping	03	06	09
6.	Welded and Rivetted Joints	02	-	02
7.	Crank and lever	03	06	09
8.	Cams	02	06	08
9.	Screw Jack	02	06	08
10.	Springs.	03	06	09
11.	Journal bearings	03	-	03
12.	Connecting Rod	02	-	02
13.	Reproduction & Preservation of drawings	02	-	02
14.	Drawing of tail stock of lathe	-	07	07
15.	Drawing of tool head of Shaper	-	07	07
16.	Drawing of plummer block	-	06	06
	TOTAL:	32	64	96

TOTAL CREDITS : 04

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.
COURSE : ADVANCED DESIGN & DRAFTING
COURSE CODE NO : M 601
PREREQUISITE : M 401, M 502

"CONTENT OUTLINES (SYLLABUS)"

(A) DESIGN :

1. Review of design and drafting fundamentals and importance of B.S. Codes (2+0=2)
2. Design of shaft on the basis of strength. (2+0=2)
3. Belt and Rope drive : Design of V-belt, Selection of belt material, design of V-grooved pully, general design oriterion. (3+6=9)
4. Spur Gear Drive: Design and drafting of spur gears. (3+8=11)
5. Pressure Vessel Design and design of pipe lines-isometric drawing of pipe lines, pipe drafting symbols, Colour coding of pipe lines, line diagram. (3+6=9)
6. Design of eccentrically loaded welded and revetted joints and their sketching and representation on drawings. (2+0=2)
7. Design of levers, cranks and their drafting -Bell crank lever, lever for safety valve. (3+6=9)
8. Cam Profile from displacement diagram for uniform velocity motion of a knife- edge follower. (2+6=8)
9. Design & Drafting of screw jack. (2+6=8)
10. Design of close coiled helical springs and leaf springs. (3+6=9)
11. Design procedure for journal bearings. (3+0=3)
12. Design and drafting of connecting rod. (2+0=2)
13. Reproduction, Presentation & Reading of drawing :
    Role of scanner, photocopier and Microfilms in reproduction and duplication of drawings, Preservation of drawings, tracing etc. - different methods. (2+0=2)
14. Drawings of Machine parts. (0+20=20)

"DESIGN AND EXERCISES"

1. Design and drawing of V-Grooved pulley including production drawing for pattern and Mechining details.
2. Drawing of Spur gear assembly indicating details of tooth profile.
3. Isometric or thographic and line drawing of pipe lines.
4. Drawing of spring loaded safety valve.
5. Production drawing of bell crank lever.
6. Cam profile of a knife-edge radial and offset follower having uniform velocity motion.
7. Drawing of screw jack assembly.
8. Drawing of tail stock of lathe.
9. Drawing of tool head of shaper.
10. Drawing of plummer Block assembly and details.
11. Production Drawing of any other machine component also may be Teken up-

NOTE:-

1. It is proposed that ten numbers of drawing sheets be drawn in class practice. However, minimum eight no. of sheets are essential.
2. Latest Code (BS-1988) be followed for drawing practice.
3. Design Data Book should be used when ever found necessary.
4. First angle method of projection is to be followed.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : ADVANCED DESIGN & DRAFTING.

COURSE CODE NO.: M 601

PREREQUISITE : M 401 & M 502

"LIST OF SUGGESTED REFERENCE BOOKS"

1. Machine Design Vol. I & II, by R.C.Patel and A.D.Pandya.
2. Elements of Machine Design, By N.C. Pandya & C.S. Shah.
3. Mechanical Machine Design, By Dr.R.C.Behal & Dr.V.K.Goel.
4. Machine Design, By G.R.Nagpal.
5. Machine drawing, By G.R.Nagpal.
6. Machine Drawing, By N.Siddheshwer-Tata Mc Graw Hills.
7. Machine Drawing, By N.D. Bhatt.
8. Fundamentals of Engineering Drawing, By Warren J. Luzadder - Prenfice Hall Co.
9. Mechanical Drawing, By Giesecke, Michel, Spencer, Hill. - Collier Mack millan International Edition.
10. Engineering Graphics, By Giesecke, Mitchell, Spencer, Hill Lobing - Macmillan.
11. LATEST ISI Code for Drawing.
12. Design Data Book - PSG coimbtore.
13. Design Data Book - Dr. Kamal Kumar & Bhagat.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGG. (M.P.E. & C.S.)

COURSE CODE NO.: M - 601 TO M - 607

CATAGORY : DIVERSIFIED COURSES.

LIST OF PARTICIPANTS

01- Shri A.K. Chakrawarti .. Senior Manager, Issco Pipe & Foundry Ltd. Ujjain.

02- " S.N. Bede .. Deputy Manager Planning Department, Issco Pipe & Foundry Ltd.Ujjain.

03- " K.C. Maheshwari .. Manager Mechanical Engg. Shree synthetic Ltd. Ujjain.

04- " A.N. Pisolkar .. Deputy Manager (Planning) Issco Pipe & Foundry Ltd.Ujjain.

05- " N.R. Bhavsar .. Head of the Deptt.(Mech.Engg.) Govt. Polytechnic, Khandwa.

06- " M.S. Thakur. .. Head of the Deptt. (Mech.Engg.) Govt. Polytechnic, Ujjain.

07- " S.G. Deo .. Workshop Superintendent, Govt. Polytechnic, Jhabua.

08- " G.B. Bamankar .. Workshop Superintendent, Govt. Polytechnic, Jaora.

09- " H.K. Pareekh .. Lecturer Mechanical Engg. Govt. S.V.Polytechnic, Bhopal.

10- " W.S. Pawar .. Lecturer/Automobile Engg. Govt. Polytechnic, Jabalpur.

11- " R.C. Dubey .. Lecturer Mechanical Engg. S.V. Polytechnic, Indore.

12- " R.K. Moondra .. Lecturer Mechanical Engg. Govt. Polytechnic, Ujjain.

13- Shri S.A. Pednekar .. Lecturer Mechanical Engg.
Govt. Polytechnic, Ujjain.

14- " I.D.Sabnani .. Lecturer Mechanical Engg.
Govt. Polytechnic, Ujjain.

15- " D.K. Joshi .. Lecturer Mechanical Engg.
Govt. Polytechnic, Ujjain.

16- " P.K. Uppal .. Asstt. W/S Superintendent,
Govt. Polytechnic, Ujjain.

C.D.C. FACULTY

Shri K.K. Jain. .. Deputy Director (C.D.C.)
M.P. Board of Technical Education,
Bhopal.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

D E T A I L E D C U R R I C U L U M

COURSE TITLE : FABRICATION TECHNOLOGY

COURSE CODE NO.: M - 602

PREREQUISITE : NIL.

CATEGORY : DIVERSIFIED COURSE

DIPLOMA PROGRAMME IN

MECHANICAL ENGINEERING

(Under Multi Point Entry And Credit System)

Developed By
STATE CURRICULUM DEVELOPMENT CENTRE
M.P.BOARD OF TECHNICAL EDUCATION, BHOPAL.

In Collaboration with
TECHNICAL TEACHERS TRAINING INSTITUTE, BHOPAL.

Sponsored By
DIRECTORATE OF TECHNICAL EDUCATION, BHOPAL.

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P R E F A C E

The curriculum of the Course Fabrication Technology of Diversified Courses category was developed in a workshop organised by state Curriculum Development Centre at the Govt. Polytechnic, Ujjain from .. 06-04-92 to 08-04-92.

The curriculum includes objectives at knowledge, comprehension and application levels, so that a proper understanding of the concepts, principles, rules and relationships can be imparted effectively to the students. To reinforce the theoretical concepts, demonstrations have also been suggested at some places.

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We always aspire to improve this.

Secretary,
M.P. Board of Technical Education,
Bhopal (M.P.)

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING(MPE & CS)

COURSE : FABRICATION TECHNOLOGY

COURSE CODE NO.: M 602

PREREQUISITE : NIL.

"R A T I O N A L E"

Fabrication Technology is one of the basic engineering functions which has applications in almost all types of engineering industries. With the development of technology, the fabrication techniques have found new area and playing a prominent role in manufacturing industries. This course is designed to provide the students with the basic knowledge of fabrication techniques with an overview on the advance technologies. Since fabrication is an art and fabricators are the architects in various manufacturing industries. It is imprative that they acquire specialised skill and knowldege in the various techniques of fabrication. These can be achieved by proper training with the development of welding technology in the last 30 years, fabrication industries are becoming more and more welding oriented because of its advantages. Fabrication by welding is now-adays more popular as a result of which Engineers and Technicians are avoiding revetting. Keeping the present trend in view, more emphasis have been given to welding technology but other fabrication techniques have also been considered to some extent. The course includes ferrous and non- ferrous fabrications used in industries.

This course has, therefore, been designed with the aim to provide the knowledge of all fabrication rocesses/techniques in order to provide proper understanding of the subject alongwith sufficient practical knowledge. To develop trained persons for entrepreneurship is one of the objectives of the course.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGG. (M.P.E. & C.S.)

COURSE CODE NO.: M - 601 TO M - 607

CATAGORY : DIVERSIFIED COURSES.

LIST OF PARTICIPANTS

01- Shri A.K. Chakrawarti .. Senior Manager, Issco Pipe & Foundry Ltd. Ujjain.

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C.D.C. FACULTY

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M.P. Board of Technical Education,
Bhopal.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPES&CS)

COURSE : FABRICATION TECHNOLOGY.

COURSE CODE NO.: M 602

PREREQUISITE : NIL.

"SCHEME OF STUDIES"

S.No.	TOPIC	Theory Hrs.	Practical Hrs.	Total Hrs.
1.	Introduction to Fabrication Technology.	02	-	02
2.	Preparation, Estimation & Costing	04	15	19
3.	Welding Technology	10	30	40
4.	Other Methods of fabrication	04	09	13
5.	Assembly Methods for Fabrication work.	04	10	14
6.	Testing of Fabricated Assemblies	04	-	04
7.	Safety	02	-	02
8.	Introduction to CAD/CAM	02	-	02
	TOTAL:	32	64	96

TOTAL CREDITS : 4

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPE&CS)

COURSE : FABRICATION TECHNOLOGY

COURSE CODE NO.: M - 602

PREREQUISITE : NIL.

1. INTRODUCTION TO FABRICATION TECHNOLOGY:

Definition, different methods of fabrication for engineering application. Materials for fabrication, Applications in Industries. (2+0=2)

2. PREPARATION, ESTIMATION & COSTING:

Preparations for fabrications, estimations of materials, surface developments in case of sheet metal fabrication, Operations for preparation such as sawing, shearing bending, cutting etc,, cleaning and edge preparations, costing of fabrication work. (4+15=19)

3. WELDING TECHNOLOGY :

3.1 Review of basic concepts, clasification of welding plastics, Fusion, conventional & non-conventional, weldability & Metallurgy of welding, welding procedures & techniques, Thermal cutting, Types of welded joints, welding methods such as left wards, right wards & Vertical welding; welding symbols.

3.2 Welding processes: Detail study of Electric arc welding, Resistance welding (spot welding, seam welding, etc.), Oxy-acetylene Gas welding, submerged arc welding, inert-gas arc welding, TIG, MIG welding, Thermit welding, laser beam, plasma, ultrasonic & Electron beam welding.

3.3: Defects in welded joints, factors affecting residual stresses & distortion, methods of removing them, remedies of defects, testing of weld-ments, Finishing of welded joints. (10+30=40)

4. OTHER METHODS OF FABRICATION:

4.1 Bolting & Rivetting : Applications & limitations types of bolted & Rivetted joints, Tube joining : Comparison with other methods of joining, use of washers, visual inspection & detection of faulty joints.

4.2 Adhesive joining : Types of adhesives, modes of application, use and limitations.

4.3 Soldering & Brazing : Description of methods application and limitations. (4+9=13)

5. ERECTION EQUIPMENTS PROCEDURE AND TECHNIQUES :

Site assembly, sub-assembly, complete Assembly : Acceptance of telerances on drift type of work. Limitations of assembly due to transformation & erection facilities. Techniques & equipments used : use of jigs & Fixtures, bolted & rivetted assemblies : Assembly of water-tight & oil-tight joints. Typical assembly examples. I.S. Codes. (4+10=14)

6. INSPECTION, QUALITY CONTROL AND TESTING OF FABRICATED ASSEMBLIES :

Testing of Assembly- Due penetration method. Magnetic Yoke method, pressure-testing of vessels, testing of assembly for leakage, Procedures for Assuring proper inspection and Quality control of Fabricated Assemblies. (4+0=4)

7. SAFETY : Humen safety & industrial safety in fabrication work, safety precautions in different types of fabrication work in ship assembly. (2+0=2)

8. INTRODUCTION : of CAD/CAM :

Concept of CAD/CAM : (2+0=2)

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPE & CS)

COURSE : FABRICATION TECHNOLOGY

COURSE CODE NO.: M - 602

PREREQUISITE : NIL.

"LIST OF EXPERIMENTS"

S.No.	Practical Details	Shop	Time Alloted(Hrs.)
1.	Marking & Cutting of metal sheets, bar bending, plate cutting on shearing & bending machine.	Sheet Metal	06
2.	Edge preparation for different types of welded joints. Practice of drilling & Tapping for febrication work.	Fitting shop	09
3.	Cutting of Metal by gas flame	Welding shop	09
4.	Gas welding (3 Jobs)	Welding shop	09
5.	Arc Welding (3 Jobs)	Welding shop	09
6.	Spot Welding (1 Job)	Welding shop	03
7.	Brazing (1 Job)	Sheet Metal	03
8.	Soldering (1 Job)	Sheet Metal	03
9.	Rivetting practice	Black Simithy/ Sheet Metal	03
10.	Assembly work (Small structures)	In appropriate Shop as per Suitability of resources.	10
	TOTAL		64

NOTE:- Ist is strongly recommanded that there should be at least two visits to the well known industries in dealing with fabrication work and students will have to submit a report. During these visits the student is expected to observe the following :-

1. Layout and size of fabrication shop.
2. Equipments and tools used by the industry.
3. Methods being used by the industry.
4. Typical fabricated products.
5. Safety precautions.
6. Effect on environment and methods to overcome pollution.
7. Any other information as observed in a particular industry.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPE & CS)

COURSE : FABRICATION TECHNOLOGY.

COURSE CODE NO.: M - 602

PREREQUISITE : NIL.

"LIST OF BOOKS FOR REFERENCES"

1. Production Technology by - R.K. Jain (Khanna Publication)
2. Welding Engineering Hand book by - J.A. Oates (Mc-Graw Hill Publi.)
3. Gas Welding part - I, II, III By - Felix Wattke (Asia Publishing House)
4. The welding Encyclopedia by - T.B. Jefferson, (Mc-Graw Hill Publi.)
5. Industrial Fastner's Hand book. (Trade & Tech.Press Ltd.)
6. Hand book fastening & Joining. By - Loughner & Hargen. metal part (Mc Graw Hill Publications)
7. Workshop Technology Part-III by- Chapman.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

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DETAILED CURRICULUM

COURSE TITLE : REFRIGERATION AND AIR CONDITIONING

COURSE CODE NO.: M - 603

PREREQUISITE : M - 406 (THERMAL ENGINEERING)

CATEGORY : DIVERSIFIED COURSE

DIPLOMA PROGRAMME IN

MECHANICAL ENGINEERING

(Under Multi Point Entry And Credit System)

Developed by

STATE CURRICULUM DEVELOPMENT CENTRE

M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL

In Collaboration with

TECHNICAL TEACHERS TRAINING INSTITUTE, BHOPAL

Sponsored By

DIRECTORATE OF TECHNICAL EDUCATION, BHOPAL.

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P R E F A C E

The curriculum of the Course Refrigeration And Air conditioning of Diversified Courses category was developed in a workshop organised by state Curriculum Development Centre at the Govt. Polytechnic, Ujjain from .. 06-04-92 to 08-04-92.

The curriculum includes objectives at knowledge, comprehension and application levels, so that a proper understanding of the concepts, principles, rules and relationships can be imparted effectively to the students. To reinforce the theoretical concepts, demonstrations have also been suggested at some places.

Comments and healtty oriticism from faculty members are, however, welcome so that, if required, the prepared curriculum can be reviwed and revised periodically.

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We always aspire to improve this.

Secretary,
M.P. Board of Technical Education,
Bhopal (M.P.)

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPE & CS)

COURSE : REFRIGERATION AND AIR CONDITIONING.

COURSE CODE NO.: M - 603

PREREQUISITE : M - 506 (Thermal Engineering)

"RATIONALE"

Now-a-days more emphasis is being given for the thermal environmental control for :-

1. Providing comfort to people in homes, offices, shops, industries and travelling in cars, railways, buses etc.
2. Storing food-stuff, vegetables, fruits, milk, medicines, blood etc.
3. Production of commodities like beverages, wines, bakery products and chemicals.
4. Liquefaction of gases.
5. Food preservation for longer period.
6. Air conditioning for computers.
7. Manufacturing processes like precision machining, printing, textiles etc.
8. Cryogenic surgery.
9. Production of low temperature (150 $^{\circ}$K) Cryogenic Temperatures.

With the advancement of science and technology the use of refrigeration, air conditioning and production of low temperature is getting momentum and has become of paramount importance. The course in "Refrigeration and Air Conditioning" is introduced as an elective subject under diversified courses with the objective providing enough training to mechanical engineering technicians, so that when they go in the field, they can take up the task related to refrigeration and air conditioning without much difficulty.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPE & CS)

COURSE : REFRIGERATION AND AIR CONDITIONING.

COURSE CODE NO.: M - 603

PREREQUISITE : M - 406 (Thermal Engineering)

"SCHEME OF STUDIES"

S.No.	Title	Lect. Hrs.	Tut./Lab Hrs.	Total Hrs.
1.	Introduction to Refrigeration	02	-	02
2.	Thermodynamics of Refrigeration.	08	02	10
3.	Basic components of Vapour Compression refrigerntion system.	06	04	10
4.	Vapour Absorption refrigeration system	04	02	06
5.	Properties of commonly used refrigerants.	04	02	06
6.	Application of Refrigeration	04	08	12
7.	Refrigeration Fittings, tools, Charging and leak detection	04	04	08
8.	Introduction to Air Conditioning.	02	02	04
9.	Psych rometry	04	04	08
10.	Air conditioning System	05	-	05
11.	Maintenance and repairing of refrigerating and Air Conditioning units.	05	04	09
	TOTAL:	48	32	80

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPE &CS)

COURSE : REFRIGERATION AND AIR CONDITIONING.

COURSE CODE NO.: M - 603

PREREQUISITE : M - 406 (Thermal Engineering)

"COURSE CONTENTS (SYLLABUS)"

TOPIC 1. INTRODUCTION TO REFRIGERATION:

History of Refrigeration, meaning and need of Refrigeration, difference between refrigeration and Cryogenics, production of Refrigeration by Various methods. Refrigeration systems and their classification on the basis of use, size, and application. (2+0=2)

TOPIC 2. THERMODYNAMICS OF REFRIGERATION:

Revision of I and II law of thermodynamics, clausius statement, comparison between Heat Engine, Heat pump and Refrigerator using heat reservoir, Heat source, sinks & work. Unit of refrigeration, Refrigerating effect, work input, co-efficient of performance. Reversed carnot cycle with gas and vapour as working substances. P - V, T - S and schematic diagrames. Calculation of Refrigeration effect, work, C.O.P. and Heat rejection. Practical difficulties with carnot cycle. With gas and vapour as working substance schematic diagram, representation on P - V and T - S planes, Use of P - H diagrams for vapours vapour compression cycle, schematic diagram, its representation on P - V, T - S and P - H diagrams. Wet, dry and superheated vapour compression.

Use of Tables and charts of common refrigerants for calculating work input, regrigerating effect and C.O.P. Deviation of actual vapour compression System from theoretical cycle and reasons for deviation. Effect of subcolling and superheating on Vapour compression system.

(8+2=10)

TOPIC 3. BASIC COMPONENTS OF VAPOUR COMPRESSION REFRIGERATION SYSTEM :

Basic components of Vapour compression Refrigeration system and their function - Compressor, condenser, Expansion device and Evaporator.

COMPRESSOR - Classification reciprocating - open and hermetically sealled, rotery, and their field of application. Working single and double acting reciprocating compressor. Working of hermetically sealed compressor.

CONDENSER - Types (water cooled, air-cooled, evaperative) and their field of application and brief description.

EXPANSION DEVICES :- Classification such as Automatic Expansion valve, Thermostatic expansion valve, Capillary tube and their working and field of application.

EVAPORATORS - Types of evaporators (Dry expansion and flooded type, and princip of their working and application.

TOPIC 4. VAPOUR ABSORPTION REFRIGERATION SYSTEM :

Comparison between vapour compression and vapour absorption system, The oretical and practical vapour absorption system, An.....Absorption and lithium bromide - water absorption system. Three fluid system. (Electrolux system.)

(4+2=6)

TOPIC 5.PROPERTIES OF COMMONLY USED REFRIGERANTS:

Definition, Primary and Secondary refrigerants, examples of each type. Desirable properties of good refrigerant. Environmental problems related to halogenated hydrocarbons as refrigerants, New developments. (4+2=6)

TOPIC 6.REFRIGERATION PLANTS :

Layout and working of Ice Plant, cold storage, water cooler and Household Refrigerator.

(4+8=12)

TOPIC 7.REFRIGERATION FITTINGS,TOOLS,CHARGING AND LEAK DETECTION:

Tubing - Materials, Heat treatment, Specifications.

Tools - Use of tube cutter, spring and Mechanical bender: Flaring and swaging tools, Pinch off Tool, Wrenches, pliers etc.

Fittings- Flared tube fittings, unions, elbows etc.

Joints - Making soldered and brazed joints. Installation and removal of servicing gauge and testing manifold: Working of suction and discharge compressor service valves.

Charging of Refrigerant - Evacuating a refrigeration system, removing refrigerant from a refrigeration system, leak detection Methods.

(4+4=8)

TOPIC 8.INTRODUCTION TO AIR CONDITIONING :

Meaning of Air conditioning, application of Air conditioning in Theatres, Community Halls, Industry, Restaurants, Hospitals and Window air Conditioner.

(2+2=4)

TOPIC 9.PSYCHROMETRY :

Psychrometry - Definition, Terminology, psychrometric charts and tables, psychrometric processes, use of psychrometric charts for solving simple problems.

(4+4=8)

TOPIC 10.AIR CONDITIONING SYSTEMS :

Central and unit air conditioning, Residential and commercial air conditioning system. Types of fans and ducts - Air distribution system. Thermal Insulation Methods and Insulation cladding.

(5+0=5)

TOPIC 11.MAINTENANCE AND REPAIRING OF REFRIGERATION AND AIR CONDITIONING UNITS :

Fault locationin vapour Compression system and Air conditioners. Repair and maintenance of household refrigerators. Water coolers, and Air conditioners.

(5+4=9)

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHNICAL ENGINEERING (MPE & CS)

COURSE : REFRIGERATION AND AIR CONDITIONING.

COURSE CODE NO.: M - 603

PREREQUISITE : M - 406 (Thermal Engineering)

LIST OF EXPERIMENTS AND VISITS :

1. Handling and use of tools such as - 04
   Tube cutter, Tube bender (Spring and mechanical Type). Flaring and Swaging tool, wrenches, pliers, Service Valves, Service guages, preparation of soldered and brazing joints.

2. Study of water cooler with respect to - 02
   (a) Refrigerant used and flow path.
   (b) Electric circuit
   (c) Water Flow path
   (d) Specification of main components used.
   (e) Capacity of the unit.

3. Study of packaged/Window/Air conditioner with respect to - 02
   (a) Capacity.
   (b) Electric circuit
   (c) Air flow path.
   (d) Specification of main components used.
   (e) Refrigerant used.

   Determination of capacity of the unit.

4. Study of Ice-plant/refrigerator,cold storage with respect to - 02
   (a) Electric circuit.
   (b) Refrigerant used and its flow path.
   (c) Capacity.
   (d) Specification.

5. Leakage detection using :- 02
   (a) Soap and water
   (b) Halide Torch
   (c) Vaccum Method
   (d) Pressure method

6. Operating service valves and gauge manifold.

7. Removing air from Refrigeration system., before charging. 02

8. Removing Refrigerant from system. 02

9. Charging/Recharging the system refrigerator, Water cooler, Air conditioner.

10. Determination of refrigeration capacity 02
    power input, C.O.P. of the given unit available in the institution.

11. Testing refrigeration and Air conditioning system control components for proper functioning and replacement :
    (a) Capacitor
    (b) Starting and running windings of hermetically sealed compresser.
    (c) Overload
    (d) Relay
    (e) L P and H P .....
    (f) Thermostat.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPE & CS)

COURSE : REFRIGERATION AND AIR CONDITIONING.

COURSE CODE NO.: M - 603

PREREQUISITE : M - 406 (Thermal Engineering)

"R E F E R E N C E S"

S.No.	Title of Books	Writer	Publisher.
1.	Refrigeration and Air Conditioning.	C.P. Arora	Tata Mc.Graw Hills.
2.	Ashrae guide and data Book.	Ashrae	Ashrae
3.	Audels Refrigeration and Air conditioning guide.	E.P.Anderson	Taraporwala.
4.	Practical Refrigeration.	-do-	-do-
5.	Refrigeration and Air Conditioning.	A.S.Sarao & P.C.Gaabi	Satya Prakashan.
6.	Modern Refrigeration practice.	G.R.King	Mc-Graw Hills.
7.	A course in Refrigeration & Air conditioning.	S.Domkundwar & S.C.Arora	Dhanpat Rai & sons.
8.	Refrigeration and Air Conditioning.	R.C.Jordan & G.B.Priester	Prentice Hall
9.	Basic Refrigeration and Air Conditioning.	B. Hazra & D.N.Chakravarty.	Dhanpat Rai
10.	Principles of Refrigeration.	R.W.Marsh &	Taraporwala.
11.	Refrigeration and Air Conditioning.	P.L.Ballaney	Khanna Publishers.
12.	Principles of Refrigeration.	D.P.Gupta.	Rajdhani.
13.	I.S.:1476-1971 Specification for domestic Refrigerators (Mechanically Operated)	Indian Standards Institution, Manak Bhawan, 9, Bahadur Shah Zafar Marg, New Delhi-1.	I.S.I.
14.	I.S.:1391-1960 Room Air Conditioner.	-do-	-do-
15.	I.S. : 1474-1959 Comm.Refrigerator.	-do-	-do-
16.	I.S. : 1475-1971 Self Contained.	-do-	-do-
17.	I.S. Drinking Water Coolers.	-do-	-do-
18.	Refrigeration & Air conditioning.	R.C.Patel.	

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGG. (M.P.E. & C.S.)

COURSE CODE NO.: M - 601 TO M - 607

CATAGORY : DIVERSIFIED COURSES.

LIST OF PARTICIPANTS

01- Shri A.K. Chakrawarti .. Senior Manager, Issco Pipe & Foundry Ltd. Ujjain.

02- " S.N. Bade .. Deputy Manager Planning Department, Issco Pipe & Foundry Ltd.Ujjain.

03- " K.C. Moheshwari .. Manager Mechanical Engg. Shree synthetic Ltd. Ujjain.

04- " A.N. Pisolkar .. Deputy Manager (Planning) Issco Pipe & Foundry Ltd.Ujjain.

05- " N.R. Bhavsar .. Head of the Deptt.(Mech.Engg.) Govt. Polytechnic, Khandwa.

06- " M.S. Thakur. .. Head of the Deptt. (Mech.Engg.) Govt. Polytechnic, Ujjain.

07- " S.G. Deo .. Workshop Superintendent, Govt. Polytechnic, Jhabua.

08- " G.B. Bamankar .. Workshop Superintendent, Govt. Polytechnic, Jaora.

09- " H.K. Pareekh .. Lecturer Mechanical Engg. Govt. S.V. Polytechnic, Bhopal.

10- " W.S. Pawar .. Lecturer, Automobile Engg. Govt. Polytechnic, Jabalpur.

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16- " P.K. Uppal .. Asstt. W/S Superintendent,
Govt. Polytechnic, Ujjain.

C.D.C. FACULTY

Shri K.K. Jain. .. Deputy Director (C.D.C.)
M.P. Board of Technical Education,
Bhopal.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

DETAILED CURRICULUM

COURSE TITLE : CAD/CAM

COURSE CODE NO.: M - 604

PREREQUISITE : 301 (CPMP. APPLICATION)

CATEGORY : DIVERSIFIED COURSE

DIPLOMA PROGRAMME IN

MECHANICAL ENGINEERING

(Under Multi Point Entry And Credit System)

Developed by

STATE CURRICULUM DEVELOPMENT CENTRE

M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL.

In Collaboration with

TECHNICAL TEACHERS TRAINING INSTITUTE, BHOPAL

Sponsored BY

DIRECTORATE OF TECHNICAL EDUCATION, BHOPAL.

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P R E F A C E

The curriculum of the Course "CAD AND CAM [illegible]" of Diversified Courses category was developed in a workshop organised by state curriculum Development centre at the Govt. Polytechnic, Ujjain from .. 06-04-92 to 08-04-92.

The curriculum includes objectives at knowledge, comprehension and application levels, so that a proper understanding of the concepts, principles, rules and relationships can be imparted effectively to the students. To reinforce the theoretical concepts, demonstrations have also been suggested at some places.

Comments and healtty oriticism from faculty members are, however, welcome so that, if required, the prepared curriculum can be revived and revised periodically.

We are highly grateful to the Director of Technical Education, Bhopal for their valuable guidance, encouragement and active co-operation in the curriculum development work.

Thanks to the principal and staff of Govt. Polytechnic, Ujjain for getting the workshop arranged and taking active part in preparing the curriculum. Thanks are also due to the principal and C.D.C. faculty of T.T.T.I., Bhopal for their valuable guidance and suggestions as and when asked for.

We always aspire to improve this.

Secretary,
M.P. Board of Technical Education,
Bhopal (M.P.)

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPE & CS)

COURSE : CAD/CAM

COURSE CODE NO.: M - 604

PREREQUISITE : 301 - (Comp. Appl.)

"R A T I O N A L E"

Computer based numerically controlled machine tools are increasingly finding place in industries. Further integration of the computer Aided Design and Drafting (CADD), which has been in use in the industry for some years now, with CAM Operations has lead to efficient product design & phototyping and shorter production runs. The need to absorb CAD/CAM technology for its effective and efficient use has, therefore, become imperative.

This course is being introduced as diversified course of Diploma Programme in Mechanical Engineering under Multi Point Entry and Credit system, and has the hard core course on computer Applications (301) as prerequisite. The course aims at developing appreciation of the use of CAD/CAM as a computer based tool in drafting, designing and manufacturing processes. The focus is therefore, to familiarise students with a CAD/CAM environment, its components, their functions, and methods of using the existing CAD/CAM software, in general, with a view to improve efficiency in drafting and designing.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPE & CS)

COURSE : CAD/CAM

COURSE CODE NO.: M - 604

PREREQUISITE : 301 (Comp. Appl.)

"SCHEME OF STUDIES"

S.No.	Topic	Theory Hrs.	Practical Hrs.	Total Hrs.
1.	Fundamentals of CAD/CAM	05	02	07
2.	CAD/CAM hardware	06	02	08
3.	Software of CAD/CAM System	06	08	14
4.	Introduction to Auto CAD	10	14	24
5.	Introduction to Conventional	05	-	05
6.	Introduction to Part Programming through numerical Control.	05	12	17
7.	Introduction to different types of Computer based numerical control system.	05	-	05
	TOTAL :	42	38	80

CREDITS : 04

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MFE & CS)

COURSE : CAD/CAM

COURSE CODE NO.: M - 604

PREREQUISITE : 301 - Computer Application.

"CONTENT"

TOPIC 1. FUNDAMENTALS OF CAD/CAM :

1. History of CAD/CAM
2. Concept of CAD/CAM
3. General design steps in CAD/CAM
4. Benefits of CAD/CAM

(5+2=7)

TOPIC 2. HARDWARE OF CAD/CAM SYSTEM IN CIM ENVIRONMENT :

1. Introduction
2. Block diagram of integrated CAD/CAM system.
3. Hardware components of CAD system in CIM. environment. (CAD Workstation input, process & output unit details).
4. Hardware components of CAM system in CIM environment. (CNC controller and CAD interfacing, CNC components. Conveyors and robot units).
5. Functions of each hardware unit in CIM.

(6+2=8)

TOPIC 3. SOFTWARE OF CAD/CAM SYSTEM :

1. Introduction.
2. Software configuration of a CAD system.
3. Functions of a CAD package.
4. Constructing the geometry.
5. Effects of transformations.
6. Wireframe versus solid modeling.
7. CAD/CAM integration.
   (e.g. through intermediate codes & post Processor.

(6+8=14)

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TOPIC 4. INTRODUCTION TO AUTO CAD :

1. Introduction
2. Features of Auto Cad.
3. Important commands, their functions & applications (Incremental approach to design/drafting.

(10+14=24)

TOPIC 5. INTRODUCTION TO CONVENTIONAL NUMERICAL CONTROL :

1. Introduction.
2. Basic components of NC system.
3. The NC procedures.
4. NC coordinate systems.
5. NC motion control systems.
6. Applications of Numerical control and potential applications of NC machine tools.

(5+0=5)

TOPIC 6. INTRODUCTION TO PART PROGRAMMING THROUGH NUMERICAL CONTROL :

Purpose of part programming, steps of part-programming, Difference between manual and computer assisted part programming, Difference between language based and CAD package based part programming.

(5+12=17)

TOPIC 7. INTRODUCTION TO DIFFERENT TYPES OF COMPUTER BASED NUMERICAL CONTROL SYSTEMS :

Classification of NC controller technology as:-

1. Computer numerical control.
2. Direct numerical control.
3. Adoptive control machining systems.

(5+5=10)

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPE & CS)

COURSE : CAD/CAM

COURSE CODE NO.: M - 604

PREREQUISITE : 301 - COMPUTER APPLICATION.

"LIST OF EXPERIMENTS"

1. Auto CAD commands and their applications in various types of Designs/Drawings

   Ten/Fifteen experiments.

2. CAM experiments on:

   2.1 Entry of part programme.

   2.2 Preparation of control tape.

   2.3 Development and execution of programmes using following features :

   (a) Tool Control.

   (b) Base Control.

   2.4 Use of point cut, point to point cut and continuous cutting following tool path.

   2.5 Execution of programme using linear cutting and contour interpolation.

3. Material job handling using Robot system and conveyer assembly.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPE & CS)

COURSE : CAD/CAM

COURSE CODE NO.: M - 604

PREREQUISITE : 301 (Computer Application)

"LIST OF SUGGESTED REFERENCE TEXT BOOKS

TEXT BOOKS :

1. CAD/CAM ; Computer - Aided Design and Manufacturing by M.P. Groover, & E.W.Zimmers, Sr.,Prentice - Hall of India Pvt. Ltd., (EEE), New Delhi, 1986.

2. Inside Auto CAD, by Daniel Raker and Harbest Rice, BPB publications, Delhi (Latest edition).

REFERENCE BOOKS :

3. (I) Working out with Auto CAD.

(II)Working out with Auto CAD disc.

(III)The Auto CAD vides.

(IV) Stepping Auto CAD - instructer's guide New Riders publishing, P.O. Box, 4846.
Thousand Oeks CA 91360 U.S.A.
C/o - BPB Publications, Delhi -110 006.
(376,Old Lajpat Rai Market).

4. Introduction to Computer Aided Drafting by Donald D. Voisinet (2nd Ed.), Mc-Graw-Hill.

5. Mastering Auto CAD by BPB publication, Delhi.

6. Illustriated Auto CAD by - T.W.Berghauser and P.L.Schlieve, BPB Publications, Delhi.

7. Numerical Control by Marthin, E.L.B.S.

8. Understanding CAD/CAM- Design with computer, by D.J.Bowman, and R.N. MC - Dougal, BPB Publications, Delhi.

9. Numerical Control by Child -

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"A D D R E S S E S"

1. Hcl Limited,
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Bhopal - 554 824 (Ph.No.)

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Bhopal - 462 014
565926 (Telephone No.)

3. Control Station,
E-1/127, Arera Colony,
Bhopal - 462 016.
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4. PCL,
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7. Mr. K.N. Labh,
Sr. Manager (Design)
BHEL.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGG. (M.P.E. & C.S.)

COURSE CODE NO.: M - 601 TO M - 607

CATAGORY : DIVERSIFIED COURSES.

LIST OF PARTICIPANTS

01- Shri A.K. Chakrawarti .. Senior Manager, Issco Pipe & Foundry Ltd. Ujjain.

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C.D.C. FACULTY

Shri K.K. Jain. .. Deputy Director (C.D.C.)
M.P. Board of Technical Education,
Bhopal.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

DETAILED CURRICULUM

COURSE TITLE : TOOL ENGINEERING.

COURSE CODE NO.: M - 605

PREREQUISITE : M - 501 (MACHINE TOOL TECHNOLOGY)

CATEGORY : DIVERSIFIED COURSE

DIPLOMA PROGRAMME IN

MECHANICAL ENGINEERING

(Under Multi Point Entry And Credit System)

Developed BY

STATE CURRICULUM DEVELOPMENT CENTRE

M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL

In Collaboration with

TECHNICAL TEACHERS TRAINING INSTITUTE, BHOPAL

Sponsored By

DIRECTORATE OF TECHNICAL EDUCATION, BHOPAL.

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P R E F A C E

The curriculum of the Course Tool Engineering of Diversified Courses category was developed in a workshop organised by state Curriculum Development Centre at the Govt. Polytechnic, Ujjain from .. 06-04-92 to 08-04-92.

The curriculum includes objectives at knowledge, comprehension and application levels, so that a proper understanding of the concepts, principles, rules and relationships can be imparted effectively to the students. To reinforce the theoretical concepts, demonstrations have also been suggested at some places.

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Thanks to the principal and staff of Govt. Polytechnic, Ujjain for getting the workshop arranged and taking active part in preparing the curriculum. Thanks are also due to the principal and C.D.C. faculty of T.T.T.I., Bhopal for their valuable guidance and suggestions as and when asked for.

We always aspire to improve this.

Secretary,
M.P. Board of Technical Education,
Bhopal (M.P.)

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : TOOL ENGINEERING.

COURSE CODE NO.: M - 605

PREREQUISITE : M - 501 (Machine Tool Technology)

"R A T I O N A L E"

The present trend towards higher productivity in almost all fields of engineering manufacture has resulted in the evolution of newer and better techniques of manufacture and brought about a through change in the design of machine tools. Such an evolution is characterised by the increased quality and reduced cost of production machines, more and more use of automatic, programme - controlled or transfer machines, in the field of specialised production of complicated components.

Machine tools are factory equipment for producing machines, instruments, and tools of all kinds, Looking to the present need of the well established large scale industries, tool engg. Course is included in the diversified category of Diploma in Mechanical Engineering based on multi point entry and credit system with the idea that the students desirous of carrying out work in the field of tool engineering, could do justice after undertaking this course.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION, BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING (MPE & CS)

COURSE : TOOL ENGINEERING.

COURSE CODE NO. : M - 605

PREREQUISITE : M - 501 (Machine Tool Technology)

"SCHEME OF STUDIES"

S.No.	Topic	Contact Hours Theory Hrs.	Lab./Practical/ Tutorial Hrs.	Total Hrs.
1.	General Consideration in tool design.	08	-	08
2.	Design & Cutting tools	08	06	14
3.	Work holding devices	04	04	08
4.	Design of Press Working tools.	12	08	20
5.	Numerical control in machine tools	10	08	18
6.	Gages and Gage design.	06	06	12
	TOTAL:	48	32	80

TOTAL CREDITS : 04

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PREREQUISITE : M - 501 (Machine tool Technology)

"CONTENT OUTLINES"

TOPIC 1. GENERAL CONSIDERATION IN TOOL DESIGN :

Original direction for designs, tooling layout, Detailing stock lists and notes. Safety as related to tool design, tool materials, heat treatment. Surface roughners, fits & tolerances, tooling economics.

Material handling at the workplace, Rates for good design.

(8+0=8)

TOPIC 2. DESIGN OF CUTTING TOOLS :

Mechanics of cutting, Types of chips, force system in cutting, single pt. tool, multi point tool, linear travel tools, axial feed, rotary tools, tool wear & causes, tool designing e.g. Tool gemotry etc.

(8+6=14)

TOPIC 3. WORK HOLDING DEVICES :

Elements & types of jigs & fixtures, general considerations in designing jigs & fixtures. Work holders for flat or irregular work PCS; round work PCS.

(4+4=8)

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TOPIC 4. DESIGN OF PRESS WORKING TOOLS :

Power presses: Major components, types, cutting operations, calculation of Centre of Pr., Clearences. Piercing die design, Blanking die design, die block general design, die block calculation; punch dimensioning : method of punch support, Stock stops.

(12+08=20)

TOPIC 5. NUMERICAL CONTROL IN M/C TOOLS :

Basic Clessification of NC M/C working principle of NC MKS ; different system of control. Instructions processing methods Numerical control for vertical milling M/c. Programming & system of Notations and codes in NC M/C tools. , Storage media, Reading & reading informations, general data on Mechining Centres.

(10+08=18)

TOPIC 6. GAUGES & GAGE DESIGN :

Introduction, Fixed gages, gage telerances selection of Material for gages, Indicating gages.

(6+6=12)

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PREREQUISITE : M - 501

"LIST OF EXPERIMENTS"

1. Study of different types of chips and list factors favourable for formation. - 3
2. Orthogonal & Oblique cutting, force system measurement of different forces. - 3
3. Study of a six point location of a rectangular block. 1
4. Study of different methods of location. 2
5. Study of six point location of a three tagged block. - 1
6. Perform calculation of centre of pressure. - 2
7. Study of different types of punch support. 2
8. Perform different types of die cutting operations e.g. piercing, blanking, lancing, cut off. - 4
9. Study of different fixtures used for N/C M/c tools. 3
10. Study of different cutting tools for N/C M/Cen. 2
11. Select a N/C M/C & design a tooling cart to transport & carry tooling from the tool setting centre to the individual M/C. - 3
12. Study of different types of snep gages, Indicating gages. - 3
13. Study & list the different materials for gages. - 3

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COURSE : TOOL ENGINEERING.

COURSE CODE NO.: M - 605

PREREQUISITE . : M - 501 (M/C Tool Technology)

LIST OF SUGGESTED REFERENCE BOOKS :

1. "Fundementals of Tool Design" - ASTME - Prentice-Hall of India (Pvt.) Ltd., New Delhi.
2. "Tool Design" By Cyril Donaldson and George H. Lecain, Mc-Graw-Hill, Book Company, New York, Toronto, London.
3. "Tool Design" by Herman W.Pollack, D.B. Taraporwala Sons & Co. Pvt. Ltd., Bombay.
4. "Production Tooling Equipment" By S.A.J. Persons, B.L. Publications, Bombay, Delhi, Calcutta, Madras.
5. "Machine Tools" BY N. Chernov, MIR Publishers, Moscow.
6. "Design of Machine & Tools" By S.K. Basu, Allied Publishers, 13/14, Asafali Road, New Delhi - 1.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGG. (M.P.E. & C.S.)

COURSE CODE NO.: M - 601 TO M - 607

CATAGORY : DIVERSIFIED COURSES.

LIST OF PARTICIPANTS

01- Shri A.K. Chakrawarti .. Senior Manager, Issco Pipe & Foundry Ltd. Ujjain.

02- " S.N. Bade .. Deputy Manager Planning Department, Issco Pipe & Foundry Ltd.Ujjain.

03- " K.C. Moheshwari .. Manager Mechanical Engg. Shree synthetic Ltd. Ujjain.

04- " A.N. Pisolkar .. Deputy Manager (Planning) Issco Pipe & Foundry Ltd.Ujjain.

05- " N.R. Bhavsar .. Head of the Deptt.(Mech.Engg.) Govt. Polytechnic, Khandwa.

06- " M.S. Thakur. .. Head of the Deptt. (Mech.Engg.) Govt. Polytechnic, Ujjain.

07- " S.G. Deo .. Workshop Superintendent, Govt. Polytechnic, Jhabua.

08- " G.B. Bamankar .. Workshop Superintendent, Govt. Polytechnic, Jaora.

09- " H.K. Pareekh .. Lecturer Mechanical Engg. Govt. S.V.Polytechnic, Bhopal.

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12- " R.K. Moondra .. Lecturer Mechanical Engg. Govt. Polytechnic, Ujjain.

13- Shri S.A. Pednekar .. Lecturer Mechanical Engg.
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14- " I.D.Sabnani .. Lecturer Mechanical Engg.
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15- " D.K. Joshi .. Lecturer Mechanical Engg.
Govt. Polytechnic, Ujjain.

16- " P.K. Uppal .. Asstt. W/S Superintendent,
Govt. Polytechnic, Ujjain.

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Shri K.K. Jain. .. Deputy Director (C.D.C.)
M.P. Board of Technical Education,
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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

DETAILED CURRICULUM

COURSE TITLE : AUTOMOBILE ENGINEERING.

COURSE CODE NO.: M - 606

PREREQUISITE : NIL.

CATEGORY : DIVERSIFIED COURSE

DIPLOMA PROGRAMME IN

MECHANICAL ENGINEERING

(Under Multi Point Entry and credit System)

Developed By

STATE CURRICULUM DEVELOPMENT CENTRE

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