

Book No-6

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION BHOPAL



THREE YEARS DIPLOMA PROGRAMME IN ELECTRICAL ENGINEERING Under Multipoint Entry & Credit System

DETAILED SYLLABUS

| APPLIED TECHNOLOGY | APPLIED TECHNOLOGY COURSES | DIVERSIFIED COURSES |
|---|--|--|
| 1. E-401 Electrical Engg. Materials & Circuits. | 1. E-501 Instrumentation & Control. | 1. E-601 Advanced Instrumentation & Control. |
| 2. E-402 Electrical Machines. | 2. E-502 Generation Transmission & Distribution. | 2. E-602 Electric Traction. |
| 3. E-403 Basic Electronics. | 3. E-503 Utilisation of Electrical Power. | 3. E-603 Computer Engg. |
| 4. E-404 Electrical Engg. Drawing. | 4. E-504 Power System operation & Protection. | 4. E-604 Power Electronics. |
| 5. E-405 Electronics & Electrical Measurements & Measuring Instruments. | 5. E-505 Industrial Management. | 5. E-605 Power System & Control. |
| 6. E-406 Mechanical Engg. | 6. E-506 Industrial Electronics | |
| | 7. E-507 Electrical Installation & Maintenance. | |
| | 8. E-508 Estimating & Costing | |
| | 9. E-509 Project. | |

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DIRECTOR 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.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

THREE YEARS DIPLOMA PROGRAMME IN ELECTRICAL ENGINEERING

UNDER

MULTI POINT ENTRY AND CREDIT SYSTEM

DETAILED SYLLABUS :

BASIC TECHNOLOGY COURSES FOR ELECTRICAL ENGINEERING

- E-401 - ELECTRICAL ENGINEERING MATERIALS AND CIRCUITS.
 - E-402 - ELECTRICAL MACHINES.
 - E-403 - BASIC ELECTRONICS.
 - E-404 - ELECTRICAL ENGINEERING DRAWING.
 - E-405 - ELECTRONICS & ELECTRICAL MEASUREMENTS AND MEASURING INSTRUMENTS.
 - E-406 - MECHANICAL ENGINEERING.
-

SPONSORED BY -

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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 jocketed Diploma programme in Civil, Mechanical, Electrical and Electronics & Tele-Communication Engineering. Curriculum 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 need of industry, is the demand of the time.

Earlier 10+ and 12+ science stream/technical stream students in different proportions were joining the three year diploma programme in all Polytechnics. Out of which both 10+ and the 12+ students were admitted to the first year/semester of the three year diploma programme. These students do not have any option in selection of course(s) (subjects) and have no opportunity for taking alternative courses appropriate to their capability.

The National policy on Education, therefore, rightly recognised the need of a flexible structure which would allow students to enter into 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, Directorate of Technical Education, Madhya Pradesh and M.P. Board of Technical Education has 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. Government Polytechnic, Bhopal from July, 1990 and is now operated in all the co-education polytechnic of M.P.

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 overlap of the content.
- (d) Relevance of the content.
- (e) Prerequisite of the content.

(Contd...)

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The comments and healthy criticism from faculty members are however welcome, so that this prepared syllabi 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.

LIST OF PARTICIPANTS.

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. 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.

T.T.T.I. FACULTY.

- (1) Prof. V.M. Kapse. Head of the Department C.D.C.
- (2) Dr. N.S. Kapruan.
- (3) Prof. G.N.N. Rao.
- (4) Prof. H.R. Ramanna.
- (5) Dr. K.C. Sabbarwal.
- (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.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION, BHOPAL. REVISED ON 15.10.92
 SCHEME OF STUDIES & EXAMINATION OF DIPLOMA IN ELECTRICAL ENGINEERING (MPECS) - (TEE)
 W.C.F. Oct./Nov-1992.

BASIC TECHNOLOGY.

| S.No. | Code No. | Course. | Pre-requi- site. | Th. | Pr. Ass. | Term work | Lab work | I | II | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 50 | Rem- arks |
|-------|----------|---|---------------------|-----|----------|--------------|-------------|----|----|---------------|--------|-----|-----|--------|-----|-----|--------|----|--------------|
| 1. | E-401 | Electrical Engg. Materials & cir- -cuits. | - | 4 | 2 | 5 | 20 | 20 | 10 | 10 | 10 | 100 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 50 | |
| 2. | E-402 | Electrical Machine. | E401 | 5 | 2 | 6 | 20 | 20 | 10 | 10 | 10 | 100 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 50 | |
| 3. | E-403 | Basic Electronics. | - | 5 | 2 | 6 | 20 | 20 | 10 | 10 | 10 | 100 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 50 | |
| 4. | E-404 | Electrical Engg. Drawing. | - | 1 | 4 | 8 | 20 | 20 | 10 | 10 | 10 | 100 | 1 | 4 Hrs. | 100 | - | - | - | |
| 5. | E-405 | Electronics & Ele- ctric Measurement & Measuring Instruments. | - | 5 | 2 | 6 | 20 | 20 | 10 | 10 | 10 | 100 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 50 | |
| 6. | E-406 | Mechanical Engg. | - | 3 | 2 | 4 | 20 | 20 | 10 | 10 | 10 | 100 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 50 | |
| 7. | E-407 | Generation, Trans- mission & Distri- bution. | - | 5 | 2 | 6 | 20 | 20 | 10 | 10 | 10 | 100 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 50 | |
| | | | | | | | | | | Total Credits | 36 | 140 | 140 | 70 | 70 | 700 | - | - | 300 |

All Courses are compulsory.

- (1) Sessional Marks : 280
- (2) Prog. Ass. Marks. : 140
- (3) Theory paper marks : 700
- (4) Practical Marks : 300

Total Marks : 1420

(5) Total Credits : 36

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : ELECTRICAL ENGINEERING MATERIALS & CIRCUITS
COURSE CODE NO. : E-401
PRE-REQUISITE : NIL.

R A T I O N A L E

Introduction to materials have assumed great significance in recent times. A technician engineer must be familiar with the composition, characteristics and properties of engineering materials used in industries as well as in daily life, so that he can choose the right materials for various works in electrical and electronic industries. The syllabus is, therefore, aimed at imparting a need based knowledge of electrical engineering materials.

Electrical circuit theory forms a base for fundamental understanding of the subjects of electrical engineering. The necessity for introducing this section of the subject needs no further emphasis.

Every electrical apparatus is studied through an electrical circuit which contains some components of which it is made and every component of an electrical circuit is made of some material. Thus there is close relationship between the electrical engineering materials and the circuits hence the materials and circuits are grouped to form one complete subject.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : ELECTRICAL ENGINEERING MATERIALS & CIRCUITS
COURSE CODE No. : E-401

SCHEME OF STUDIES

| S.No. | TOPIC | THEORY HRS. | PRACTICAL HRS. | TOTAL |
|-------|---|----------------|-------------------|-------|
| 1. | Conducting materials. | 08 | 04 | 12 |
| 2. | Insulating materials. | 08 | 04 | 12 |
| 3. | Magnetic materials | 06 | 04 | 10 |
| 4. | Special purpose materials. | 02 | - | 02 |
| 5. | Circuit analysis. <i>Electrical circuit</i> | 08 12 | - | 08 |
| 6. | Net work theorem. | 08 12 | 10 | 18 |
| 7. | A.C.Circuits. | 10 16 | 10 | 20 |
| 8.4. | Polyphase A.C. circuits. | 08 12 | - | 08 |
| 9.6. | Transients. <i>Symmetrical components</i> | 06 12 | - | 06 |
| TOTAL | | 64 | 32 | 96 |

CREDITS : 5

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : ELECTRICAL ENGINEERING MATERIALS & CIRCUITS
COURSE CODE No. : E-401

C O N T E N T S

TOPIC DETAILS :

TOPIC No.1 CONDUCTING MATERIALS.

Requirements for a good electrical conducting material, comparison of good conducting materials like copper, aluminium, steel etc.

Types of copper conducting materials like hard drawn, soft drawn, enamelled etc.

Application of these conductors.

Properties of materials used in electrical machines like (a) Brush (b) Contact (c) Fuse wire (d) Filament etc.

High resistivity materials, their composition and applications like manganin, Chromel, Nichrome, Ureka etc.

Semi conducting materials, Intrinsic and extrinsic materials. Application of semi conducting materials.

TOPIC No.2 INSULATING MATERIALS.

Properties of insulating materials. dielectric strength, loss angle, permitivity, volume and surface resistivity, factors affecting dielectric strength, like moisture, temperature etc. Classification of insulating materials on temperature basis. Commonly used insulating materials with properties like mica, porcelain, ceramic, varnish, transformer oil etc.

TOPIC No. 3 MAGNETIC MATERIALS.

Classification of magnetic materials like diamagnetic, paramagnetic, ferro and ferri etc.

Comparative study of magnetization characteristics of silicon steel, soft steel, castiron etc.

soft and hard magnetic materials, grain magnetic material, Advantages and limitations, curie temp.

Hysteresis loss, factors affecting this loss, eddy current loss, steps to reduce eddy current loss.

TOPIC No. 4 SPECIAL PURPOSE MATERIALS.

For terminals, connectors, switches, wires overhead conductors, bimetal, springs their properties and applications.

ELECTRICAL CIRCUITS.

TOPIC No. 5 CIRCUIT ANALYSIS.

Active and passive element, Ideal current source and voltage source. Unilateral and bilateral elements.

Number of loops, nodes, branches of a network, Analysis of networks by "Mesh" and "Nodel" methods. Two terminal network, input and output impedance and admittance.

TOPIC No. 6 NETWORK THEOREMS.

star-Delta transformation, substitution, superposition, Thevenin's, Nortons' and Maximum power transfer theorems with numerical problems.

*reciprocity
reciprocity*

TOPIC No. 7 SINGLE PHASE A.C. CIRCUITS.

operator Representation of A.C. quantity by phasor methods, Rectangular and polar co-ordinates, REC, series and parallel combinations.

Impedance, power in a single phase circuits concept of power factor, conductance, admittance and susceptance. Resonance, series and parallel, Resonance curve.

TOPIC No. 4 POLYPHASE CIRCUITS.

Concept of polyphase A.C. circuits, advantages over single phase. Generation of three phase voltage system. Three phase circuits, phase sequence, vector and wave diagrams. star and delta connections, phase and line values of current and voltage, power in a three phase circuits. Balanced and unbalanced systems.

TOPIC No. 9 TRANSIENTS :

Concept of transient, Variation of current when connected to D.C. or A.C. series circuit of R.L. combination and R.C. combination. Time constant.

TOPIC No. 5 * Symmetrical Components :-

Operator 'a'. Resolution of unbalanced three phase system into positive, negative and zero sequence components. Relation between unsymmetrical and symmetrical components. Simple numerical problems.

TOPIC No. 6. TRANSIENTS.

Concept of transient. Variation of current Transients in D.C. and A.C. in R-L and R-C circuits. Time Constant :

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
COURSE : ELECTRICAL ENGINEERING MATERIALS & CIRCUITS
COURSE CODE No.: E - 401

LIST OF EXPERIMENTS.

- No. 1 : Verification of Kirchoff's laws. *Current Law*
- No. 2 : ~~Verification of Kirchoff's Voltage Law~~ *Verification of Kirchoff's Voltage Law*
- No. 3 : Verification of Norton's and Thevenin's theorem. *Verification of Thevenin's theorem*
- No. 4 : ~~Verification of Maxwell's theorem~~ *Verification of Superposition theorem*
- No. 5 : Performance of R-L-C series circuits
- No. 6 : Performance of R-L-C parallel circuit.
- No. 7 : Verification of star Delta transformation.
- No. 8 : ~~Electrical resonance series and parallel.~~
- No. 9 : Study of conducting, insulating and magnetic materials.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
COURSE : ELECTRICAL ENGINEERING MATERIALS & CIRCUITS
COURSE CODE No.: E - 401

REFERENCE BOOKS. X

1. X Electrical Engineering material - by P.L.Kepoor
(S.Chand, Delhi)
2. X Electrical Engineering materials- By G.P.Chalotra
(Khanna Pub.)
3. ① A course in Circuit analysis. - by soni & Gupte
(Dhanpet Rai & Sons)
Pub.
4. X Electrical Engineering materials- by T.T.T.I., Madras
Pub.
5. Instructional Materials Learning- T.T.T.I., Bhopal.
peckage.
6. Electrical Engineering materials- by Dekker
(Prentice hall Pub.)

- ② Schamun's Electrical circuits^{***}
Pub. Narayan Reddy
- ③ Network Analysis — Pub. Khanna,
- ④ Electrical Technology — B.L.Thareja
Pub.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPIAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING

COURSE : ELECTRICAL MACHINES

COURSE CODE NO.: E-402

PRE-REQUISITE : E-401

R A T I O N A L E

Electrical machines constitutes the largest number of devices which use electrical power. A technician comes across a large number of situations where electrical machines are used and installed. He must be well familiar with the various parts and their operation under normal operating conditions. This subject includes the parts their materials, the working principle and performance characteristics of electrical machines in common use.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING

COURSE : ELECTRICAL MACHINES

COURSE CODE No.: E - 402

SCHEME OF STUDIES

| S.No. | TOPIC | TH. HRS. | PR. HRS. | TOTAL |
|-------|------------------------------|-------------|-------------|-------|
| 1. | Energy conversion principle. | 04 | - | 04 |
| 2. | D.C. Generator | 18 09 | 04 | 13 |
| 3. | D.C. Motors. | 15 07 | 06 | 13 |
| 4. | Transformer | 14 | 08 | 22 |
| 5. | Three phase induction motor. | 16 12 | 04 | 20 |
| 6. | Synchronous generator. | 09 12 | 04 | 13 |
| 7. | Synchronous motor | 07 10 | 04 | 11 |
| 8. | Single phase Induction motor | 04 06 | 02 | 06 |
| 9. | A.C. commutator motor. | 06 | - | 06 |
| 10. | Special purpose machines. | 04 06 | - | 04 |
| TOTAL | | 80 | 32 | 112 |

CREDITS : 6

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PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : ELECTRICAL MACHINES
COURSE CODE NO. : E-402

U/c I

C O N T E N T S

TOPIC -1. ENERGY CONVERSION PRINCIPLE

Law of conservation of energy, Electro mechanical energy conversion. [Production of E.M.F. and torque in rotating machines,] classification of machines.

TOPIC -2. D.C. GENERATOR

Principle, construction, armature winding, types of winding -E.M.F. equation, armature reaction and commutation interpole and compensating winding, types of generators and their performance characteristics, Losses and efficiency simple numerical problems.

APPLICATIONS

TOPIC -3. D.C. MOTORS

Principle, production of back E.M.F. torque equation. Classification and characteristics of motors. Speed control. Losses and efficiency. D.C. motor starters. Losses and efficiency, swinburns test, applications and numerical problems.

Breaking of induction motor

TOPIC-4 TRANSFORMERS.

Principle, constructional details E.M.F. equation, classification, transformer on no load and load vector diagram, equivalent circuit, voltage regulation. Open circuit and short circuit test. swinburn's test, separation of iron losses, Losses and efficiency, condition of maximum efficiency. All day efficiency, cooling of transformer, auto transformer, parallel operation, Three phase transformer connections, Scott and open delta connection. Comparison of three phase transformer with three single phase transformer.

parallel operation of transformer

Specifications - Applications of transformers

* Ratio test
Polarity test

Name plate rating

Simple numericals.

DOL

Star delta starter

Autotransformer starter

Rotor resistance.

Autotransformer

Control type starts

B
Pst

no load and blocked rotor
loss

TOPIC - 5. THREE PHASE INDUCTION MOTOR.

Engn Mech II

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Principle construction and types. Production of

rotating magnetic field, Torque equation, torque slip,

Characteristics equivalent circuit and phas diagram, losses and efficiency. Types of starters, Methods of speed control, performance characteristics.

TOPIC - 6 SYNCHRONOUS MACHINES

(A) SYNCHRONOUS GENERATOR :- Principle, construction

details, parts, salient and cylindrical rotors, speed frequency relationship, Flux distribution and waveform, emf. equation, distribution factor, pitch factor, armature reaction OCC and S.S.C., Synchronous impedance, regulation and methods to find regulation, phasor diagram on load, load characteristics parallel operation, methods of synchronising, power angle characteristics.

(B) SYNCHRONOUS MOTORS : Principle, construction details, phasor diagram, effect of change in excitation, V curves, Synchronous condenser, Starting of Synchronous motors, Hunting and its prevention, cooling of synchronous machines.

TOPIC - 7. SINGLE PHASE INDUCTION MOTORS :

(A) Working principle, cross field theory and double revolving field theory, Types of motors (split phase, shaded pole, capacitor motor) and their construction characteristics and applications.

(B) A.C. COMMUTATOR MOTOR : Introduction, Series motor, compensated series motor, commutating poles, universal motor, repulsion motors.

TOPIC - 9. SPECIAL PURPOSE MACHINES : - Principles and working of linear induction motor, Stepper motor.

DC
brushless motor
PM motor

808.10 motor

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : ELECTRICAL MACHINES
COURSE CODE NO. : E-402

LIST OF PRACTICAL

- (1) Magnetization characteristics of shunt generator.
- (2) Load characteristics of shunt and compound generator
- (3) Speed control of d.c. shunt motor (i) armature control and (ii) field control.
- (4) Load characteristics of a D.C. motors.
- (5) To perform swinburn test on D.C. shunt motor.
- (6) O.C. and S.C. test on single phase transformer, calculation of parameters, efficiency and regulation.
- (7) Load test on single phase transformers and calculate regulation.
- (8) Parallel operation of single phase transformers.
- (9) Scott connection of transformer.
- (10) To perform sumpner test to calculate efficiency of a single phase transformer.
- (11) Measurement of slip by (i) Centre zero a m meter (ii) shobscope.
- (12) O.C.C. and S.C.C. of Synchronous generator and determination of regulation.
- (13) Synchronisation of (i) Two Synchronous generators and (ii) a generator with mains supply.
- (14) Plotting of V curves of Synchronous motor at various loads.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : ELECTRICAL MACHINES
COURSE CODE NO. : E-402

LIST OF REFERENCE BOOKS.

| <u>S.No.</u> | <u>NAME of Book</u> | <u>Author</u> | <u>Publisher</u> |
|--------------|---|-------------------------|------------------------------|
| (1) | Electrical machines Vol. I & II. | Bhattacharya. | T.T.T.I. Chandigarh Pub. |
| (2) | Electric machines | Nagrath and Kothari. | TITA -Mcgraw Publication. |
| (3) | Electrical Machinery | S.K.Sen. | Khanna Publication. |
| (4) | The performance and Design of A.C. machines. | M.G. Say | ELBS Publication. |
| (5) | Electrical Technology | B.L.Tharaj. | |
| (6) | Electrical Technology. | S.L. Uppal. | |

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : BASIC ELECTRONICS
COURSE CODE NO. : E-403
PRE-REQUISITE : E -401

R A T I O N A L E

Electronics has widespread applications in almost all branches of engineering and science . The syllabus of Basic Electronics has been developed to impart basic knowledge of constructional details, operational principle, characteristic and applications of basic circuits of semiconductor devices.

As the thermionic devices finds reducing applications, emphasis on emission of electron is not given, however the elementary portion of ICs and Digital techniques have been included in the syllabus to keep pace with modern development.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAM E : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : BASIC ELECTRONICS

COURSE CODE No. : E-403

SCHEME OF STUDIES

| S.No. | TOPIC | THEORY HRS. | PRACTICAL HRS. | TOTAL |
|-------|------------------------------------|----------------|-------------------|-------|
| (1) | Electron emission | 04 | -- | 4 |
| (2) | semiconductor devices. | 10 | 8 | 18 |
| (3) | Power Supply. | 10 | 2 | 12 |
| (4) | Resonating and filter clets | 08 | 2 | 10 |
| (5) | Amplifiers. | 10 | 8 | 18 |
| (6) | Oscillators. | 10 | 2 | 12 |
| (7) | Non sinusoidal Generators | 08 | 2 | 10 |
| (8) | Modulation and Demodu- -lation. | 06 | 4 | 10 |
| (9) | Integrated Circuits. | 08 | 2 | 10 |
| (10) | Digital Techniques. | 06 | 2 | 8 |
| | | 80 | 32 | 112 |

Credits 6

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING

COURSE : BASIC ELECTRONICS

COURSE CODE NO. E-403

C O N T E N T S

1. ELECTRON EMISSION : Motion of charge in Electric field
Electron volt, work function, expression for thermionic
emission, Methods of electron emission applications of
emission.

2. SEMICONDUCTOR DEVICES

*Difference between Ge and Si
subband semiconductor devices.*

DIODES : Formation of PN junction, growth junction, conduc-
-tion in PN Junction , effect of temperature, Construction,
Characteristics and application of different types of diodes -
i.e. junction diode Zener diode, Tunnel diode, photo diode
and varactor

*junction
Diode (Semiconductor diode)
Zener Diode*

TRANSISTOR : Bipolar junction transistors : PNP and NPN

VI currents in transistor, Transistor characteristics in
different configurations ; CB, CE? CC Load line and dynamic
transfer curves Z & h parameters and applications.

SPECIAL SEMICONDUCTOR DEVICES

Construction, characteristics and applications of JET, &
MOSFET, UJT, SCR, Diac & Triac

3. POWER SUPPLY

Rectifiers

Single phase H.W., F.W. and bridge type Rectifiers Filter,
Calculation of output voltage average & RMS value ripple
factor and rectification efficiency. Diode P.IV. voltage
doubler rectifier.

Filters, need of filtering & types of filter

J Semiconductor M.A.C.T

*5 Regulated P.S. - Linear and Switch mode
P.S difference
Zener regulated P.S and limitations.
Series and Shunt P.S. using IC's
SMPS (block diagram only)
IC regulated P.S
78XX and 79XX series*

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FILTERS → Need of filtering, Types of Filters

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RESONATING FILTER CIRCUITS : Review of resonance filters in communication and measuring circuits Low pass, High pass, Band pass and Band elimination filters.

AMPLIFIERS : Transistors as Amplifier, CB, CE, CC configurations, Methods of biasing Voltage gain current gain, Power gain, Input and Output impedances, Classification of Amplifier on the basis of applications, frequency, coupling and conduction. Circuit diagram frequency response band width and applications of R.C. coupled, Transformer coupled and Tuned amplifiers. D.C. differential amplifier, Characteristics, advantages and applications. FEED amplifier biasing and advantages, Peculiar connections : darlington, cascade, and push pull Block diagram of feed back amplifier, effect of feed back amplifier on gain, derivation of gain, Types of feed back , on the basis of positive or negative current or voltage and shunt or series.

U-III

Operation Amplifier : Types : Inverting, non-inverting voltage gain, input output impedances. Use of O-P-amps as comparator, scaler, multipliers, summer, Integrator, differentiator.

OSCILLATORS : Types : Feed back Oscillator, Barkhausen criterion oscillators such as Hartley, Colpitts Tuned Collector, Factors affecting stability and generated frequency with expression. Crystal oscillator advantages and applications.

Wien bridge (principle, working) R.C. Oscillator application

R.C. OSCILLATORS : Phase shift and wein bridge, working Principle, and expression of generated frequency.

RF frequency Oscillators : block diagram.

U-IV

Regulated P.S

7. NONSINUSOIDAL GENERATOR : Astable, Monostable and Bistable Multivibrator circuits, Principle of working and output wave forms. Schmitt-trigger & UJT. Oscillators; circuits, output wave forms and applications. U-IV
8. MODULATION AND DEMODULATION : Types : A.M. , F.M. , P.M. P.M.
 Amplitude modulation : ^{Principle} Expression wave form, degree of Modulation, Frequency components, their power, band width SSB and suppressed carrier. Frequency modulation : Expression, wave form, modulation index ; ^{Principle of application} and band width. Methods of A.M. and F.M. detection : ^{Principle and F.M. detection} Linear Diode detector for A.M. and Quadrature detection for F.M. U V
9. INTEGRATED CIRCUITS : Concept of ICs - unit 4 U V
 classification; types and their advantages. Applications of common ICs such as 741, 555, 723, 810 and digital ICs. X
10. DIGITAL TECHNIQUES : Binary numbers, addition, subtraction, multiplication and division. Logic gates and their symbols, Truth table and application.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING

COURSE : BASIC ELECTRONICS

COURSE CODE NO. : E- 403

LIST OF EXPERIMENTS.

- 1) Study of electronic circuit components/parameters i.e. Types, rating colour codes of Resistors, Capacitors and chokes and coils.
- 2) Identification of terminals, knowing the specification rating and application of B.J.T., UJT., JET., diodes, SCR, Triac etc. referring the semiconductor data manual.
- 3) Study of common measuring and testing equipments i.e. Multimeters T.V.M., CRO, Function generator etc.
- 4) Characteristics of diodes transistors, SCRS.
- 5) To assemble H.W. and F.W. rectifiers, study of wave forms with and without filter circuits; To measure the values of output with C.R.O. and comparison with calculated values.
- 6) Study of resonant circuits and plotting of related curves. Calculation of half power frequencies, BW and gain.
- 7) To assemble an amplifier & to plot frequency response characteristics with (1) R.C. coupling and (2) transformer coupling.
- 8) To assemble an oscillator circuit and to trace and to measure frequency generated.
- 9) Study of A.M. modulation. To observe wave form of
(1) Carrier signal, (2) Modulating signal and
(3) Modulated signal and to measure modulation index with the help of CRO

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- (10) Study of Zener regulated power supply and determination of its regulation.
- (11) Study of UJT. Oscillator and observing its wave forms on CRO.
- (12) Study of A.M. diode detector.
- (13) Study of astable and monostable multivibrators using transistors and IC 555.
- (14) Study of inverting and non inverting amplifiers using IC 741 and calculation of its gain.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING

COURSE : BASIC ELECTRONICS

COURSE CODE NO. E-403

LIST OF REFERENCE BOOKS.

- (1) Basic Electronics & Linear Circuits
by Bhargava, T., T.T.I. Chandigarh Pub.
- (2) Electronic Principles
by S. Rambhadran Khanna Pub.
- (3) Integrated Electronics
by Millman and Halkias, McGraw Hill Pub.
- (4) Technical Electronics
by S. Rambhadran Khanna Pub.
- (5) Electronic Principles
by Malvino Tata McGraw Hill Pub.
- (6) Pulse and Digital Electronics
by Mithal and Vanbasi Khanna Pub.
- (7) Electronic Devices & Circuits
by G.K. Mithal Khanna Pub.

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MIDYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
COURSE : ELECTRICAL ENGG. DRAWING.
COURSE CODE NO. : E-404
PRE-REQUISITE : NIL

R A T I O N A L E

Drawing is said to be the language of Engineers.
This clearly indicates the importance of the subject.
Basic drawing is already covered in other courses.

Different
Here the topics are chosen on the basis
of all the electrical engineering subjects. Importance
should be given for the line work, lettering and
neatness of the figures.

"****"

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPIAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING

COURSE : ELECT. ENGG. DRAWING.

COURSE CODE NO. E-404

SCHEME OF STUDIES

| S.No. | Topic | Theory Hrs. | Pract.Hrs. | Total |
|-------|-----------------------------------|-------------|------------|-------|
| 1. | SYMBOLS AND NOTATIONS | 1 | 5 | 6 |
| 2. | DOMESTIC WIRING | 1 | 5 | 6 |
| 3. | INSTRUMENT CIRCUITS | 2 | 7 | 9 |
| 4. | WINDING DIAGRAMS. | 2 | 10 | 12 |
| 5. | ELECTRIC MACHINE DRAWING | 2 | 10 | 12 |
| 6. | POWER WIRING | 2 | 7 | 9 |
| 7. | SIMPLE ELECTRONIC CIRCUITS | 2 | 4 | 6 |
| 8. | ALTERNATOR PANEL DIAGRAMS | 2 | 7 | 9 |
| 9. | TRANSMISSION AND DISTRIBUTION. | 2 | 9 | 11 |
| TOTAL | | 16 | 64 | 80 |

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
COURSE : ELECTRICAL ENGINEERING DRAWING.
COURSE CODE NO. E-404.

C O N T E N T S.

TOPIC NO.1 : SYMBOLS AND NOTATIONS :

Symbols of practical units, Multiples and submultiples, types of supplies, single phase, three phase three wire, three phase four wire, D.C. Supply etc. Accessories like main-switches, distribution boards, fans, light fixtures, bell, buzzer, lighting arrester, All types of motor starters, instruments, electronic components etc.

Rating plate of machines .

TOPIC No.2 DOMESTIC WIRING :

All types of light circuits. Fluorescent tube circuits, Intermediate switch circuits, fan circuits wiring of residential building.

*Sodium lamp temp
Muzung. lamp temp*

TOPIC No.3 INSTRUMENT CIRCUITS.

Connection of meters in circuits, Ammeter, Voltmeter, Wattmeter, Energymeter, Power factor meter, frequency meter, Synchroscope etc.

Extension of range using shunt, Multiplier, current transformer, Potential transformers etc.

TOPIC No.4 WINDING DIAGRAMS.

Simplex type lap and wave diagrams for D.C. Machines. Single phase and three phase motor winding diagrams with full pitch and short pitch coils.

PIC NO. 5 ELECTRICAL MACHINE DRAWING :

Parts of D.C. machines like , magnetic poles, commutator, armature etc, A.C. machines rotor, slip rings, coupling etc. Various cable sections. Tap-changer and bushing of transformer assembly diagrams of D.C. machine, A.C. machine, transformer.

PIC NO.6 POWER WIRING. :

Internal wiring diagrams of single phase motor. Wiring diagrams of D.C. and A.C. motor starters. Like -Three point hunt motor starter, four point compound motor starter. Direct on line (D.O.L.) Star-delta, contactor type and auto transformer starter.

Internal connections of D.C. series, shunt and compound motors, Three phase motors squirrel cage and slip ring, synchronous etc.

Plate and pipe earthing ^{as per I.S.S.} as per I.S.C.

PIC NO. 7 : SIMPLE ELECTRONIC CIRCUITS :

Battery eliminator, battery charger, single stage transistor amplifier, connections of common emitter, collector and base amplifier circuits.

PIC NO.8 ALTERNATOR PANEL DIAGRAMS :

Panel diagram with circuit breaker, isolator measuring instruments, Synchroscope, over current and earth fault detection, differential protection, voltage regulator etc.

PIC NO.9 TRANSMISSION AND DISTRIBUTION :

All types of transmission towers and distribution poles. Arrangement of various types of cross arms, with insulators and spacers, strcy arrangements.

Electrical layout of 33KV /11KV substation 11KV/415V pole mounted substations with all protective devices etc.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,

BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : ELECTRICAL ENGINEERING DRAWING.

COURSE CODE NO. : E-404

REFERENCE BOOKS.

- (1) Engineering Drawing by C.N. Verma
(Khanna Pub.)
- (2) Electrical Engineering
Drawing work book by T.T.T.I. Bhopal.
- (3) Electrical Drawing by Narayan.
- (4) A text book of Electrical Drawing.
by S.L. Uppal (Khanna Pub.)
- (5) Electrical Drawing - by K.L. Narang.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
COURSE : ELECTRONICS AND ELECTRICAL MEASUREMENT
AND MEASURING INSTRUMENT.

COURSE CODE NO. : E-405

PRE-REQUISITE : E-401

R A T I O N A L E

This subject is very important as most of the technicians who get employment in Industries, Electricity Boards or in any electrical field are required to measure various electrical quantities and to use different electrical and electronics instruments. This subject is included as a Basic Technology subject in the Multi Point Entry and Credit System in order to train the technician engineer to make various measurements and connect and install various measuring instruments. A technician must be well familiar with the modern developments and latest measuring instruments, and so in addition to make electrical measurements he is also called upon to make electronic measurements. The syllabus therefore includes the principles of measurement and construction of various types of measuring instruments commonly used in the field of electrical and electrical Engg.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
COURSE : ELECTRONICS AND ELECTRICAL MEASUREMENT
AND MEASURING INSTRUMENT.
COURSE CODE NO. : E-405
PRE-REQUISITE : E-401

SCHEME OF STUDIES

| S.No. | Theory Hrs. | Practical Hrs. | Total Hrs. |
|--|-------------|----------------|------------|
| 1. Classification of measuring instruments, errors and accuracies. | 06 | - | 06 |
| 2. Construction operation and other details of Electrical instruments. | 10 | 4 | 14 |
| 3. Wattmeters and energy-meters. | 06 | 4 | 10 |
| 4. Measurement of resistance. | 08 | 08 | 16 |
| 5. Measurement of inductance and capacitance. | 08 | 02 | 10 |
| 6. Additional measuring instruments. | 08 | 02 | 10 |
| 7. Magnetic measurements. | 08 | 02 | 10 |
| 8. Dielectric measurements. | 04 | 02 | 06 |
| 9. Cathode Ray Oscilloscope. | 06 | 04 | 10 |
| 10. Electronic voltmeters. | 04 | 02 | 06 |
| 11. Audio and radio frequency measurements. | 03 | - | 03 |
| 12. A.F. & R.F. Power measurements. | 03 | - | 03 |
| 13. Digital instruments. | 06 | 02 | 08 |
| Total | 80 | 32 | 112 |
| Credit - 6 | | | |

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
 COURSE : ELECTRONICS AND ELECTRICAL MEASUREMENTS
 AND MEASURING INSTRUMENTS.
 COURSE CODE NO. : E-405

C O N T E N T S.

- (1) Classification of measuring instruments, errors and accuracies- Classification of instruments based on various effects of electric current, indicating recording and integrating types of meters. Accuracy, precision and sensitivity, types of errors.
- (2) Construction, operation and other details of electrical instruments- Deflecting, controlling and damping forces, supporting systems, Moving coil, Electrodynamic meter, moving iron and induction type instruments, Static Voltmeter and Hot wire type instruments, vibration galvanometer, Standard meters, Shunt & multipliers CT & Pt.
- (3) Wattmeter and Energy meters :- Dynamometer and induction type wattmeter, Induction type E.M. Use of instrument transformer, measurement of 3 phase power in balance and unbalance condition, 3 phase wattmeter.
- (4) Measurement of resistance :- Classification of resistance, effect of contact resistance, Kelvin's double bridge, wheat-stone bridge, Ammeter, voltmeter method and Ohmmeter, multimeter, Effect of Temp. and humidity on insulation resistance. Megger, Importance of earth resistance, Earth tester.
- (5) A.C. Bridges :- Measurement of inductance and capacitance by a.c. bridges: Maxwell, Anderson, Hay's bridge. (no phasor diagram)
- (6) Additional measuring instruments :- Electrical resonance and Weston frequency meter, dynamometer and Lipman p.f. meter, Weston synchroscope, Mertz price maximum demand meter, Rotating type phase sequence indicator.

and Vibration Feed

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(7) MAGNETIC MEASUREMENT : Ballistic galvanometer, measurement of flux by B.G. Gressort flux meter, fishy simplex permeameters, determination of hysteresis loop for ring and bar specimen.

Lloyd Fisher square measurement of iron loss.

(8) Dielectric Measurement.

(1) By Hettmeter.

(2) C.R.O.

(3) Schering bridge.

(9) CATHODE RAY Oscilloscope : CRT Electrostatic and magnetic deflection, time base, x and y amplifiers, controls on the C.R.O. Dual beam oscilloscope.

(10) ELECTRONIC VOLTMETER : Diode & Transistor volt meter, ESTVM, Balanced bridge, D.C. amplifier A.C. & D.C. differential voltmeters, specification of electronic voltmeter, milli and microvoltmeters.

(11) A.F. & R.F. measurement : A.F. & R.F. measurement, ranges of frequency measured, sensitivity etc.

(12) A.F. & R.F. power measurement.

(13) Digital instruments :- Digital instruments, advantages, types of DVM, specifications, digital multimeters, frequency counter/ timers.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : ELECTRONICS AND ELECTRICAL MEASUREMENTS AND
MEASURING INSTRUMENTS.
COURSE CODE NO. : E-405
PRE-REQUISITE : E-401

LIST OF RECOMMENDED EXPERIMENTS.

- (1) Measurement of low resistance by Kelvin Double bridge.
- (2) Measurement of medium resistance by wheat stone bridge.
- (3) Measurement of insulation resistance by Megger.
- (4) Measurement of earth resistance by earth tester.
- (5) Measurement of inductance by Maxwell's bridge.
- (6) calibration of
 - (i) voltmeter.
 - (ii) ammeter.
 - (iii) wattmeter.
 - (iv) Energy meter.
- (7) Measurement of P.F. by ammeter, voltmeter and wattmeter method.
- (8) Measurement of R,L,C, by universal bridge method.
- (9) To plot B.H. curve by method of reversal using B.G.
- (10) Use of CRO for measurement of voltage, current, phase and frequency etc.
- (11) Measurement of 3 phase power by two wattmeter method.
- (12) Study and use of digital instruments, e.g. digital multimeter, frequency meter, electronic timers and counters.
- (13) Study and use of various electrical instrument e.g. phase sequence meter, wave meter, M.D. meter, tong tester.
- (14) study and use of C.T. & P.T. for extension of instrument range.
- (15) Use of multimeter in a circuit for measurement of voltage, current and resistance.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPLI.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : ELECTRONIC AND ELECTRICAL MEASUREMENT AND
MEASURING INSTRUMENT.
COURSE CODE NO. : E-405
PRE-REQUISITE : E-401

REFERENCE BOOKS.

| <u>S.No.</u> | <u>NAME</u> | <u>AUTHOR</u> | <u>PUBLISHER.</u> |
|--------------|--|------------------------|--------------------------|
| (1) | Electrical Measurement & Measuring instruments. | E.W. Golding | Pitman & Sons India Ltd. |
| (2) | A Course in Electrical & Electronic Measurement & Instrumentation. | A.K. Sawhney. | Dhanpat Rai & Sons. |
| (3) | Electrical and Electronics Measurement & Instrumentation. | S. Ramabhadran | Khanne Pub. |
| (4) | Electrical Measurement. | H.V. Satyanarayan Rao. | Khanne Pub. |
| (5) | Electronic Instrumentation. | by Prenshey | Prentice Hall |

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : MECHANICAL ENGINEERING.
COURSE CODE NO. : E-406
PRE-REQUISITE : NIL

RATIONAL E.

It is strongly felt that electrical technician should have basic knowledge of strength of materials, thermodynamics, hydraulics and manufacturing processes. As such the subject Mechanical Engineering is kept for electrical technicians.

After going through the subject, the electrical technician is expected to develop skill to use the above fields in the electrical engineering.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : MECHANICAL ENGINEERING.

COURSE CODE NO. : E-406 PRE-REQUISITE : NIL

SCHEME OF STUDIES.

| S.No. | TOPIC | THEORY HRS. | PRACTICAL HRS. | TOTAL HRS. |
|-------|--------------------------------------|----------------|-------------------|---------------|
| (1) | Properties and Testing of Materials. | 4 | 8 | 12 |
| (2) | Heat treatment. | 4 | - | 4 |
| (3) | Materials. | 6 | - | 6 |
| (4) | Metallurgical Processes. | 3 | 6 | 9 |
| (5) | Shearing and bending moment. | 3 | - | 3 |
| (6) | Bending stresses in beams. | 2 | - | 2 |
| (7) | Torsion. | 2 | - | 2 |
| (8) | Stresses in frames. | 2 | - | 2 |
| (9) | Hydrostatics. | 2 | - | 2 |
| (10) | Fluid mechanics and Machinery. | 4 | 6 | 10 |
| (11) | Properties of gases and Vapours. | 3 | - | 3 |
| (12) | Steam Power Plants. | 3 | 4 | 7 |
| (13) | Ideal Heat Engine Cycles. | 3 | 2 | 5 |
| (14) | I.C. Engines. | 3 | 4 | 7 |
| (15) | Steam turbine. | 2 | 2 | 4 |
| (16) | Power and transmission. | 2 | - | 2 |
| | | 48 | 32 | 80 |

Total Credits - 4.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : MECHANICAL ENGINEERING.

COURSE CODE NO. : E-406 PRE-REQUISITE : NIL.

CONTENTS.

TOPIC 1. PROPERTIES AND TESTING OF MATERIALS :-

Introduction, Mechanical properties- Stress, strain, strength, Elasticity, plasticity, Ductility, Toughness, brittleness, hardness, malleability, formability, weldability, tensile strength, fatigue, Hardenability, stiffness, tenacity, Modulus of elasticity, Modulus of rigidity, endurance, poisson's ratio, proportional limit, yield point, ultimate strength Fabrication characteristics, Destructive and non-destructive testing, stress-strain diagram, Hardness tests, impact tests.

TOPIC 2. HEAT TREATMENT : - Introduction, definitions, classification, types of heat treatment, hardening- case hardening- processes, tempering- processes.

TOPIC 3. MATERIALS : - Introduction, Ferrous materials - cast iron, -Classification, wrought iron, steel- classification - Alloy steels Major alloying elements, stainless steel, - low carbon medium carbon and high carbon steels- classification of alloy steels, tool steels, Non-ferrous metal, - copper properties, application and classification, Brass-types Bronze- types and applications, special alloys- high tensile brass german silver, monel metal, bearing alloys, Aluminium - Classification and application, Zinc- properties, zinc alloys, Tin properties- application, plastic- classification, application, lubricants- properties and selection.

TOPIC 4. METALLURGICAL PROCESSES :- Introduction- various processes, secondary processes, application of powder metallurgy, advantages and disadvantages, welding- purpose, types- Arc welding, Thermit welding, Resistance welding, plastic or forged welding, soldering, brazing.

TOPIC 5 SHEARING AND BENDING MOMENT :- Introduction, definition, bending, pure bending, transverse bending, shear force and bending moment, S.F. & B.M. diagrams for cantilever, simply supported and overhanging with point and U.D.L.

TOPIC 6 BENDING STRESSES IN BEAMS :- Introduction, definition assumptions, theory of simple bending, Neutral axis, moment of resistance, section modulus, Hollow circular sections.

TOPIC 7 TORSION :- Introduction, theory of pure torsion of circular shaft, assumption made, polar modulus, torsional rigidity, H.P. transmitted by a shaft.

TOPIC 8 STRESS IN FRAMES :- Introduction, classification, perfect, imperfect and redundant frame, stress calculation- graphical method only.

TOPIC 9 HYDROSTATICS :- Introduction - fluids and their properties liquid pressure, intensity of pressure, pascal's law, pressure head of liquid, total pressure, centre of pressure, Determination of centre of pressure in case of inclined plane, Concept of atmospheric and gauge pressure, absolute pressure.

TOPIC 10 FLUID MECHANICS & MACHINERY :- Introduction, types of flow, Bernoulli's theorem- statement, and its application. J- tube differential manometer, venturimeter, pilot tube, orifice meter, Cc, Cv & Cd, Notches- rectangular, triangular and trapezoidal notch- determination of discharge, weir- types, determination of discharge, loss of head due to friction, hydraulic gradient, total energy, reciprocating pump, centrifugal pump, comparison, water turbines- purpose, type- construction and working of pelton wheel, Francis and Kaplan turbines Hydel power plant.

Contd..

- TOPIC 11 PROPERTIES OF GASES AND VAPOURS :- Introduction, internal energy, specific heat, enthalpy, Charles's law Boyle's law, characteristic equation for perfect gas. 1st law and 2nd law of thermodynamics, entropy, universal gas constant, Isothermal, Isobaric, Isochoric, Adiabatic, Isentropic, Polytropic, free expansion, throttling processes.
- TOPIC 12 STEAM POWER PLANTS : Boilers and accessories, Introduction, Basic steam power cycle, classification of boilers, boiler mountings, boiler accessories, super-heater, Economizer, air pre-heaters, root blower, Modern high pr. boilers.
- TOPIC 13 IDEAL HEAT ENGINE CYCLES :- Introduction, Ideal cycles, Thermal efficiency Indicator diagram, I.H.P., B.H.P. mech, Carnot cycle.
- TOPIC 14 I.C. ENGINES :- Introduction, working principle of petrol and diesel engines, 2 & 4 stroke cycle engines, cooling, lubricating systems, specification of I.C. engines.
- TOPIC 15 STEAM TURBINE :- Introduction, working principle, types functions and applications.
- TOPIC 16 POWER & TRANSMISSION :- Introduction belt drive gears- types, velocity ratio, Max. power for belt drive.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : MECHANICAL ENGINEERING.
COURSE CODE NO. : E-406 PRE-REQUISITE : NIL.

LIST OF EXPERIMENTS.

- (1) study of universal testing machine.
- (2) study of hardness tester and impact testing M/c.
- (3) To perform tensile and compression test on U.T.N.
- (4) To perform hardness test on Brinell . Hardness testing M/c. and Charpy/Izod test on impact testing M/c.
- (5) study of welding machines.
- (6) To prepare joint by welding, soldering and brazing.
- (7) study of reciprocating pump.
- (8) study of centrifugal pump.
- (9) Determination of discharge through venturimeter.
- (10) study of Fire- tube boiler.
- (11) study of water tube boiler.
- (12) study of 2/4 stroke petrol engine.
- (13) study of 2/4 stroke Diesel engine.
- (14) study of steam turbine- Impulse/ Reaction.

M.D.H.V. PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPLI.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : MECHANICAL ENGINEERING.

COURSE CODE NO. : E-406 PRE-REQUISITE : NIL.

LIST OF IS CODE AND BOOKS.

- (1) IS : 1499-1977 Method for Charpy Impact Test (U-Notch) for metal ISI.
- (2) IS : 1598-1977 Method for Izod Impact test of Metal -dd-
- (3) IS : 4258-1967 Hardness conversion Tables for metal -do-
- (4) IS : 1500-1968 Method for Brinell Hardness test for -do- steel.
- (5) IS : 1789-1961 Method for Brinell hardness test for Grey cast Iron.
- (6) IS : 1521-1972 Method for Tensile Testing of steel wire.
- (7) IS : 1501-1968 Method for Vickers Hardness Test for Steel.
- (8) IS : 1586-1968 Method for Rockwell hardness Test (B and C scales) for steel.
- (9) IS : 5619-1970 Recommendations for fatigue testing of metals.
- (10) IS : 5242-1969 Method of test for determining shear strength of mild steel.
- (11) IS : 1692-1974 Method for simple bend testing of steel sheet and strip less than 3mm thick.
- (12) IS : 1599-1974 Method for bend test for steel products other than sheet, strip wire and tube.
- (13) Manufacturing processes by Herbert W Yankee-Prentice Hall
- (14) Thermodynamics by R. Yadav Central Book Depot.
- (15) Thermodynamics by Vaswanti & Kumar.
- (16) Hydraulics & Hyd. M/cs. by K.D. Saxena.
- (17) General Mechanical Engineering by Hazra & Choudhary.

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MIDHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL

.....
THREE YEARS DIPLOMA PROGRAMME IN

ELECTRICAL ENGINEERING

UNDER

MULTIPOINT ENTRY AND CREDIT SYSTEM.
.....

DETAILED SYLLABUS

APPLIED TECHNOLOGY COURSES FOR ELECTRICAL ENGINEERING

- E 501 INSTRUMENTATION AND CONTROL.
- E 502 GENERATION TRANSMISSION AND DISTRIBUTION.
- E 503 UTILISATION OF ELECTRICAL POWER.
- E 504 POWER SYSTEM OPERATION AND PROTECTION.
- E 505 INDUSTRIAL MANAGEMENT.
- E 506 INDUSTRIAL ELECTRONICS.
- E 507 ELECTRICAL INSTALLATION AND MAINTENANCE.
- E 508 ESTIMATING AND COSTING.
- E 509 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.

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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 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 opportunity for taking alternative courses appropriate to their capability.

The National policy on Education, therefore, 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 an 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)

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- (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 overlaps of the content.
- (d) Relevance of the content.
- (e) Prerequisite of the content.

(Contd....)

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The comments and healthy criticism from faculty members are however welcome, so that this prepared syllabi 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, TMI, Bhopal and the CDC faculty of TMI, 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.

LIST OF PARTICIPANTS.

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. 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.

T.I. FACULTY.

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

CURRICULUM DEVELOPMENT CENTRE.

- Shri Ashok Ratnaparkhi. Joint Director.
- Shri K.K.Jain. Deputy Director.
- Shri C.P.Bhargava. Deputy Director.

* * *

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION, ENGPAL.
 REVISED ON 15.10.92.
 W.E.F. Oct/Nov. 92. (DDE)

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| APPLIED TECHNOLOGY | | | | | | | | | | | | | | | | | | | | |
|--------------------|----------|--|---------|------------|------|---------|----------|------------|------------|---------------|----------|--------|----------|-------|----------|-------|----------|--------|----|-----|
| S.No. | Code No. | Courses | Pr. Th. | Hours/week | Cre- | Pr. Th. | Term Lab | Assessment | paper Dur. | Marks. | Pr. Dur. | Marks | Pr. Dur. | Marks | Pr. Dur. | Marks | Pr. Dur. | Marks | | |
| | | | | | | | | | | I | | II | | | | | | | | |
| | | | | | | | | | | work | work | | | | | | | | | |
| 1. | E-501 | Instrumentation & Control. | E405 | 5 | 2 | 6 | 20 | 20 | 10 | 10 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 50 | |
| 2. | E-503 | Utilisation of Electrical Power. | E402 | 4 | 2 | 5 | 20 | 20 | 10 | 10 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 50 | |
| 3. | E-504 | Power system operation & Protection. | E402 | 4 | 2 | 5 | 20 | 20 | 10 | 10 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 50 | |
| 4. | E-505 | Industrial Management. | - | 4 | - | 4 | 20 | - | 10 | 10 | 1 | 3 Hrs. | 100 | - | - | - | - | - | - | |
| 5. | E-506 | Industrial Electronics. | E403 | 4 | 2 | 5 | 20 | 20 | 10 | 10 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 50 | |
| 6. | E-507 | Electrical Installation & Maintenance. | - | 3 | 2 | 4 | 20 | 20 | 10 | 10 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 50 | |
| 7. | E-508 | Estimating & Costing - 90 Credits | - | 4 | - | 4 | 20 | - | 10 | 10 | 1 | 3 Hrs. | 100 | - | - | - | - | - | - | |
| 8. | E-509 | Project. | - | 5 | 5 | - | - | 50 | - | - | - | - | - | - | - | - | - | - | 50 | |
| | | | | | | | | | | Total Credits | 38 | 140 | 150 | 70 | 70 | 7 | 7 | 7 | 7 | 300 |

REMARKS:

(1) Student will not be able to take these 5 & 6 level courses unless he clears all foundation courses.

(2) Course code E-505 is common with Mechanical & Electrical.

| | | |
|------------------------|--------|--|
| (1) Sessional Marks | : 290 | Total Marks considering Applied Category & Diversified Category. |
| (2) Prog. Ass. Marks. | : 140 | (1) Sessional Marks |
| (3) Theory paper marks | : 700 | (2) Prog. Ass. Marks |
| (4) Practical Marks | : 300 | (3) Theory paper Marks |
| | | (4) Practical Marks |
| Total Marks | : 1430 | Total Credits |
| Total Credits | : 38 | Total Credits |

Total Credits = 38

Total Marks = 1430

Total Credits = 38

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : INSTRUMENTATION & CONTROL

COURSE CODE NO. : E-501

PRE-REQUISITE : E-402, E-403, E-405

R A T I O N A L E

There has been a tremendous growth in the field of instrumentation and automation over the past few decades and almost all non electrical measurements have been replaced by electrical and electronic measurements. It is, therefore, very essential that students be given knowledge of the basic principles of vast field of instrumentation and with this view this Subject has been included in the curriculum as an Applied Technology subject in the multi point entry and credit system. The curriculum broadly covers the area of measurement of physical quantities using electrical transducers, elementary and process control.

The subject is dealt at the level of basic principles in order to develop broad base concept so the student is able to utilise and develop his knowledge in the field.

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PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : INSTRUMENTATION AND CONTROL.

COURSE CODE NO. : E-501 PRE-REQUISITE : E-402, E-403, E-405.

SCHEME OF STUDIES

| S.No. | TOPIC | THEORY HRS. | PRACTICAL HRS. | TOTAL |
|-------|-------------------------------------|----------------|-------------------|-------|
| 1. | Measuring system. | 6 | 2 | 8 |
| 2. | Transducers. | 12 | 6 | 18 |
| 3. | Signal conditioners. | 12 | 2 | 14 |
| 4. | Indicators and Recorders. | 8 | 4 | 12 |
| 5. | Measurement of Physical quantities. | 16 | 8 | 24 |
| 6. | Material Analysis. | 10 | 4 | 14 |
| 7. | Telemetry. | 8 | 4 | 12 |
| 8. | Process control. | 8 | 2 | 10 |
| | | 80 | 32 | 112 |

Credits - 6.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPLAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : INSTRUMENTATION AND CONTROL.

COURSE CODE NO. : E-501 PRE-REQUISITE : E-402, E-403, E-405.

C O N T E N T S

TOPIC No.1 MEASURING SYSTEM :- Elements of a measuring system, Block diagram, performance, standards, time lag error, distortion, noise and noise factor.

TOPIC 2 TRANSDUCERS :- Importance and characteristics, Actuating mechanism, classification self generating type transducers, moving coil microphone, thermo couples fows types material and ranges, photo electric transducers, characteristics and application, piezo electric effect, materials and applications. Variable parameter transducers, classification types and measurement by strain gauge, potentiometric transducers, Magneto striction transducer, Inductance transducers classification and application. Differential type self inductance transducer, mutual inductance transducer and L.V. D T. connection, operation and application. Capacitance transducers working and application. Frequency generating transducers classification and application.

TOPIC.3 SIGNAL CONDITIONERS : - Purpose, classification, input modifier, frequency range d.c. amplifier, chopper amplifier, Instrumentation amplifier, potentiometer and bridge devices.

TOPIC. 4 INDICATORS AND RECORDERS :- End devices- classification, Digital indicators, 7 segment L.E.D. display, Nixie tube L.C.D. display, Recorders- types- objectives and classification. Other forms of recorder-printer, magnetic tape, floppy disc,

contd..

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- TOPIC NO. 5. MEASUREMENT OF PHYSICAL QUANTITIES :- Measurement of non electrical quantities by electrical methods and its advantages and disadvantages. Measurement of pressure, pressure actuator, Pirani gauge, Thermo couple gauge, L.V.D.T. strain gauge and capacitor gauge. Flow measurement electro magnetic flow meter, photo electric and temperature measurement- Resistance thermometers, materials, ranges characteristics and measurement by bridge circuit. Thermistors, ranges characteristic and applications, optical and radiation pyrometers. Measurement of level- Potentiometer, Capacitive, photoelectric methods. Measurement of speed, vibration, velocity and acceleration by frequency generating transducers, vibration pick up, velocity and acceleration measurement by inductive and capacitive transducers, Measurement of strain, bending and torsion by strain gauge, Measurement of weight by strain gauge and L.V.D.T.
- TOPIC No.6. MATERIAL ANALYSIS :- Humidity, deformation and its measurement by resistance and capacitive transducer. PH value- meaning and its scale, PH cell and PH meter. Gas analysis by thermal and conductivity cell oxygen analysis.
- TOPIC No.7 TELEMETRY :- Necessity, principle, classification, current and voltage telemetry. Position telemetry- synchro. Frequency and pulse, telemetry- principle pulse modulation PAM PPM & PFM and PCM. elementary ideas about land line and R.F. telemetry methods of transmission, multiplexing. Application and choice of system.
- TOPIC No.8 PROCESS CONTROL :- Importance and definition of variables, Open loop and closed loop control system, block diagram. Servomechanism ON-OFF control.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : INSTRUMENTATION AND CONTROL.

COURSE CODE NO. : E-501 PRE-REQUISITE : E-402, E-403, E-405

LIST OF RECOMMENDED PRACTICALS FOR INSTRUMENTATION AND
CONTROL.

- (1) Determination of noise factor using wave distortion meter.
- (2) Measurement of load/ weight using strain gauge and cantilever.
- (3) Measurement of linear displacement by LV, D.T. & to draw its characteristics.
- (4) Measurement of liquid level using capacitive transducer.
- (5) Measurement of temperature by
 - (i) Thermo couple
 - (ii) Thermistor
 - (iii) Resistance thermometer.
- (6) Measurement of pressure using LV, D.T. & diaphragm gauge.
- (7) Measurement of level using potential divider.
- (8) Measurement of PH value using pH meter.
- (9) Measurement of speed by stroboscope and/or F.G.T.
- (10) Measurement of :
 - (i) Humidity
 - (ii) Conductivity
 - (iii) viscosity using available transducers.
- (11) study and measurement of error voltage of synchros.
- (12) study of time division and frequency division multiplexing system.
- (13) Measurement of angular displacement by capacitive transducer.
- (14) Measurement of vibration using piezo electric transducer.
- (15) Measurement of displacement by inductive transducer.
- (16) Measurement of linear displacement by L.D.R.
- (17) Study and measurement of temperature using optical/ Radiation pyrometer.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : INSTRUMENTATION AND CONTROL.
COURSE CODE NO. : E-501
PRE-REQUISITE : E-402, E-403, E-405.

LIST OF REFERENCE BOOKS.

- | | Writer |
|--|-----------------------------|
| (1) Electrical & Electronic Measurement & Instrumentation. | - A.K. Shawhney. |
| (2) Instrumentation & devices. | - Sharma & Mani Rangan. |
| (3) Process control. | - Harriot T.M.H.Edition. |
| (4) Electronic instrumentation. | - Prensley Prentice Hall |
| (5) Mechanical & Industrial measurement. | - R.K. Jain Khanna Pub. |

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : GENERATION, TRANSMISSION AND DISTRIBUTION
COURSE CODE NO. : E-502
PRE-REQUISITE : NIL.

R A T I O N A L E

The basis of entire use of electricity is governed by its generation, transmission and distribution. Day by day the use of electricity is spreading tremendously. Hence the field of generation, distribution and transmission has got great importance. Power station high voltage transmission lines and wide spread distribution system makes this subject very useful so it is essential to make the students well familiar with this subject in order to enable him to perform his duties confidently and efficiently. To understand the subject better, frequent visits should be arranged in consultation with state Electricity Boards/various departments and industries to see the machines, instruments, structures etc. on the spot in working conditions. Special attention has been drawn in the topic of Generation by introducing portion for pollution control.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : GENERATION, TRANSMISSION AND DISTRIBUTION.
COURSE CODE NO. : E-502
PRE-REQUISITE : NIL.

SCHEME OF STUDY

| S.No. | TOPIC | THEORY HRS. | PRACT.HRS. | TOTAL |
|-------|---------------|-------------|------------|-------|
| 1. | Generation. | 25 | 10 | 35 |
| 2. | Economics. | 10 | - | 10 |
| 3. | Tariffs. | 08 | - | 08 |
| 4. | Transmission. | 22 | 10 | 32 |
| 5. | Distribution. | 15 | 12 | 27 |
| Total | | 80 | 32 | 112 |

Credits - 6

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : GENERATION, TRANSMISSION AND DISTRIBUTION.
COURSE CODE NO.: E-502 PREREQUISITE : NIL.

CONTENTS.

TOPIC NO. 1 GENERATION :
Conventional and non-conventional energy sources, Renewable sources of energy, sources for bulk energy generation, Thermal, Hydro and Nuclear power generation. Efforts being done for Magneto hydro-dynamic (MHD) Wind, Tidal, Geothermal, Photo-voltaic and Biogas. Detailed study of generating stations- Thermal, Hydro and Nuclear schematic diagram, site selection, component, equipments and auxiliaries for thermal power Hydro power and Nuclear power stations. *Non conventional sources of energy*
Advantages / Disadvantages of Thermal, Hydro, Nuclear, Gas turbine plant and Diesel power plants.
Hydro power station- Multipurpose hydro projects, Types of water turbines, auxiliaries.
Nuclear power stations :- Types of reactors fuels used. Gas turbine plant and diesel power plants, preventive measures to control pollution, in various generating stations.

U-I

TOPIC .2 ECONOMICS :
Concept of terms like -- Maximum demand, connected load, load curves, max. demand factor, load factor Diversity factor, Plant factor, Plant utilization factor , spinning reserve, Base load and peak load. Numericals on above terms.

V-IT

TOPIC NO. 3 TARIFFS :
Types, Flat, Block, Two-part, Max. demand and power factor tariffs, Their merits and demerits, selection of tariff.

TOPIC NO. 4 TRANSMISSION :
Concept of transmission, single line diagram of complete power system, standard voltages of A.C, transmission. Transmission efficiency, H.V.D.C. transmission system. (line Diagram) *(No derivation)*
Overhead lines (a) Mechanical design K₁-1 concept sag- calculation of sag on equal level supports. Effect of wind ice and temp. on sag, sag template.

U-III

problem on formula
Sag concept, causes, effect of sag.

1. Non Conventional Sources of Energy
 Concept and need of primary and secondary energy sources, Differences between conventional and non-conventional sources of energy. Concept of solar, wind, Biogas, Ocean, Tidal, Geothermal, fuel cells, MHD and their practical applications.

3. Economics → Load, Types of load, load curve, load duration curve, constant load, Average load, Maximum Demand, L.F., Diversity factor, ~~Maximum Demand Factor~~, Plant factor, Plant Utilization factor, Reserve capacity, Capacity factor, Numerical on above terms.

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Types of line supports, joints, clamps, earth wires and guards, vibration dampers

Qv-II
Importance of R, L, C in economic line (No design)

(b) Electrical Design :

R.L.C. of single and three phase line, Transposition, corona discharge and power loss.

Types of insulators, string efficiency and voltage distribution. Grading ring and arcing horns, Testing of insulators.

(c) Underground cables :

Classification construction of L.T. & H.T. cables Advantages and disadvantages of cables. Selection of cables, Methods of laying.

v-IV

(d) Transmission line calculations :

Lumped and distributed constants " π " and " T " line concepts. Voltage regulation, Transmission efficiency. Ferranti effect.

v-IV

TOPIC NO. 5 DISTRIBUTION :

v-V

Classification of distribution lines, Ring main, Radial etc. Permissible voltage drops. Calculations, Extension of existing lines. I.S. codes of clearance of conductor, conductor clearance from telephone lines, Railway lines, building etc. Earthing of lines, Stay wires etc.

service mains : service line to a small building Big institution, and factories.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL,

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
COURSE : GENERATION, TRANSMISSION AND DISTRIBUTION.
COURSE CODE NO. : E-502
PRE-REQUISITE : NIL

LIST OF EXPERIMENTS.

- (1) Performance of short transmission line
(a) "π" and (b) "T" configurations.
(simulation can be done by selecting suitable resistance capacitance and inductance.)
- (2) Study of different types of insulators.
- (3) Voltage distribution across a string of insulators.
(By simulating condensers) and calculation of fascimile insulator string
- (4) Study of L.T. and H.T. cables and different types of overhead conductors.
- (5) Voltage distribution in a radial system and ring main system.
- (6) Use of current transformer for measuring high currents.
- (7) Visit to a sub-station and if possible to a generating stations.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
COURSE : GENERATION, TRANSMISSION AND DISTRIBUTION.
COURSE CODE NO. : E-502 PREREQUISITE : NIL.
SUBJECT : GENERATION TRANSMISSION AND DISTRIBUTION.

LIST OF REFERENCE BOOKS.

- (1) A course in Electrical Power By- Soni, Gupta and
Bhatnagar
(Dhanpat Rai &
Sons Pub.)
- (2) Indian Electricity Rules &
related I.S. Codes.
- (3) Electrical Power By- S.L. Uppal
(Khanna Pub.)
- (4) Transmission and Distribution of electrical power. By- Raina
T.P.T.I. Chandigarh.
- (5) Transmission and Distribution By- J.B. Gupta.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : UTILISATION OF ELECTRICAL POWER.

COURSE CODE NO. : E-503.

PRE-REQUISITE : E-402.

R A T I O N A L E

Utilisation of Electrical Power is the important activity in the field of Electrical Engineering. Electrical power is used for Industrial commercial and domestic purposes. It is, therefore, quite natural that a large number of technicians are called upon to work in establishments which utilise electrical power. The syllabus of the subject is aimed at giving the student a sufficient background to understand the salient features for the utilisation of Electrical energy in various field.

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MIDHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : UTILISATION OF ELECTRICAL POWER

COURSE CODE NO. : E-503 PRE-REQUISITE : E-402

SCHEME OF STUDIES

| S.No. | TOPICS. | THEORY HRS. | PRACTICAL HRS | TOTAL |
|-------|--|-------------|---------------|-------|
| 1. | Electric drives. | 16 | 10 | 26 |
| 2. | Electric Heating. | 10 | 6 | 16 |
| 3. | Electric welding. | 06 | 2 | 8 |
| 4. | Illumination. | 12 | 6 | 18 |
| 5. | Power factor improvement | 6 | 4 | 10 |
| 6. | Electro Chemical process and Storage Batteries. | 14 | 4 | 18 |
| | | 64 | 32 | 96 |

Total Credits 5

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : UTILISATION OF ELECTRICAL POWER

COURSE CODE NO. : E-503 PREREQUISITE : E-402

C O N T E N T S

TOPIC NO. 1 ELECTRIC DRIVES :

Merits and demerits of Electric drives, Factors governing selection of motors, Drive requirements. Group and individual drive, starting and running characteristics of various motors. Selection of starters, hand operated and contactor type starters, liquid resistor type starter. Speed control of motors, electronic speed control, Load equalisation, use of fly wheel, Motor enclosures, Selection of motors for particular service size and rating of motors.

TOPIC 2 ELECTRIC HEATING :

Advantages and disadvantages of Electric heating. Methods of electric heating. Principle of electric heating. Resistance heating, heating elements and alloys. Causes of failures of heating elements. Arc furnaces, principle, construction, working and uses, electrode materials. Induction heating principle, construction and use of Ajax Wyatt (core type) and coreless type. L.f. and h.f. induction furnaces. Dielectric heating principles and uses.

TOPIC 3 ELECTRICAL WELDING :

Definition, classification of Electrical welding, Principle of arc welding, electrical principles of an arc, electrodes for metallic arc welding arc length, arc time and arc current. Qualities of a good weld, weld defects. Resistance welding, advantages, classification, principle and working, comparison of resistance in arc welding process, A.C. & D.C. arc welding.

Contd....

TOPIC NO. 4 ILLUMINATION :

Electromagnetic wave spectrum, solid and plane angle, definition of Electrical terms used, sensitivity of human eye. Luminous efficiency, polar curve, horizontal and vertical laws of illumination, definition of terms used in lighting scheme, lighting scheme calculation, street and Flood lighting scheme, various types of lamps, their use and fittings.

TOPIC NO. 5 POWER FACTOR IMPROVEMENT :

Causes of low p.f. Ill effects of low p.f. Methods of improvement of p.f. and its economics.

TOPIC NO. 6 ELECTRO-CHEMICAL PROCESSES AND STORAGE BATTERIES :

Electro deposition and Faraday's laws of electrolysis various electro-chemical processes like electroplating electro-extraction, electro-winning, anodising and their applications.

Storage batteries, classification construction, Battery maintenance, Battery charging circuit diagram, Application of storage batteries.

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MIDHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : UTILISATION OF ELECTRIC POWER.

COURSE CODE NO. : E-503 PREREQUISITE : E-402.

SUBJECT : UTILISATION OF ELECTRIC POWER

LIST OF PRACTICALS.

- (1) study and operation of D.C. Motor starters.
 - (a) Two point, three point and four point starter.
 - (b) Drum type controllers.
- (2) Study and operation of starter of Induction Motors.
 - (a) D.O.L.
 - (b) Star-Delta starter.
 - (c) Rheostatic type starter/ Liquid starter.
- (3) Speed/ torque characteristics of D.C. shunt/series/ compound motor.
- (4) Speed control of slip ring motor by variation of rotor resistance.
- (5) Speed control of squirrel cage Induction motor by changing no. of poles/frequency.
- (6) To verify the change in power factor by changing load parameters and its improvement using capacitance.
- (7) To draw 'V' curves of synchronous motor.
- (8) Study and operation of resistance oven and to control its temperature.
- (9) Study of Dielectric/Induction heating.
- (10) Measurement of luminous efficiency of lamps by lux meter.
- (11) Study and operation of various types of lamps.
- (12) Study of electro plating/ electro extraction.
- (13) Study of arc welding.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : UTILISATION OF ELECTRIC POWER

COURSE CODE NO. : E-503

PRE-REQUISITE : E-402

REFERENCE BOOKS.

| <u>S.NO.</u> | <u>NAME</u> | <u>WRITER/AUTHOR</u> | <u>PUBLISHER.</u> |
|--------------|--|----------------------|----------------------------|
| 1. | Electrical Power | Dr. S.L. Uppal. | Khanne Pub. |
| 2. | Art and science of Ut. of Electrical Energy. | H. Pratch. | Dhanpat Rai & Sons Pub. |
| 3. | Utilisation of Electrical Energy. | E.O. Taylor. | Orient Longman |
| 4. | Electrical Utilisation | Balwarsingh. | Bright Pub. Allahabad. |
| 5. | A Course in Electric Power. | J.B.Gupta. | Chaston Pub. House. |

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : POWER SYSTEM OPERATION AND PROTECTION.
COURSE CODE NO. : E-504.
PRE-REQUISITE : E-402, E-405

R A T I O N A L E

A technician has to play an important role in the operation of a power system; so that apart from reliability of operation the system stability is also maintained within the desired limits. It is, therefore, necessary that a technician must understand the problems of system operation.

The protective equipment used in an electrical power system have an important relation with the variety of power system problems, hence the power system operation and protection are being grouped together to make one comprehensive subject.

The curriculum has been designed to meet the requirements of a technician engineer, so that he can skillfully handle the problems of the power system. The contents included in the subject are kept at a level to develop proper skills, knowledge and attitude suiting to the job requirement.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPLI.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : POWER SYSTEM OPERATION AND PROTECTION.

COURSE CODE NO. E-504 PRE-REQUISITE : E-402, E-405

SCHEME OF STUDIES.

| No. | TOPIC | THEORY HRS. | PRACTICAL HRS. | TOTAL HRS. |
|-----|---|----------------|-------------------|---------------|
| 1) | INTRODUCTION TO POWER SYSTEM. | 3 | - | 3 |
| 2) | REPRESENTATION OF POWER SYSTEM. | 5 | 4 | 9 |
| 3) | SYMMETRICAL COMPONENTS. | 5 | 4 | 9 |
| 4) | POWER SYSTEM STABILITY AND RELIABILITY. | 6 | - | 6 |
| 5) | CONTROL OF ACTIVE AND REACTIVE POWER. | 2 | - | 2 |
| 6) | MODERN TRENDS. | 5 | 2 | 7 |
| 7) | INTRODUCTION TO PROTECTION | 4 | 4 | 8 |
| 8) | PROTECTIVE RELAYING. | 8 | 4 | 12 |
| 9) | CIRCUIT INTERRUPTION DEVICES. | 10 | 6 | 16 |
| 10) | PROTECTION AGAINST OVER VOLTAGES. | 6 | 4 | 10 |
| 11) | PROTECTIVE SCHEMES. | 10 | 4 | 14 |
| | | 64 | 32 | 96 |

Total Credits 5.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : POWER SYSTEM OPERATION AND PROTECTION.
COURSE CODE NO. : E-504 : PREREQUISITE :- E-402, E-405

C O N T E N T S.

- (1) INTRODUCTION TO POWER SYSTEM :
Growth of Power system in India, Future schemes, various elements of power system. Interconnection, its necessity and advantages, Planning operation and improvement of power system Load study, Type of fault AC/DC calculating board/digital computers.
- (2) REPRESENTATION OF POWER SYSTEM :
Single line diagram, Use of standard symbol. P.U. quantity definition and advantages, Base impedance conversion of p.u. values from one set of base values to other base values. Generalised ABCD constants, Their values in terms of circuit parameters. To prove $AD-BC=1$, characteristics of ABCD constants. The relations of $Z_{so}, Z_{ss}, Z_{ro}, Z_{rs}$ in terms of generalised constants. || 2(a)
- (3) SYMMETRICAL COMPONENTS : *Analysis of faults*
Operator a and j. Resolution of unbalanced three phase system into positive, negative and zero sequence components. Relation between unsymmetrical and symmetrical components. Phase sequence impedance, phase sequence networks. Analysis of L-G, L-L and L-L-G fault by symmetrical components, Numericals. * In class or at
- (4) POWER SYSTEM STABILITY AND RELIABILITY. :
Necessity of stability its meaning, types of stability, stability limit, Elementary two machine system. Power angle characteristic, Equal area criterion, swing equation, Factors affecting stability, Methods of improving stability. Reliability - Factors affecting reliability. Methods of improving reliability. Functions of a system operator to maintain reliability.

- (5) CONTROL OF ACTIVE & REACTIVE POWER FLOW :
General considerations, control of voltage, frequency and power in an interconnected system. Methods of supplying VAR.
- (6) MODERN TRENDS :
E.H.T. Lines, Bundled conductors. HVDC system- block diagram and advantages and disadvantages.
- (7) INTRODUCTION TO PROTECTION :
Purpose of a Protective system requirement and selection. Abnormalities in a power system and their effects. Reasons for failure of Air/Organic/porcelain insulation. Self and non-self clearing faults. Use of CT/PT in protective scheme. Definition of terms regarding CT/PT. Advantages. Neutral earthing, their methods and advantages.
- (8) PROTECTIVE RELAY :
Type of relays, construction details, purpose, requirements of protective gear characteristics desirable. Primary and back up relaying. Types of back up relays, causes of failure of primary relaying. Explanation of terms used in relaying.
Principle and working of different types of relays- electromagnetic and induction type. Induction type over current relay; reverse power relay time and current settings. Differential relays- Distance relays. Thermal relay inverse current characteristics.
- (9) CIRCUIT INTERRUPTION DEVICES:
Function of fuse. fusing factor, fusing characteristic Advantages and Disadvantages. Difference between isolator and circuit breakers. Circuit breaker capacities. Arc formation in C.B. and methods of arc extinction. Definition of various terms with reference to circuit interruption wave form. Working principle and operation of Bulk oil/Minimum oil/Air blast/SF CB. Merits and Demerits of different types of C.B.
- (10) PROTECTION AGAINST OVER VOLTAGES :
Causes and effects of over voltage. Travelling waves. Over voltage Protection- Earthwire, Lighting arresters- Multiple gap type, horn gap type. Line type, station type and distribution type. Surge absorber.

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(ii) PROTECTIVE SCHEMES :

Protection of alternator- Various abnormalities Merz price differential protection, over current and earth fault protection.

Protection of transformer- Various abnormalities differential protection Buchholz relay.

Feeder and transmission line protection- Time graded and over current protection- current graded system differential protection.

Protection of Induction Motors- Use of thermal relays and under voltage protection.

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MIDHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPLA.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : POWER SYSTEM OPERATION AND PROTECTION.

COURSE CODE NO. : E-504 PRE-REQUISITE : E-402, E-405.

LIST OF EXPERIMENTS.

- (1) To determine the positive, negative, zero sequence and neutral currents of an unbalanced alternator.
- (2) To determine the ABCD constants of a given π -Tee network.
- (3) To determine Z_{so} , Z_{ss} , Z_{ro} , Z_{rs} for a given π -Tee network.
- (4) Study of a HVDC system.
- (5) Study and use of CT/PT. employed for protection and determine their ratio error.
- (6) Study of an Induction type o/c relay and plot the inverse characteristic.
- (7) To plot the inverse characteristic (current time) of a given fuse wire.
- (8) To determine the fusing factor of different fuse wire.
- (9) To study the differential protection of transformer/alternator.
- (10) Visit to power station- Study of different Protective elements/schemes- ground wire Lightning arrestors, D.C. fuse, c-circuit breaker.
- (11) To find out values of various electrical quantities with the help of calculating boards.

MIDHYA PRDESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
COURSE : POWER SYSTEM OPERATION AND PROTECTION.
COURSE CODE NO. : E-504 PRE-REQUISITE : E-402, E-405.

LIST OF REFERENCE BOOKS.

| <u>S.No.</u> | <u>NAME</u> | <u>AUTHOR</u> | <u>PUBLISHER.</u> |
|--------------|---|-----------------------|-----------------------|
| (1) | Switchgear & Protection | Sanil Rao | Khenne Pub. Delhi. |
| (2) | A course in Electrical Power. | J.B.Gupta. | Kalson Pub.Ludhiana. |
| (3) | Transmission & Distribution of Electrical Energy. | H.Cotton & Barber. | E.L.B.S. |
| (4) | A course in Elect.Power. | Soni,Gupta Bhatnagar. | Dhanpat Rai and Sons. |
| (5) | Electrical Power | S.L.Uppal. | Khanna Publisher . |
| (6) | Principles of Elect. Power Transmission. | H. Waddicar. | Asia Pub. House. |
| (7) | Elements of Power System Analysis. | W.D.Stevenson. | Mcgraw Hill. |
| (8) | Power system operation | R.H. Miller | Mcgraw Hill. |

S.No. NAME AUTHOR PUBLISHER.

(1) Switchgear & Protection Sanil Rao Khenna Pub. Delhi.

(2) A course in Electrical Power. J.B.Gupta. Kalson Pub.Ludhiana.

(3) Transmission & Distribution of Electrical Energy. H.Cotton & Barber. E.L.B.S.

(4) A Course in Elect.Power. Soni,Gupta Bhatnagar. Dhanpat Rai and Sons.

(5) Electrical Power S.L.Uppal. Khanna Publisher .

(6) Principles of Elect. Power Transmission. H. Waddicar. Asia Pub. House.

(7) Elements of Power System Analysis. W.D.Stevenson. Mcgraw Hill.

(8) Power system operation R.H. Miller Mcgraw Hill.

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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-REQUISITE : 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 impart 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 competence in 'Supervision'. If he supplements this background with a minimum of experience there can be no reason as to why he would not make an 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 with what is now-a-days popularly known as the 'Mathematical Approach towards Management'. Of course the use of mathematical statistics in particular in planning and controlling production, inventory and project work.

contd..

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Modern management concepts like CPM and PERT ~~value~~ value determination, Inventory control and economic batch size under the mathematical approach. It is now realized in all industry that these techniques pay back well-on implementation. Detailed coverage of these 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.

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

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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. | 2 | - | 2 |
| 2. | System Thinking. | 3 | - | 3 |
| 3. | Materials Management. | 10 | - | 10 |
| 4. | Production planning & control. | 8 | - | 8 |
| 5. | Value analysis. | 2 | - | 2 |
| 6. | Project planning by Network. | 10 | - | 10 |
| 7. | Industrial Relations. | 6 | - | 6 |
| 8. | Supervision & Leadership | 6 | - | 6 |
| 9. | Organisational Dynamics. | 8 | - | 8 |
| 10. | Operation Research. | 6 | - | 6 |
| 11. | Computers in Management. | 3 | - | 3 |
| | | 64 | - | 64 |

Credits - 4

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

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

CONTENTS.TOPIC -1. WHAT IS MANAGEMENT.

Management definition, activities Theories- Decision, quantitative, Mathematical, Behavioural Sciences.

TOPIC-2. SYSTEM THINKING.

System definition, 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 J.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, characteristics 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.

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TOPIC. 5 VALUE ANALYSIS.

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Concept of Cost and Concept of value, objectives, components and types of value, V.I. 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; IST; EPO; IPO, Free float, total float and Net work 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 Grievances, 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 styles- motivational power and employees relations, effectiveness of leadership system.

TOPIC.9 ORGANIZATIONAL DYNAMICS :-

Organization 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 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,
BHOPL.

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING.

COURSE : INDUSTRIAL MANAGEMENT.

COURSE CODE NO. : M-505 PRE-REQUISITE : NIL

LIST OF REFERENCE BOOKS.

- (1) Learning package on Industrial Management
T.T.T.I. Bhopal.
- (2) OPM AND PERT -Principles and application.
L.s. Srinath.
- (3) Modern Production Management
-Buffa.
Pub. Wiley 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.
- Ghuja.
- (7) Value Analysis - Miles.
- (8) Manpower Management - R.S. Diwedi
- Prentice Hall of India , New Delhi.
- (9) Personnel Management and industrial Relations.
- R.S. Dava.
- (10) Production and Operations Management - Rey 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 ELECTRICAL ENGINEERING

COURSE : INDUSTRIAL ELECTRONICS

COURSE CODE NO. : E- 506

PREREQUISITE : E-403 (BASIC ELECTRONICS)

R A T I O N A L E

The field of electronics is very vast and fastly developing. In modern industries most of the machines are electronically operated and controlled. It is, therefore very essential that technicians are given a sufficient background of the subject Industrial Electronics to keep in pace with modern developments. Looking to the time constraints it is not feasible to impart the complete knowledge of this vast subject but an endeavour has been made to impart sufficient knowledge regarding concepts and principles of various types of electronic devices, control equipments and electronically operated machines. Basic idea about microprocessor and microcomputer has also been included in the syllabus looking to the modern trend and application of computers in every field.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : INDUSTRIAL ELECTRONICS.

COURSE CODE NO. : E-506

PRE-REQUISITE : E-403

S C H E M E O F S T U D I E S

INDUSTRIAL ELECTRONICS.

| S.No. | Contents. | Theory Hrs. | Practical Hrs. | Total. |
|-------|------------------------------|----------------|-------------------|--------|
| 1. | Power rectification. | 08 | 6 | 14 |
| 2. | Controlled Rectification. | 08 | 4 | 12 |
| 3. | Inverters. | 08 | 4 | 12 |
| 4. | Converters. | 06 | 2 | 8 |
| 5. | Regulated Power Supply. | 08 | 4 | 12 |
| 6. | Speed control of Motor. | 08 | 4 | 12 |
| 7. | H.F. Heating. | 08 | 4 | 12 |
| 8. | Resistance Welding. | 06 | - | 6 |
| 9. | Microprocessor and computer. | 04 | 4 | 8 |
| TOTAL | | 64 | 32 | 96 |

Total Credits - 5.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : INDUSTRIAL ELECTRONICS.
COURSE CODE NO. : E-506 PRE-REQUISITE : E-403

CONTENTS.1) POWER RECTIFICATION :

Need and advantages of polyphase rectification, circuit diagram of 3 phase and 6 phase H.W. and 3 phase F.W. (bridge) rectifiers, Derivation of I_{rms} , I_{dc} , Ripple factor, P. I.V. and efficiency for 3 ph. H.W. and F.W. rectifiers.

Different transformers feeding poly phase rectifiers; such as Double star, zig zag and branched.

connections : Working and advantages.

Transformer utility Factor : PUF and S.U.F.

2) CONTROLLED RECTIFICATION :

Review of power controlling devices such as S.C.R. and Triac various types of triggering circuits such as phase shift, BJT, Schmitt trigger circuits Mathematical relation for I_{dc} and I_{rms} in case of single phase, three phase H.W. and bridge rectifiers. Applications of controlled rectifiers. Series and parallel combination of SCRs.

3) INVERTERS :-

Need of inversion, Inverter circuits using SCR in series and parallel mode circuit diagram of emergency tube light.

4) CONVERTERS :-

Need of converter, types of converter (DC to DC and A.C to A.C.) Block diagram of DC to DC converter (chopper). Circuit diagram of chopper using switching transistors and SCRs. Need of commutation; types and methods of commutation single phase and three phase cycloconverter.

(5) REGULATED POWER SUPPLY :

Need of Regulation zenar regulated D.C. Power supply and its limitations , Working of simple, shunt and series regulated power supply using transistors, Short circuit protection IC regulated power supply circuit diagram. Block diagram of (SMPS) switch mode power supply. AC stabilizer using tap changer, Block diagram of servo-stabilizer.

(6) SPEED CONTROL OF MOTORS :

Review of factors affecting the speed of D.C. and induction motors. Advantages of electronic speed control. Speed control of seperately excited D.C. Motor by single phase and 3 phase controlled rectifiers- Methods of speed regulation, Field failure protection, armature current limiter (block diagram). Dual rectifier for reversal of rotation. Speed control by chopper controlling duty cycle (block diagram) Circuit diagram of speed control of single phase induction motor by cycloconverter. Speed control of 3 ph. Induction motor by cycloconverter (block diagram). Speed control of slip ring induction motor by SCRs in rotor circuit.

(7) HIGH FREQUENCY HEATING :

Classification of high frequency heating ; Induction heating and dielectric heating - Relation of depth of penetration, power density and heat produced in Induction heating. Important characteristics, Merits, demerits and applications of Induction heating. (Numerical problems be exercised) Principle and circuit diagram of dielectric heating. Expression for heat generated, involving frequency various methods of electrode arrangement in dielectric

contd..

heating. applications merits and demerits of dielectric heating (Simple numerical problems be given for exercise) generating of X-rays and ultrasonic waves, Industrial application of X-rays and ultrasonic devices.

6) RESISTANCE WELDING :

Basic circuit diagram. basic control used in resistance welding electronic line contactor and its advantages over conventional line contactor

..... Synchronous, non synchronous operation , heat control circuit and block diagram of sequence timer.

6) MICROPROCESSOR & COMPUTER :

Concept of micro processor, structure, block diagram, function of various units, applications. Concept of microcomputer, block diagram, input and output devices, classification and applications. Introduction to CNC machines and PL Programmable logic controller.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : INDUSTRIAL ELECTRONICS.

COURSE CODE NO. : E-506 PRE-REQUISITE : E-403

LIST OF PRACTICALS IN INDUSTRIAL ELECTRONICS.

- (1) Study of poly phase rectifiers : 3 phase, 6 phase 3 phase bridge, tracing of wave forms, measurement of peak, r.m.s. average values and ripple frequency and ripple r.m.s. values, using C.R.O.
- (2) Study of series regulated D.C. power supply find its load regulation.
- (3) Speed control of single phase induction motor using triac.
- (4) Speed control of D.c. shunt motor using controlled rectifier.
- (5) Study of SCR inverter used in emergency light.
- (6) Study of A.C. stabilizer/servo stabilizer.
- (7) Study of dielectric induction heating.
- (8) Study of microprocessor.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING

COURSE : INDUSTRIAL ELECTRONICS.

COURSE CODE NO. : E-506 PREREQUISITE : E-403

LIST OF REFERENCE BOOKS.

- (1) Industrial Electronics & Instrumentation
by V.K.M. John. Khanna Pub.
- (2) Industrial Electronics
by Chute & Chute. McGraw Hills Pub.
- (3) Industrial Electronics
by Nenedict & Weiner. Prentice Hall of India Pub.
- (4) Industrial Electronics & Control
by Kloeffler. Wiley Eastern Pub.
- (5) Introduction to th^Vristors
and their application.
by M. Rommoorthy. East West Press Pub.
- (6) Industrial Electronics
by John Ryder. P.H. Pub.
- (7) Digital Principles & applications
by Malvino and leach. Tata Mc Graw Hill Pub.
- (8) Digital Computer Electronics
by Malvina. Tata McGraw Hill Pub.

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,

BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : ELECTRICAL INSTALLATION AND MAINTENANCE.
COURSE CODE NO. : E-507
PRE-REQUISITE : NIL.

RATIONAL E.

This subject is very important as most of the technician who get employment in Electricity Board, Industries etc. are required to install, test and commission the electrical equipments and further required to maintain the same. The syllabus of this subject is aimed to develop the abilities in the areas of installation, testing commissioning and maintenance of electrical equipments.

The topics of preventive maintenance which have been included in the syllabus will help the student in the field to follow the programme of preventive maintenance thus avoiding undue shut downs of the system. A component of environmental pollution being very important finds a place in this subject.

Stress has been laid for making use of I.E. Rules and I.S.S. wherever applicable^{b?} in order to follow the same in the field. A topic on safety measures has also been introduced in order to avoid electrical accidents.

List of practicals has been prepared in such a way that student will be able to acquire and develop the desired practical skills for job.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
 COURSE : INSTALLATION AND MAINTENANCE
 COURSE CODE NO. : E-507 PREREQUISITE : NIL.

S C H E M E O F S T U D I E S.

| S.No. | TOPIC | THEORY HRS. | PRCT. HRS. | TOTAL |
|-------|--|----------------|---------------|-------|
| 1. | INSTALLATION. | 5 | 4 | 9 |
| 2. | COMMISSIONING. | 03 | 4 | 7 |
| 3. | EARTHING. | 04 | 2 | 6 |
| 4. | INSULATION TESTING AND MAINTENANCE. | 6 | 4 | 10 |
| 5. | PREVENTIVE MAINTENANCE AND ENVIRONMENTAL POLLUTION PREVENTION. | 8 | 6 | 14 |
| 6. | TROUBLE SHOOTING. | 10 | 4 | 14 |
| 7. | ELECTRICAL ACCIDENTS AND SAFETY MEASURES. | 4 | 2 | 6 |
| 8. | TESTING AND MAINTENANCE OF RELAYS & CIRCUIT BREAKERS. | 4 | 4 | 8 |
| 9. | HOT LINE MAINTENANCE. | 4 | 2 | 6 |
| | | 48 | 32 | 80 |

Total Credits - 4.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
COURSE : INSTALLATION AND MAINTENANCE.
COURSE CODE NO. : E-507 ; PREREQUISITE : NIL.

C O N T E N T S.

TOPIC NO. 1 INSTALLATION :

Study and use of theodolite. Types of heavy electrical equipment, unloading accessories precautions for unloading, installation of small and large machines of both static and rotating type. Installation of pole mounted transformer.

TOPIC NO.2 COMMISSIONING :

Tests required before commissioning procedure to be adopted for commissioning the electrical equipment in respect of :

- (a) Mechanical fixture and alignment.
- (b) Electrical tests.
- (c) Initial precautions for starting.

TOPIC NO.3 EARTHING :

Reasons of earthing, earthing system earth lead and its size; permissible earth resistance for different installations, improvement of earth resistance, double earthing earth resistance measurement. i.e. Rules for earthing.

TOPIC NO.4 INSULATION TESTING AND MAINTENANCE.

Instruments used for measuring insulation resistance, reasons for deterioration of insulation resistance, improving insulation resistance, drying of insulation, Measurement of internal temperature of winding, vacuum impregnation, /filtering of insulating oil, testing of insulating oil.

TOPIC NO. 5 PREVENTIVE MAINTENANCE AND ENVIRONMENTAL POLLUTION PREVENTION.

Concepts of preventive maintenance, advantages, preventive maintenance schedule for transformer induction motor, transmission line, circuit breaker and underground cable.

Contd...

preventive measures to control environmental pollution results due to production of . smokes gases, flow of waste material and automic reactions in research stations, plants, elect. & electronic equipments and accessories.

6. TROUBLE SHOOTING : - Normal performance of equipment, trouble shooting internal and external faults, instruments and accessories for trouble shooting, trouble shooting charts.

7. ELECTRICAL ACCIDENTS AND SAFETY MEASURES:- Electrical accidents, Safety regulation, treatment of shock, fire extinguishers.

8. TESTING AND MAINTENANCE OF RELAYS AND CIRCUIT BREAKERS :
Testing of Relays; Factory test, commissioning test and preventive periodic maintenance test. Testing of circuit breakers, voltage test, type test, preventive maintenance of circuit breaker.

9. HOT LINE MAINTENANCE : Meaning and advantages, special type of non-conducting material used for preparing tools tools for hot line maintenance.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
 COURSE : ELECTRICAL INSTALLATION AND MAINTENANCE
 COURSE CODE NO. : E-507 PREREQUISITE : NIL.
ELECTRICAL INSTALLATION AND MAINTENANCE.

LIST OF EXPERIMENTS.

The following experiments may be demonstrated either in institute or in field.

- (1) Maintenance of O.H. Lines.
- (2) Maintenance of switchgear OCB
- (3) Maintenance of distribution transformer in distribution system.
- (4) Routine/ Preventive maintenance of induction motors in textile mills/ industrial establishment.
- (5) (a) shut down and energising procedure.
 (b) Accident report writing.
 (c) Permit to work.
 (d) Fire extinguisher.
- (6) Insulation oil testing.
- (7) Earth resistance testing.
- (8) Test report of electrical installation.
- (9) Maintenance schedule.
- (10) Trouble shooting.
- (11) Report on hot line maintenance.
- (12) Uses of theodolite, (a) direct ranging of a straight line.
 (b) to fix a point on a straight line.
 (c) To check verticality of a pole.
 (d) To measure horizontal angle.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : ELECTRICAL INSTALLATION AND MAINTENANCE
COURSE CODE NO. E-507 PREREQUISITE : NIL.

LIST OF REFERENCE BOOKS.

| <u>S.No.</u> | <u>Name of Book.</u> | <u>Author.</u> | <u>publisher.</u> |
|--------------|--|-----------------------------|---|
| 1. | Electrical Installation work (vth metric edition) | T.C.Francis, E.L.B.S. ELBS. | |
| 2. | Electrical Installations Maintenance & fault location work book. | T.T.T.I. (W.R.) Bhopal. | |
| 3. | Preventive maintenance Electrical equipment. | Charles J Hurburt. | |
| 4. | Commission of Electrical Plant. | RCH Richardson. | |
| 5. | Operation and maintenance of Electrical Equipments vol. I & Vol.II | BVS Rao. | Asia Publishing or Media Promotor Publishers Pvt. Bombay. |
| 6. | Electrical Maintenance & Repairs. | J.I.Watts. | McMillers London. |
| 7. | Troubles in Electrical Equipments. | N.E.Stafford. | McGraw Hills Pub. |
| 8. | J. Text Book of Electrical installation work vol.2. | R.A. Mac. | Macdonald London. |
| 9. | Electrical Maintenance & Repairs. | P.P.Gupta. | Dhanpat Rai & Sons Pub. |
| 10. | Estimating Commissioning and maintenance of Electrical equipment. | S.Rao. | Khanna Pub. |
| 11. | Fundamentals of maintenance of Electrical Equipment. | Bhatia | Khanna Pub. |
| 12. | Relevant IS. | | |

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : ESTIMATING AND COSTING
COURSE CODE NO. : E-508
PRE REQUISITE : NIL.

RATIONALS.

An electrical engineer has to estimate and cost for different jobs he has to undertake. Thus it is necessary to have knowledge of preparation of good estimate so that the work is carried in a systematic and efficient manner.

Also many times the technician has to decide the things according to situations, so he should have skills to make decisions.

The subject deals with these aspects. The areas are domestic installations, Industrial installations, distribution lines etc.

Field visits may be arranged to have spot information.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : ESTIMATING AND COSTING.

COURSE CODE NO. : E-508

S C H E M E O F S T U D I E S .

| S.No. | Name of Topic | Theory Hrs. | Practical Hrs. | Total |
|-------|--|----------------|-------------------|-------|
| (1) | Elements of estimating | 06 | - | 06 |
| (2) | Domestic and Industrial estimating and costing. | 12 | - | 12 |
| (3) | Service connections (Light and power) | 12 | - | 12 |
| (4) | Sub-Stations. | 12 | - | 12 |
| (5) | H.T. and L.T. Lines Overhead lines & W.G. cables. | 14 | - | 14 |
| (6) | Estimating and costing for repair/maintenance of Elect. devices/equipment. | 08 | - | 08 |
| | | 64 | - | 64 |

Total Credits - 4.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPLAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
COURSE : ESTIMATING AND COSTING.
COURSE CODE NO.: E-508 PREREQUISITE : NIL.

C O N T E N T S.

THEMATIC DETAILS.

a) ELEMENTS OF ESTIMATING :

Principles of estimating, purchase procedure, cost of materials, various charges like- labour, stores, overhead, tools, contingency etc.

b) DOMESTIC AND INDUSTRIAL WIRING :

Various types of wiring systems including P.V.C. Pipe, their merits and demerits. Calculation of total load & selection of wire. Preparation of estimates for a small residential building big institution or office building, Estimate for single storey, multi storey building. Estimate for a small workshop and industrial, installation, agricultural pump, domestic pump, floor mills etc. Estimation of total cost.

c) SERVICE CONNECTIONS :

For a single storey and multistoried building, single phase and three phase service connections, Various methods of service connections, Distribution of circuits for light and power load. (Guidance may be taken by the M.P. Electricity Boards estimates)

SUB STATIONS :

Various types of sub-stations, pole-mounted indoor and outdoor substations. Estimating quantity and cost for a sub-station of a given specifications.

(5) OVERHEAD LINES : H.T. & L.T. LINES :

Preparation of estimate and costing of 11KV OR 33 KV line. Selection of routes, Estimates for distribution lines- Location of poles for a given situation or locality. Providing street lights, Necessary hardware, stay arrangements underground cables- Providing service lines using underground cables.

(6) ESTIMATING AND COSTING FOR REPAIR/MAINTENANCE OF ELECTRICAL DEVICES/ EQUIPMENT. :

Estimates for repairing electrical equipment e.g.

- (a) Rewinding, assembling and testing of polyphase induction motor.
- (b) Repairing of 3 phase starters.
- (c) Repairing of single phase transformers.
- (d) Repairing of devices like hot plate, press, mixer fan etc.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : ESTIMATING AND COSTING.

COURSE CODE NO. : E-508 PREREQUISITE : NIL.

LIST OF REFERENCE BOOKS.

- (1) Electrical Wiring, Estimating and Costing. -by S.L.Uppal
Khanne Pub.
- (2) Electrical Wiring, Estimating and Costing. -by B.D.Azara.
Khanne Pub.
- (3) Electrical Engineering Drawing Work Book. -T.T.T.I.,
Bhopal Polytechnic
- (4) Electrical Wiring, estimating and costing -by J.B.Gupta.
- (5) Electrical estimating and Costing. - M.N.Bajpai Saroj
Publications
Allhabad.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : ELECTRICAL ENGINEERING PROJECT.

COURSE CODE NO. : E-509

R A T I O N A L E.

The curriculum has been designed to develop the following objectives :

- 1) Develop habit of enquiry.
- (2) Collect information from various sources.
- (3) Create awareness of recent developments.
- (4) Create curiosity in new problems.
- (5) Arrange information in logical order.
- (6) Develop and demonstrate confidence and ability to tackle new problems.
- (7) Integrate and reinforce the knowledge and skill.
- (8) Understand and follow standard test procedures.
- (9) Observe safety precautions.
- (10) Interpret events and results.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : ELECTRICAL ENGINEERING PROJECT.

COURSE CODE NO. : E-509

SCHEME OF STUDIES.

| S.No. | Topic | Hours. |
|-------|--|--------|
| (1) | Compilation of information on latest development. | 17 |
| (2) | Power Project or Electronic or Electrical Project. | 25 |
| (3) | Assembly Project. | 25 |
| (4) | Report on small scale industry. | 13 |

Total 80

CREDITS - 5

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : ELECTRICAL ENGINEERING PROJECT.
COURSE CODE NO. : E-509

C O N T E N T S.

TOPIC.1 Compilation of information on topics of current development in Electrical and Electronic Engineering. Each student should take two projects, one each from Power fields and electronic fields based on following

1. Investigation project
- 2 & 3 . Compilation of information on topics of current development in Electrical and Electronic Engg.

(Few topics are listed in annexure 1)

TOPIC.2 POWER project or Electronic/Electrical Project. To conduct investigation and prepare a technical report on any one of the following.

- (1) Electrification of village/colony.
- (2) Modification of sub-station or receiving station due to increased in demand.
- (3) Solving other live problems connected with power systems and utilization.

(Few gadgets are listed in annexure 2)

TOPIC NO. 3 Assembly Project.

Design and prepare project.

These projects can include construction of domestic appliances, electronic gadgets improvement of equipment rewinding of AC or DC. machines, major repair on an electric machine/ equipment preparing control panels for machine.

TOPIC NO. 4 Report on small scale industries :

Compilation of information and writing a report on a small scale industry.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING

COURSE : ELECTRICAL ENGINEERING PROJECT.

COURSE CODE NO. : E-509

LIST OF SUGGESTED TOPICS.

- 1) Major Power stations in India of capacities 1000 MW and above (Location and capacity be shown on map).
- 2) Various generating stations and transmission lines (132 KV and above) of Madhya Pradesh. Location and capacity be shown on a map.
- 3) T.V. Transmitters in India. (Location and capacity be shown on a map).
- 4) Microwave communication in India.
(Location and capacity be shown on a map)
- 5) solar power generating stations.
- 6) Load despatch techniques in modern power system.
- 7) Major electrical and electronic industries in India or any other assigned by the teacher.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPL. ANNEXURE No. 2

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : ELECTRICAL ENGINEERING PROJECT.

COURSE CODE NO. : E-509

LIST OF SUGGESTED GADGETS.

- (1) Controlled voltage Transformer.
- (2) Battery eliminator.
- (3) Regulated power supply.
- (4) Audio Frequency amplifier.
- (5) Operational amplifier.
- (6) Multivibrator.
- (7) Light operated relay.
- (8) Temperature operated relay.
- (9) Sound operated relay.
- (10) Oscillator using UJT
- (11) Voltage stabilizer.
- (12) Inverter.
- (13) Digital Counter.
- (14) Electronic fan regulator.
- (15) Electronic Timer.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION,
BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
COURSE : ELECTRICAL ENGINEERING PROJECT.
COURSE CODE No. : E-509

LIST OF REFERENCE BOOKS.

- (1) Relevant I.S.
- (2) Engineering Experimentation Course
T.T.T.I. Bhopal.

M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL.

DIPLOMA PROGRAMME
IN
ELECTRICAL ENGINEERING
UNDER
MULTI POINT ENTRY AND CREDIT SYSTEM

COURSE CONTENTS OF DIVERSIFIED CATEGORY COURSES

- E-601 ADVANCED INSTRUMENTATION AND CONTROL
- E-602 ELECTRIC TRACTION
- E-603 COMPUTER ENGINEERING
- E-604 POWER ELECTRONICS
- E-605 POWER SYSTEM AND CONTROL

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.

VALUE : SHRI VAISHNAV POLYTECHNIC, INDORE.

P R E F A C E

The curriculum of the courses under diversified category diploma programme in Electrical Engineering under Multi Point Entry & Credit System was developed in a workshop organised by State Curriculum Development Centre of M.P. Board of Technical Education, Bhopal with the assistance of Technical Teachers Training Institute, Bhopal at Shri Vaishnav Polytechnic, Indore from 26th to 28th March 1992.

The purpose of keeping the diversified courses in the programme is to provide an opportunity for learning in the specific areas in the same discipline and to develop awareness in other interdisciplinary areas. During finalising the course content proper care has been taken about

- (a) Maintaining the sequence of topics.
- (b) Alloting contact hour for each topic.
- (c) Avoiding overlaps of the contents.
- (d) Relevance of the contents.
- (e) Pre-requisite of the course.

The comments and healthy criticism from faculty members are however welcome, so that the prepared syllabus can be reviewed and revised periodically.

We are highly grateful to Dr. Kamal Kumar, Director of Technical Education, Bhopal for his valuable guidance, encouragement and active cooperation in organising the above workshop.

Words of obligation are due to Principal, TTTL, Bhopal, Mr. M.K. Dube, Principal, Shri Vaishnav Polytechnic, Indore, Mr. J.C. Surali, HEED & other faculty members of Shri Vaishnav Polytechnic, Indore faculty members of S.G.S.I.T. & Sc., Indore, experts from various industries of Indore & participating faculty members of other polytechnics. It is out of their valuable suggestions and long term experience that these syllabi are in the hands of the user.

We aspire to improve this in times to come.

AJIT SINGH
Secretary,

M.P. Board of Technical Education,
Bhopal.

LIST OF PARTICIPANTS.FACULTY FROM POLYTECHNIC

| | |
|-----------------|------------|
| 1. R.R. GANGANE | UJJAIN |
| 2. J.L. JAIN | SANNAD |
| 3. G.C. KHERA | ASHOKNAGAR |
| 4. J.K. JAIN | INDORE |
| 5. S.S. SHARMA | INDORE |
| 6. R.C. CHAUHAN | INDORE |
| 7. R. MAHAJAN | INDORE |
| 8. RAJEEV DUHE | INDORE |
| 9. SANJAY JAIN | INDORE |

FACULTY FROM OTHER INSTITUTIONS

| | |
|------------------------|--------------------------------|
| 1. PROF. C.M. PAUDYAL | S.G.S.I.T. & SC. INDORE |
| 2. DR. M.C. SRIVASTAVA | S.G.S.I.T. & SC. INDORE |
| 3. DR. L.D. ARYA | S.G.S.I.T. & SC. INDORE |
| 4. PROF. N.D. SOMANI | S.G.S.I.T. & SC. INDORE |
| 5. PROF. ABHAY JAIN | S.G.S.I.T. & SC. INDORE |
| 6. PROF. M. CHANDWANI | S.G.S.I.T. & SC. INDORE |
| 7. DR. A.K. RAMANI | SCHOOL OF COMPUTER SC. INDORE. |
| 8. PROF. R.S. PATIDAR | SCHOOL OF COMPUTER SC. INDORE. |

EXPERTS FROM FIELDSEXPERTS FROM FIELDS

1. P.K.DUEE
RETD.MEMBER, MPFB INDORE
2. P.W. DANDEKAR
P. & P.COMPUTERS, INDORE
3. TAPAN MUKERJEE^H
TECH-FORCE MARKETING, INDORE
4. KISHORE BHURDIA
INTERFACE COMPUTER, INDORE
5. R.B. SARMAJAL
D.E., MPFB INDORE
6. R. NATH
NIVO CONTROLS, INDORE
7. R.K. POKHRIANI
BIJAJ TEMPO, PITHAMPUR
8. V.K. KHANDELWAL
D & H SECHERON, INDORE
9. HEMANT VERMA
DYNALOG COMPUTERS, INDORE
10. H.S.DUA
MICROWORKS , INDORE

FACULTY FROM C.D.C. BHOPAL

ASHOK RAJNAPARKHI

WORKSHOP CONVENOR

M.K.DUEE

(PRINCIPAL & SECRETARY)

WORKSHOP CO-ORDINATOR

J.C. SURALI

(CONVENOR, MPECS)

COMPUTERIZATION OF METER

RAVI MAHJAN

DEEPA DRA. SHINDE

INTRODUCTION

It is envisaged that the training provided through Foundation, Hard core, Softcore, Basic Technology, Applied technology courses would provide a broad base for performing the job functions in the selected discipline. The purpose of including Diversified courses is two fold

(a) Provide an opportunity of learning in specific areas in the same discipline. Following courses are introduced to achieve the objective

- E 601 Advanced Instrumentation and control.
- E 602 Electric Traction.
- E 605 Power system and control.

(b) Develop the awareness in other interdisciplinary areas. Following courses are introduced to achieve the objective.

- E 603 Computer Engineering.
- E 604 Power Electronics.

The student can select the courses suiting to his ability, aptitude, interest and the demand in the industries, thus producing the man power for a spectrum of technologies and occupations enhancing the efficiency of the system.

The curriculum of diversified category courses was developed in a workshop at Shri Vaishnav Polytechnic, Indore under the guidance of State Curriculum Development Centre, Bhopal from 26-3-92 to 28-3-92. Participants were senior teachers from various polytechnics of State, Experts from higher educational institutions like engineering college and Engineers & Experts from fields and industries.

The participants had indepth discussion on many points before the onset of discussion on finalising the course contents. Some points of discussion were

- * Job functions of electrical engg. technician at various levels.
- * Additional job functions due to advancement of technology
- * Industrial problems to be solved at technician levels.
- * Job opportunities.
- * Relevancy of curriculum to needs of industries.

The participants also discussed at length the concepts, principles, laws, materials, maintenance and repair works and the processes which an electrical engineering technician is supposed to know. The course contents were prepared in light of the above discussion.

The course contents were validated and reviewed against job functions in consultation with experts from engineering colleges, industries and fields. Some of the points on which discussions were held during validation of the course contents are listed below:-

- * Relevancy of course contents.
- * Breadth and depth of topic - It was resolved that this point should be specifically taken care of during the preparation of detailed curriculum document.
- * List of experiments.
- * Theory/Practical hours allotted for each course/topic.
- * Overlapping of contents.
- * List of reference books.
- * Competencies for performing the job functions in specific areas.

some specific recommendations of the experts from industries/ higher educational institutions are listed below :-

1. Quality product consciousness and enhanced production needs an advanced instrumentation and automation in industries. precise, effective and diversified instruments and instrumentation system are needed in a progressive industry. The curriculum of Advanced Instrumentation & Control therefore must include references on automation/biomedical, digital signal transmission and processing and process controllers etc.

2. Electric traction was previously introduced as chapter in the curriculum of electrical engg. The experts were of the opinion that electric traction should be introduced as a separate subject in light of the rapid electrification of railway tracks in Madhya Pradesh and even throughtout India. The syllabus must include a detailed information on A.C. traction system/diesel electric traction system and locomotive maintenance.

3. Computer have become indispensable. An engineering technician should have well exposure to maintenance and use of computer. Topics on CAD/CAM should be included in computer Engg. course.

4. Electric drives and processes are controlled by static converters / controllers. The topics on Thyristors, static converters and AC and DC motor controls must be included in power electronics course.

5. To meet the need of power supply undertakings and industries in light of specific job requirement of technicians the knowledge of economic load despatch, power system security and LCLP calculations are essentials for a technician.

6. The emphasis should be on operation, maintenance and safety of the system. This point must be taken care of during the preparation of detailed curriculum.

The comments of the experts have been duly incorporated in the course contents of the various diversified courses.

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MADHVA RAJESHBH BOARD OF TECHNICAL EDUCATION, MUMBAI
 SCHEME OF STUDIES & EXAMINATION OF DIPLOMA IN ELECTRICAL ENGINEERING (TEC.D)

DIVERSIFIED COURSES. w.c.f. August/September, 1967.

| S.No. | Code No. | Courses | Pre-requi- Th. | Hours/ Week | Cre- dits | Pr. Term Lab | Assessment I. | II. | 10 | 10 | 3 Hrs. | 100 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 50 | Rem |
|-------|----------|--|-------------------|----------------|--------------|-----------------|------------------|-----|----|----|--------|-----|---|--------|-----|---|--------|----|-----|
| 1. | E-601 | Advanced Instru- mentation & Control. | E501 | 3 | 2 | 4 | 20 | 20 | 10 | 10 | 3 Hrs. | 100 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 50 | |
| 2. | E-602 | Electrical Traction. | E402 | 3 | 2 | 4 | 20 | 20 | 10 | 10 | 3 Hrs. | 100 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 50 | |
| 3. | E-603 | Computer Engg. | 301 | 3 | 2 | 4 | 20 | 20 | 10 | 10 | 3 Hrs. | 100 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 50 | |
| 4. | E-604 | Power Electronics. | E506 | 3 | 2 | 4 | 20 | 20 | 10 | 10 | 3 Hrs. | 100 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 50 | |
| 5. | E-605 | Power system & Control. | E504 | 3 | 2 | 4 | 20 | 20 | 10 | 10 | 3 Hrs. | 100 | 1 | 3 Hrs. | 100 | 1 | 3 Hrs. | 50 | |

Total Credits. 8

REMARKS:-¹ Any two courses to be offered by each student. Student will not be allowed to take up these 5 & 6 level courses unless he clears all foundation courses.

2. Total credits for diversified courses = 8

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M.P. 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 : ADVANCED INSTRUMENTATION & CONTROL
COURSE CODE NO. : E-601
PREREQUISITE : E-501 INSTRUMENTATION & CONTROL
CATEGORY : DIVERSIFIED

DIPLOMA PROGRAMME
IN
ELECTRICAL 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.
VAJUE : SHRI VAISHNAV POLYTECHNIC, INDORE.

M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
COURSE : ADVANCED INSTRUMENTATION & CONTROL
COURSE CODE : E-601
PREREQUISITE : E-501. INSTRUMENTATION & CONTROL

R A T I O N A L E

With the advancement of technology in the field of instrumentation and control engineering during past few years, many types of advanced instrumentation devices, innovations, refinements and altogether new techniques have also been introduced. It is therefore essential that the students be given advanced knowledge of devices, circuits and process applied in instrumentation and controls. With this end in view, this subject of Advanced Instrumentation and Control has been introduced as a diversified course in the diploma programme of electrical engineering started under MPECS.

The curriculum broadly covers the area of detailed performance and characteristics of instrumentation systems, advanced techniques of measurements of physical quantities, signal conditioners, digital signal transmission and processing, process controllers, pneumatic control and bio-medical instrumentation.

The subject is dealt at the advance level in order to develop advanced knowledge, skill and attitude at the technician level, so that they may be able to operate, control and maintain the advanced instrumentation systems.

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M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
 COURSE : ADVANCED INSTRUMENTATION & CONTROL
 COURSE CODE : E-601
 PREREQUISITE : E-501 INSTRUMENTATION & CONTROL

SCHEME OF STUDIES

HOURS/WEEK : THEORY(3) PRACTICAL (2) CREDIT :(4)

| S.No. | TOPIC | THEORY HOURS | PRACTICAL HOURS | TOTAL HOURS |
|-------|--|--------------|-----------------|-------------|
| 1. | Performance and Characteristics of Instrumentation system. | 05 | 00 | 05 |
| 2. | Measurement of Physical Quantities. | 15 | 12 | 27 |
| 3. | Signal Conditioning and Processing. | 06 | 04 | 10 |
| 4. | Data acquisition and Conversion. | 06 | 04 | 10 |
| 5. | Digital Signal Transmission and Processing. | 05 | 02 | 07 |
| 6. | Process Controllers. | 03 | 04 | 07 |
| 7. | Electro-Pneumatic Controllers | 03 | 04 | 07 |
| 8. | Biomedical Equipments | 05 | 02 | 07 |
| Total | | 48 | 32 | 80 |

SCHEME OF EXAMINATION

| SEM | PROGRESSIVE | | | BOARD EXAMINATION | | | PRACTICAL / VIVA | | |
|-----|-------------|----|----|-------------------|-------|-------|------------------|-------|-------|
| | LD | I | II | PAPER | DURA. | MARKS | PRACT. | DURA. | MARKS |
| 20 | 20 | 10 | 10 | 1 | 3 | 100 | 1 | 3 | 50 |

M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
 COURSE : ADVANCED INSTRUMENTATION & CONTROL
 COURSE CODE : E-601
 PREREQUISITE : E-501 INSTRUMENTATION & CONTROL

COURSE CONTENTS

- | TOPIC NO. | COURSE CONTENTS |
|-----------|---|
| 1. | <p>PERFORMANCE AND CHARACTERISTICS OF AN INSTRUMENTATION SYSTEM Review of performance of measurements systems, Instrument efficiency, index scale and index number, loading effects, impedance matching and maximum power transfer, dynamic response, standard signals.</p> |
| 2. | <p>MEASUREMENT OF PHYSICAL QUANTITIES Review of various types of transducers, semi-conductors strain gauge, strain gauge circuits ; Potentiometric : Quarter, Half and Full Wheat Stone Bridge circuits; Temperature compensation through bridge arrangement. VIBRATION MEASUREMENTS : Characteristics of vibrations, vibration sensing devices, accelerometers. PRESSURE MEASUREMENTS : Vibrating element pressure sensors, pressure multiplexer, calibrations. FLOW MEASUREMENTS : Thermal, laser and rotor-torque types. TEMPERATURE MEASUREMENTS : Construction of resistance thermo-meters, construction of thermo-couple probe, thermo-couple indicators, thermo-couple response time, solid state temperature sensor. WEIGHT MEASUREMENTS : Hydraulic load cell, electronic weighing system. TORQUE MEASUREMENTS : Stress and deflection type mechanical and electrical torque measurements.</p> |
| 3. | <p>SIGNAL CONDITIONING AND PROCESSING Instrument amplifiers : Features, three amplifier configurations, phase sensitive detection, comparator, voltage to frequency and frequency to voltage converters, current to voltage and voltage to current converters, use of OP-AMP as active filters.</p> |

4. DATA ACQUISITION AND CONVERSION
Introduction, generalized data acquisition system, single and multi-channel data acquisition systems, data conversion, digital codes, D/A and A/D converters digital multi-plexer and de-multiplexer, sample & hold circuits.
5. DIGITAL SIGNAL TRANSMISSION AND PROCESSING
Introduction, data transmission systems, pulse code formats, modulation techniques for digital data transmission, modern digital signal processing, digital filters.
6. PROCESS CONTROLLERS
control actions, proportional, integral and derivative controls, choice of controls for various applications.
7. ELECTRO-PNEUMATIC CONTROLLERS
Introduction to pneumatics, advantages, different stages involved in the pneumatic systems, electro-pneumatic controls.
8. BIO -MEDICAL EQUIPMENTS
Bio medical transducers and electrodes, pressure, pulse wave, respiration sensors and temperature, plethysmograph transducers, different types of electrodes, principle and construction and operation of Pacemaker , B.P. Monitor and E.C.G.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
 COURSE : ADVANCED INSTRUMENTATION & CONTROL
 COURSE CODE : E-601
 PREREQUISITE: E-501 INSTRUMENTATION & CONTROL

LIST OF EXPERIMENTS/VISITS

1. TO OBSERVE & EXAMINE CHARACTERISTIC OF STRAIN GAUGE
2. TO OBSERVE TEMPERATURE COMPENSATION IN STRAIN GAUGE BRIDGE CIRCUIT.
3. MEASUREMENT OF LIQUID FLOW USING THERMISTOR.
4. STUDY OF VARIOUS TYPES ACCELEROMETERS.
5. PERFORM CHARACTERISTICS OF THERMO COUPLE.
6. DETERMINATION OF ELECTRONIC WEIGHING SYSTEM.
7. DETERMINATION OF THERMOCOUPLE RESPONSE TIME IN SERIES AND PARALLEL CONNECTION OF THERMOCOUPLES.
8. DEMONSTRATION OF THE FOLLOWING USING SUITABLE TRAINER AND COMPONENTS.
 (i) PHASE DETECTOR (ii) COMPARATOR (iii) VCO
 (iv) V/I & I/V CONVERTOR (v) ACTIVE FILTERS
9. DEMONSTRATION OF A/D AND D/A CONVERTOR.
10. DEMONSTRATION AND EXAMINATION OF PULSE MODULATION SYSTEM.
11. DEMONSTRATION OF P, P+I, P+D, AND P+I+D CONTROLLER FOR VARIOUS QUANTITIES SUCH AS PRESSURE, LEVEL, FLOW AND HEAT.
12. STUDY AND DEMONSTRATION OF ELECTRO-PNEUMATIC SWITCHING SYSTEM.
13. DEMONSTRATION OF AND & OR LOGIC GATES BY ELECTRO-PNEUMATIC CIRCUIT.
14. STUDY AND DEMONSTRATION OF BIOMEDICAL TRANSDUCERS AND ELECTRODES.
15. STUDY AND DEMONSTRATION OF FOLLOWING BIO-MEDICAL INSTRUMENTS (i) PACE MAKER (ii) B.P. MONITOR (iii) E.C.G.

M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
 COURSE : ADVANCED INSTRUMENTATION & CONTROL
 COURSE CODE : E-601
 PREREQUISITE: E-501 INSTRUMENTATION & CONTROL

LIST OF REFERENCE BOOKS.

| S. NO. | TITLE | AUTHOR | PUBLISHER |
|--------|--------------------------------------|----------------------|-----------|
| 1. | ELECTRONIC INST. & MEAS. TECHNIQUES | WILLIAM DAVID COOPER | |
| 2. | PRINCIPLES OF IND. INSTRUMENTATION | D. PATRANABIS | |
| 3. | ELECTRONIC INSTRUMENTATION. | D. PRINSKY | |
| 4. | INST. DEVICES & SYSTEM. | RANGIN & SHARMA | |
| 5. | ELECT. & ELECX. MEAS. & INST. | A.K. SIMHNEY | |
| 6. | DIGITAL PRINCIPLES & APPLICATIONS | MALVINO & LEACH | |
| 7. | OPAMP. DESIGN & APPLICATIONS | TOBEY & GRJEME | |
| 8. | INSTRUMENTATION | KIRK & RIMBOLI | |
| 9. | INTRODUCTION TO MEDICAL ELECTX. | S.K. GUPTA | |
| 10. | APPLIED BIO-MEDICAL INSTRUMENTATION. | GODDES B. KER | |
| 11. | INTRODUCTION TO MEDICAL INST. | KHANDPUR | |

M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL.

DETAILED - CURRICULUM

COURSE TITLE : ELECTRIC TRACTION
COURSE CODE NO.: E-602
PREREQUISITE : E-402
CATEGORY : DIVERSIFIED

DIPLOMA PROGRAMME
IN
ELECTRICAL ENGINEERING
UNDER
MULTI POINT ENTRY AND CREDIT SYSTEM

DEVELOPED BY STATE CURRICULUM DEVELOPMENT CENTRE
M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL
COLLABORATION WITH TECHNICAL TEACHERS TRAINING INSTITUTE,
BHOPAL.
SPONSORED BY DIRECTORATE OF TECHNICAL EDUCATION,
BHOPAL.
VENUE SHRI VAISHNAV POLYTECHNIC, INDORE.

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PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
 COURSE : ELECTRIC TRACTION
 COURSE CODE : E-602
 PREREQUISITE : E-402

RATIONALE

Rapid electrification of Railway tracks in M.P. and through out the country has opened new avenues of the job opportunities for the technical personnel. The electric traction helps to reduce pollution and extends fast transportation of men and material.

The subject of Electric Traction has therefore been chosen as diversified course for the Diploma Programme in electrical engineering.

The syllabus is designed to facilitate basic knowledge of various aspects of electric traction prevailing and likely to prevail in near future. The field visits are emphasized so that better understanding of the subject can be imparted. It will make the students familiar with the different equipments, accessories and hardware used in traction system.

The attention has been paid to impart the knowledge of various aspect of maintenance including trouble shooting and repairs so that a technician will be able to operate, maintain and repair the various traction devices and components satisfactorily.

M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
 COURSE : ELECTRIC TRACTION
 COURSE CODE : E-602
 PREREQUISITE : E-402

SCHEME OF STUDIES

HOURS/WEEK : THEORY (3) PRACTICAL (2) CREDIT : (4)

| S.No. | TOPIC | THEORY HOURS | PRACTICAL HOURS | TOTAL HOURS. |
|-------|---|-----------------|--------------------|-----------------|
| 1. | TRACTION PRINCIPLES AND SYSTEMS | 12 | 06 | 18 |
| 2. | TRACTION MOTORS AND TRACTION MOTOR CONTROL. | 12 | 10 | 22 |
| 3. | A.C. TRACTION SYSTEMS. | 12 | 06 | 18 |
| 4. | DIESEL ELECTRIC TRACTION. | 06 | 04 | 10 |
| 5. | ELECTRIC LOCOMOTIVE MAINTENANCE | 06 | 06 | 12 |
| TOTAL | | 48 | 32 | 80 |

SCHEME OF EXAMINATION.

| SESSIONAL | | PROGRESSIVE | | BOARD EXAMINATION | | | PRACTICAL / VIVA | | |
|-----------|----|-------------|----|-------------------|-------|-------|------------------|-------|--------|
| TW | LW | I | II | PAPER | DURA. | MARKS | ERIC. | DURA. | MARKS. |
| 20 | 20 | 10 | 10 | 1 | 3 | 100 | 1 | 3 | 50 |

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING

COURSE : ELECTRIC TRACTION

COURSE CODE: E-602

PREREQUISITE : E-402

COURSE CONTENTS

| TOPIC NO. | COURSE CONTENTS |
|-----------|-----------------|
|-----------|-----------------|

1. TRACTION PRINCIPLES AND SYSTEMS :

Traction systems with and without electricity, Steam engine drive and its characteristic, drawbacks. Electric drive and its merits and demerits. Diesel electric traction and its characteristic. Battery electric drive and its application. Types of electric system. System of current collection, catenary and contact wire. Traction mechanism, application of electric traction. Electric braking and Train lighting and air conditioning.

2. TRACTION MOTORS & TRACTION MOTOR CONTROL:

Requirement of traction motors. Types of motor available for Traction and their suitability. Control of D.C. traction motor, Series parallel control, shunt transition, bridge transition, Drum controller, Double series parallel control, Buck and Boost control, Metadyne control, Thyristor control.

3. A.C. TRACTION SYSTEMS :

Types of supply, Three phase at low frequency, Single phase at low frequency and at industrial frequency, Advantages and comparison. Substation for tractions and their types. Equipment at traction substation. Voltage regulation by Tape changing switches, sequence charts. Controlled apparatus such as electro-pneumatic, electromagnetic cam shaft contactors, Tapping switches, Reversers, Master controllers, Transformers.

4. DIESEL ELECTRIC TRACTION :

Distinction between electric traction and diesel powered traction unit, Factors governing performance of diesel powered unit, Tractive effort, maximum possible speed, output power. Transmission system and its function. Types of transmission system, mechanical, hydrolic and electric. Advantages of electric transmission. Load control, Load regulation. Servo field regulator, Static regulators Auxiliary equipments for Diesel and Electric system.

5. ELECTRIC LOCOMOTIVE MAINTENANCE :

Need of maintenance, Criterion for ideal maintenance Types of maintenance, Reliability, Methods of reducing maintenance cost, Maintenance records. Aspect of safety and pollution.

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M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
COURSE : ELECTRIC TRACTION
COURSE CODE : E-602
PREREQUISITE : E-402

LIST OF EXPERIMENTS/VISITS

1. VISIT TO LOCO SHEDS AND TRACTION SUBSTITUTION.
2. DRAW SPEED CURRENT CHARACTERISTIC OF D.C. SERIES MOTOR.
3. DRAW SPEED TORQUE CHARACTERISTIC OF D.C. SERIES MOTOR.
4. STUDY OF VARIOUS METHODS FOR SPEED CONTROL OF D.C. SERIES MOTOR.
5. STUDY OF POLE AND BOW CURRENT COLLECTOR.
6. STUDY OF PENTAGRAPH CURRENT COLLECTOR.
7. STUDY OF METALDYNE CONTROL SYSTEM.

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M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
 COURSE : ELECTRIC TRACTION
 COURSE CODE : E-602
 PREREQUISITE : E-402

LIST OF REFERENCE BOOKS

| S.No. | TITLE | AUTHOR | PUBLISHER |
|-------|------------------------------------|------------|----------------------|
| 1. | ELECTRIC TRACTION | A.T. DOVER | PITMAN & SONS |
| 2. | ELECTRIC TRACTION SYSTEM EQUIPMENT | D.W.HINGLE | PERGAMO PRESS |
| 3. | ELECTRIC TRACTION HAND BOOK. | R. BOKS | PITMAN & SONS |
| 4. | MODERN ELECTRIC TRACTION. | H. PRATAP | PRITAM SURAI & BROS. |

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M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL.

DETAILED CURRICULUM

COURSE TITLE : COMPUTER ENGINEERING
COURSE CODE NO. : E-603
PREREQUISITE : 301 COMPUTER APPLICATION
CATEGORY : DIVERSIFIED

DIPLOMA PROGRAMME
IN
ELECTRICAL 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.

VANUE : SURI VAISHNAV POLYTECHNIC, INDORE.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
 COURSE : COMPUTER ENGINEERING
 COURSE CODE : E-603
 PREREQUISITE : 301 (COMPUTER APPLICATION)

R A T I O N A L E

Computers have become generalised tool for improving productivity in business and industries. An Electrical Technician is required to use computers in numerous applications like Data processing, CAD, CAM etc. Thus an Electrical Technician should have well exposure to maintenance and use computers. Hence a diversified course of computer engineering has been selected in diploma programme in electrical engineering.

The course aims at providing students with advance knowledge of computer Hardware and Software. Fortran programming language is included due to its increasing use in engineering and scientific applications. Computer organisation will give the necessary exposure to computer hardware. Looking at the use of advance technology in the area of automation in industries, few topics on CAD & CAM are included in the curriculum. Finally in order to interface uses with bare hardware, preliminary knowledge is given by introducing the operating system concept in the curriculum.

An Electrical Engineering Technician is expected to fulfill following job function after this course-

- Explore the use of operating system.
- Development of design software for Industrial applications.
- Interfacing different I/O devices with computers.
- Preliminary maintenance of computers.
- Use of standard CAD packages.

It is expected that the curriculum will prove relevant to the needs of industry and a Technician exposed to this subject will be able to perform job functions satisfactorily.

M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.
 COURSE : COMPUTER ENGINEERING
 COURSE CODE : E-603
 PREREQUISITE : 301 COMPUTER APPLICATION.

SCHEME OF STUDIES.

| HOURS/WEEK | THEORY (3) | RACTICAL (2) | CREDIT (4) | |
|------------|---------------------------------|--------------|-----------------|-------------|
| S.No. | TOPIC | THEORY HOURS | PRACTICAL HOURS | TOTAL HOURS |
| 1. | REVIEW OF COMPUTER FUNDAMENTALS | 03 | 02 | 05 |
| 2. | FORTRAN PROGRAMMING | 14 | 16 | 30 |
| 3. | COMPUTER ARCHITECTURE | 16 | 06 | 22 |
| 4. | CAD AND CAM | 09 | 08 | 17 |
| 5. | OPERATING SYSTEM | 06 | 00 | 06 |
| TOTAL | | 48 | 32 | 80 |

SCHEME OF EXAMINATION

| SESSIONAL | PROGRESSIVE | | BOARD EXAMINATION | | | PRACTICAL /VIVA | | | |
|-----------|-------------|----|-------------------|-------|-------|-----------------|--------|-------|-------|
| | LW | I | II | PAPER | DURA. | MARKS | FRACT. | DURA. | MARKS |
| 20 | 20 | 10 | 10 | 1 | 3 | 100 | 1 | 3 | 50 |

M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING

COURSE : COMPUTER ENGINEERING.

COURSE CODE : E-603

PREREQUISITE : 301 COMPUTER APPLICATION

COURSE CONTENTS

| TOPIC NO. | COURSE CONTENTS |
|-----------|--|
| 1. | REVIEW OF COMPUTER FUNDAMENTALS : von neuman model, CPU, ALU, I/O devices, memory, software, hardware, character codes: ASCII, ISCII, EBCDIC, Language heirarchy. |
| 2. | FORTRAN PROGRAMMING : Flow chart, character set, constants & variables, data types, arithmetic operations, input - output statements, control statements, DO loops, Subscripted variables, format specification, logical expressions, functions & subroutines, files. |
| 3. | COMPUTER ARCHITECTURE : Flip-Flop, registers, half adders, full adders, counters, timers, encoders, decoders, multiplexers, demultiplexers. Microprocessor, Machine cycle, Read/write operation, I/O devices, Computer peripherals, Addressing Modes, Introduction to assembly language programming, Instruction formats, DMA. |
| 4. | CAD AND CAM : Basics of CAD, Application of computers for design, Benefits of CAD, Hardware in computer aided design, automation in manufacture and basics of CAM, Familiarity with commercial packages like AutoCad, Draftpack, IGL. |
| | OPERATING SYSTEM : Introduction, Types of operating system : Multiprogramming, Time sharing, Real time system. Functions of operating system: memory management, Device management, Processor management, Information management. |

M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
COURSE : COMPUTER ENGINEERING
COURSE CODE : E-603
PREREQUISITE : 301 COMPUTER APPLICATION

LIST OF EXPERIMENTS/VISITS

1. VISIT TO COMPUTER CENTRE.
2. FAMILIARIZATION WITH BASIC MS-DOS COMMANDS AND COMPUTER PERIPHERALS.
3. DEMONSTRATION OF FORTRAN PROGRAMMING ENVIRONMENT.
4. PROGRAMMING IN FORTRAN-77 COVERING VARIOUS ASPECTS OF THE LANGUAGE.
5. A MINI DESIGN PROGRAM IN FORTRAN-77.
6. SIMPLE PROGRAMMING IN ASSEMBLY LANGUAGE OF 8088.
7. DEMONSTRATION OF CAD SOFTWARE.
8. EXPERIMENTS RELATED TO FAMILIARIZATION WITH CAD SOFTWARE.

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M.P. 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 : POWER ELECTRONICS
COURSE CODE NO. : E-604
PREREQUISITE : E-506
CATEGORY : DIVERSIFIED

DIPLOMA PROGRAMME
IN
ELECTRICAL 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. |
| WAVE | SHRI VAISHNAV POLYTECHNIC, INDORE. |

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M.P. BOARD OF TECHNICAL EDUCATION, SHOLAR

- PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
- COURSE : POWER ELECTRONICS
- COURSE CODE : E-604
- PREREQUISITE : E-506

R A T I O N A L E

In modern industries most of the machine and processes are electronically operated, controlled and regulated. Electronic system is tremendously fast, efficient and stable. It is useful to control MW output Power with a very small input in W. It is equally good on changing the form of available electrical power in to desired form for its use. Power Electronics is thus most important diversified course in electrical engineering.

The technological advancements demand the proficiency in Power Electronics. It is there fore, necessary to impart the knowledge of this area to produce skilled Diploma Holder in electrical engineering, who can operate and maintain the electronically operated and controlled machines.

The contents of this course will cover concepts, principles of operation of electronic devices and electronically operated machines. The stress has been given towards practical aspects which will develop the skill and confidence at technician level while operating the electronically operated/controlled machines.

We hope that the curriculum will provide relevant to the needs of the industry and a Technician exposed to this subject will be able to perform his job functions satisfactorily.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
 COURSE : POWER ELECTRONICS
 COURSE CODE : E-604
 PREREQUISITE : E-506

S C H E M E O F S T U D I E S

HOURS/WEEK : THEORY (3) PRACTICAL (2) CREDIT: (4)

| S.NO. | TOPIC | THEORY HOURS | PRACTICAL HOURS | TOTAL HOURS |
|-------|--|--------------|-----------------|-------------|
| 1. | THE THYRISTOR | 08 | 02 | 10 |
| 2. | RATING, PROTECTION & COLLING OF THYRISTORS | 05 | 02 | 07 |
| 3. | APPLICATIONS | 05 | 06 | 11 |
| 4. | DRIVER/TRIGGER CIRCUITS. | 04 | 04 | 08 |
| 5. | CONVERTERS. | 09 | 08 | 17 |
| 6. | D.C. MOTOR CONTROL | 07 | 04 | 11 |
| 7. | A.C. MOTOR CONTROL | 07 | 04 | 11 |
| 8. | TIMERS | 03 | 02 | 5 |
| TOTAL | | 48 | 32 | 80 |

S C H E M E O F E X A M I N A T I O N

| SESSIONAL | | PROGRESSIVE | | BOARD EXAMINATION | | | PRACTICAL/VIVA | | |
|-----------|----|-------------|----|-------------------|-------|--------|----------------|-------|--------|
| TW | LW | I | II | PAPER | DURA. | MARKS. | PRACT. | DURA. | MARKS. |
| 20 | 20 | 10 | 10 | 1 | 3 | 100 | 1 | 3 | 50 |

M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING

COURSE : POWER ELECTRONICS

COURSE CODE: E-604

PREREQUISITE : E-506

COURSE CONTENTS

| TOPIC NO. | COURSE CONTENTS |
|-----------|--|
| 1. | <p>THE THYRISTOR : Structure, Diode & two transistor model, operation and characteristics, Ways to turn ON (light, break over voltage, gate & dv/dt), ways of turn off (Natural, reverse bias & gate). Thyristor in series, equalisation, Thyristor in parallel and their trigger method, circuit to turn ON (D.C., A.C., Pulse), circuit to turn off (Parallel and series resonant, auxiliary resonant, Parallel and series capacitances). Thyristor family devices - Triac, Diac, SCS, SUS, LASCR etc.</p> |
| 2. | <p>RATING PROTECTION AND COOLING : Major Rating (Anode voltage, current, temperature and Gate rating) factors responsible for temperature rise, circuit for over voltage, over current, voltage surge & high dv/dt, Gate protection. Modes of heat transfer, factor affecting in design of heat sink, mounting of heat sink, Brief idea about liquid and vapour cooling.</p> |
| 3. | <p>APPLICATIONS : Static A.C. & D.C. switch or C.B., Zero point switch, over voltage protection, Time delay circuits Reversing switch with plugging. Logic and digital circuits, P.F. corrector.</p> |
| 4. | <p>DRIVER/ TRIGGERING CIRCUITS : Transistorised firing circuits, phase shift trigger, UJT trigger, Schmitt trigger.</p> |
| 5. | <p>CONVERTER AND INVERTER CIRCUITS : Need of converters, live situations, Requirements, voltage & current inverters, Transistorised inverter with RC timing network.</p> |

Basic chopper circuit, chopper turn off methods classification of chopper, Morgans & Jones chopper circuits, Basic idea about four quadrant chopper.

Single phase and three phase Cyclo-converter, Frequency multiplier.

6. D.C. MOTOR CONTROL :

Performance of single phase Half wave & Full wave rectifier, Uncontrolled & Controlled rectifier on inductive load, Free wheel diode action.

Factors on which speed of D.C. Motor depends, Speed control characteristics, constant torque and constant horse power operation, speed regulation methods, Block diagram of PI speed controller.

7. A.C. MOTOR CONTROL :

Factors on which speed of induction motor depends, various methods of speed control (Integral cycle control, Phase control, cyclo-converter and Inverter), Circuit diagram and explanation in brief of the following (i)

(i) Stator voltage control (ii) Variable rotor resistance by pulse control (iii) Three phase bridge inverter.

8. TIMERS :

Series RL and RC circuits, time constants, numerical practice, Relay and Contactor construction, Contact modes, Application of Relays and Contactors. Need of Timers, Delay ON and Delay OFF, Various types of Timers (Mechanical, Electrical & Electronics). Timers using IC 555, Photo timers.

M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
COURSE : POWER ELECTRONICS
COURSE CODE : E-604
PREREQUISITE : E-506

LIST OF EXPERIMENTS/ VISITS

1. CHARACTERISTICS OF THYRISTOR FAMILY DEVICES.
2. STUDY OF VARIOUS TYPES OF TRIGGER CIRCUITS.
3. STUDY OF SINGLE AND THREE PHASE CONTROLLED RECTIFIER FOR SPEED CONTROL OF D.C. SHUNT MOTOR.
4. STUDY OF SINGLE PHASE ELECTRONIC SPEED REGULATOR.
5. STUDY OF FLASH GUN OF CAMERA.
6. STUDY OF ELECTRONIC TIMERS.
7. STUDY OF INVERTER USED WITH TV AND VCR.
8. STUDY OF SEQUENTIAL ELECTRONIC FLASHER.
9. STUDY OF LABORATORY POWER SUPPLIES AND SERVO STABILIZER.
10. STUDY OF BATTERY CHARGER CONSTANT VOLTAGE AND CONSTANT CURRENT TYPE.
11. STUDY OF UPS USED WITH COMPUTERS.
12. STUDY OF EMERGENCY TUBE LIGHT.

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M.F. BOARD OF TECHNICAL EDUCATION, BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING.

COURSE : POWER ELECTRONICS

COURSE CODE: E-604

PREREQUISITE: E-506

LIST OF REFERENCE BOOKS

| S.NO. | TITLE | AUTHOR | PUBLISHER |
|-------|---|------------------------|----------------------|
| 1. | POWER ELECTRONICS | RAMSHAW | CHAPMAN. |
| 2. | POWER ELECTRONICS | P.C.SEN | TATA MC GRAW HILL |
| 3. | THYRISTOR CONTROL OF ELECTRICAL DRIVE | S. VEDAM | TATA MC GRAW HILL |
| 4. | THYRISTORS AND THEIR APPLICATIONS. | RAMMOORTY | E.W.P. |
| 5. | THYRISTOR THEORY AND APPLICATION. | SUGANTHI & SUGANTHI | WILLEY EAST . |
| 6. | THYRISTOR ENGINEERING | M.S.BURIE | KHANNA PUB. |
| 7. | INDUSTRIAL ELECTRONICS | RASHID | |
| 8. | THYRISTOR IED POWER CONTROLLERS | G.K. DUBE | WILLEY EAST . |

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M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL.

DETAILED CURRICULUM

COURSE TITLE : POWER SYSTEM AND CONTROL
COURSE CODE NO. : E-605
PREREQUISITE : E-504
CATEGORY : DIVERSIFIED

DIPLOMA PROGRAMME
IN
ELECTRICAL 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.

VALUE : SHRI VAISHNAV POLYTECHNIC, INDORE.

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M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL.

PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
COURSE : POWER SYSTEM AND CONTROL
COURSE CODE : E-605
PREREQUISITE : E-504

R A T I O N A L E

A large number of electrical Diploma holders find job opportunities in power supply undertakings in the country. The job requirements are operation, control, maintenance and security of various power system components. So to cater the need of power supply undertakings, industries and the need of this specific job requirements, the subject POWER SYSTEM AND CONTROL finds a place in the curriculum of electrical engineering diploma as a diversified course.

Here emphasis has been made on the topics right from planning the operations, improvements, load studies and principles of economic despatch because such studies affect the design and operation of the system and the selection of apparatus for its control. For effective working of power system it must be properly controlled, keeping this in view the topic power system control is included. For designing a new power system and for planning extension of the existing one for the increased load demand, the load flow solution is essential. It was felt that a syllabus of power system and control would be incomplete without the introduction of the topics like power system security, system monitoring and LOLP calculation. Circle diagram are included only to extent that they help in fixing ideas about power flow and power limits. H.V.D.C. is included to keep in touch with modern trends.

The curriculum is relevant to the needs of power supply undertakings and industries and it will surely generate desired knowledge, skill and attitude in the students.

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M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL.

PROGRAMME : : DIPLOMA IN ELECTRICAL ENGINEERING
 COURSE : : POWER SYSTEM AND CONTROL
 COURSE CODE : : E-605
 PREREQUISITE : : E-504

SCHEME OF STUDIES

| HOURS/WEEK | THEORY (3) | PRACTICAL (2) | CREDIT : (4) | |
|------------|------------------------------------|---------------|-----------------|-------------|
| S.NO. | TOPIC | THEORY HOURS | PRACTICAL HOURS | TOTAL HOURS |
| 1. | CIRCLE DIAGRAM | 08 | 04 | 12 |
| 2. | ECONOMIC OPERATION OF POWER SYSTEM | 08 | 06 | 14 |
| 3. | LOAD FLOWS | 04 | 00 | 04 |
| 4. | HVDC/HVAC | 06 | 06 | 12 |
| 5. | MW AND MVAR | 06 | 06 | 12 |
| 6. | POWER SYSTEM SECURITY | 06 | 00 | 06 |
| 7. | LOLF CALCULATIONS | 04 | 00 | 04 |
| 8. | SYSTEM MONITORING | 02 | 06 | 08 |
| 9. | TRANSIENTS IN POWER SYSTEM | 06 | 04 | 10 |
| TOTAL | | 48 | 32 | 80 |

SCHEME OF EXAMINATION

| SESSIONAL | | PROGRESSIVE | | BOARD EXAMINATION | | | PRACTICAL / VIVA | | |
|-----------|----|-------------|----|-------------------|-------|-------|------------------|-------|-------|
| TW | LW | I | II | PAPER | DURA. | MARKS | PRCT. | DURA. | MARKS |
| 20 | 20 | 10 | 10 | 1 | 3 | 100 | 1 | 53 | 50 |

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PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
COURSE : POWER SYSTEM AND CONTROL
COURSE CODE : E-605
PREREQUISITE : E-504

COURSE CONTENTS

- | TOPIC NO. | COURSE CONTENTS |
|-----------|---|
| 1. | CIRCLE DIAGRAM : Importance of circle diagram, receiving end and sending end circle diagram. Simple numerical practice, voltage control at bus, various methods of voltage control, regulating transformers, static var compensation. |
| 2. | ECONOMIC OPERATION OF POWER SYSTEM : Introduction, incremental fuel cost, optimum loading on two units within a plant, optimum loading on units within a plant, optimum loading of plants, transmission loss as function of plant generation, unit commitments, B-loss coefficients, simple numerical practice. |
| 3. | LOAD FLOWS : Introduction, objectives of load flow, Bus classification, qualitative interpretation of SLTE and its solution. |
| 4. | HVDC/HVAC : Merits and demerits, types of links, controlled rectification, reactive power requirements, filters, controlled characteristics. |
| 5. | MW AND MVAR : Control problems, load frequency problem, speed control mechanism, control area, coherency, load damping, frequency control strategies, AVR studies. |
| 6. | POWER SYSTEM SECURITY : Concepts and meaning, various security levels, corrective rescheduling, GSDE, line outage distribution factor. |
| 7. | LOLP CALCULATIONS : (LOSS OF LOAD PROBABILITY) Effects of maintenance, different approaches to LOLP calculation. |
| 8. | SYSTEM MONITORING : System monitoring and concepts of state estimation. |
| 9. | TRANSIENT IN POWER SYSTEM : Transient in simple a.c. and d.c. circuit, three phase short circuit on unloaded alternator, Equivalent circuit of a alternator under sub-transient, transient and steady state condition, current and reactance under above conditions, asymmetry due to d.c. components. |

M.P. BOARD OF TECHNICAL EDUCATION, BHOPAL.

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LIST OF REFERENCE BOOKS

| S.No. | TITLE | AUTHOR | PUBLISHER |
|-------|--|-------------------|---------------------|
| 1. | ELEMENTS OF POWER SYSTEM ANALYSIS. | W.D.SIEVENSION | Mc GRAW HILL |
| 2. | POWER SYSTEM OPERATION. | R.H.MILLER | Mc GRAW HILL |
| 3. | MODERN POWER SYSTEM ANALYSIS | WAGMATH & KOTHARI | TATA Mc GRAW HILL |
| 4. | ELECTRICAL POWER SYSTEM | A.HUSAIN | |
| 5. | ELECTRICAL POWER SYSTEM | C..WIDHMAN. | WILEY EASTERN |
| 6. | GENERATION OF ELECTRICAL ENERGY | B.R.GUPTA | A.H. WHEELER |
| 7. | POWER SYSTEM OPERATION AND CONTROL. | MURPHY | TATA Mc GRAW HILL. |
| 8. | POWER SYSTEM ANALYSIS AND STABILITY | R.S.JHA. | DHANPAT RAI & SONS. |
| 9. | POWER GENERATION, OPERATION AND CONTROL. | WOOLENBURG | |

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PROGRAMME : DIPLOMA IN ELECTRICAL ENGINEERING
COURSE : POWER SYSTEM AND CONTROL
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LIST OF EXPERIMENTS/VISITS

1. STUDY OF HVDC SYSTEM.
2. STUDY OF HVAC SYSTEM.
3. STUDY OF VARIOUS TYPES OF VOLTAGE REGULATORS.
4. STUDY OF CONTROL RECTIFIERS.
5. STUDY OF INVERTERS.
6. STUDY OF SPEED CONTROL MECHANISM.
7. PROBLEM SOLVING ON P.C.
8. FIELD VISITS.

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