### CHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

#### COURSE OF STUDY AND SCHEME OF EXAMINATION OF DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING

#### SEMESTER – VI

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- L-Lecture
- T-Tutorial
- P- Practical
- ESE-End Semester Exam
- CT-Class Test
- TA-Teachers Assessment
CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

1. SEMESTER : VI
2. SUBJECT TITLE : ELECTRIC TRACTION
3. CODE : 224611 (24)
4. BRANCH DISCIPLINE : ELECTRICAL ENGINEERING
5. TEACHING AND EXAMINATION SCHEME

<table>
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6. DISTRIBUTION OF MARKS AND PERIODS:

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|   | Total       | 64 | 100 |

7. RATIONALE
This course is under applied technology group is intended to enable the student understand the facts, concepts, principles and procedures related to the electric traction so that he can acquire supervisory skills, which will help him to discharge his role as a supervisor when he starts working in the industry. The field visits are emphasized that better understanding of the subject can be imparted.
8. DETAILED COURSE CONTENTS

Chapter – 1  Overview of Electrical Traction System In India
- Electric Drive – strengths and limitations
- Choice of traction system in India

Chapter – 2  Systems of Track Electrification
- Description of various systems D.C., 1-phase low frequency A.C.,
  1-phase high frequency at 3-phase A.C. and composite system.
- 25 K.V. 1 phase A.C., 50 Hz systems – strengths and limitations.
- Problems associated with A.C. traction system. Current & voltage
  unbalance.
- Comparison between A.C. and D.C. systems.

Chapter – 3  Traction Mechanics
- Speed time curve
- Simplified speed time curve
- Average speed and schedule speed
- Tractive effort
- Specific energy consumption, Factors affecting specific energy
  consumption
- Mechanics of train movement
- Coefficient of adhesion, factors affecting the coefficient of adhesion.

Chapter – 4  Operation and Control of Electric Traction System
- Control of DC traction system
- Remote control system equipment and network
- General principle of operation
- Supervisory and alarm facilities
- Frequency allocation.

Chapter-- 5  Electric locomotive maintenance
- Need & types of maintenance
- Method of reducing maintenance cost
- Maintenance record

9. SUGGESTED IMPLEMENTATION STRATEGIES

1. Lecture session with question and answer
2. Use of audio visual aids
3. Assignments on various topics.

Moreover, when teaching this course, some of the actual devices need to be brought to
the class and demonstrated to the students

10. SUGGESTED LEARNING RESOURCES

a) Textbooks mentioned in the references.
b) Laboratory manuals
c) Periodicals like, news magazines, journals etc.
11. SUGGESTED REFERENCES

<table>
<thead>
<tr>
<th>S.No.</th>
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<tr>
<td>1</td>
<td>Electrical power</td>
<td>1992</td>
<td>Gupta J. B.; Kataria &amp; Sons Pub. New Delhi</td>
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<td>Soni, M.L. et al; Dhanpat Rai &amp; Sons, New Delhi</td>
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<td>Generation, Distribution &amp; utilisation of</td>
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<td>electrical energy</td>
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SUBJECT TITLE – ELECTRIC TRACTION LAB

Practical Code: 224622 (24)
Periods: 48

12. PRACTICAL EXPERIENCES

Visit to the railway maintenance section of Indian Railways followed by report of

a) Operation of the electrical system
b) Control room operations
c) Switchgear and protection
d) Maintenance of locomotive and other equipment
e) Power supply, return supply and wiring system.

2. Study of different current collectors in AC and DC system
3. Study of metro DC traction system
4. Study of PSI system
CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

1. SEMESTER : VI
2. SUBJECT TITLE : SWITCHGEAR AND PROTECTION
3. CODE : 224612 (24)
4. BRANCH DISCIPLINE : ELECTRICAL ENGINEERING

5. TEACHING AND EXAMINATION SCHEME

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7. RATIONALE

In power stations and sub-stations applications of switchgear and various protective schemes applied to various electrical equipment/machines, busbars, feeders, transmission lines/ distribution lines etc. are essential to minimize normal and abnormal faults and for safety of human beings. This course is intended to develop in the students the skill in operating various controls and switchgear used in power systems. He/she needs to make remedial measures for faults/abnormalities in machines/equipment in power system using appropriate diagnostic instruments/devices.
8. DETAILED COURSE CONTENTS

Chapter – 1 Principles of Protection
- Line diagram of a power system and its elements
- Faults and abnormalities, their causes, types and effects
- Functions of basic elements of a protective system
- Backup protection and its types
- Importance of neutral earthing
- Methods of neutral earthing and its advantages

Chapter – 2 Over Voltage Protection
- Causes and effects of over voltages
- Methods of reducing over voltages
- Types, Operating principles, applications of lightning arrester
- Surge absorber

Chapter – 3 Protective Relays
- Concept of protective relaying
- Classification of relays and their selection
- Construction and working principle of relays electromagnetic, induction, reverse power, differential, distance, IDMT, & thermal relay
- Basic terms related to relays pick-up value, reset value and operating current.
- Settings of various types of relays
- Causes of failure of primary relaying
- Use & types of backup relays in power system

Chapter – 4 Instrument Transformers
- Instrument transformers used for protection
- Polarity marking of CT & PT and their specifications
- Connection diagram of CT & PT in a 1-phase and 3-phase protective systems

Chapter – 5 Circuit Interrupting Devices
- Necessity and types of interruption devices like ACB, OCB, AB Switch, SF6 and vacuum circuit breakers & their working principle
- Line diagram of a protective system showing different circuit interrupting devices
- Arc formation in CB & methods of arc extinction
- Terms related to circuit interruption wave form
- Requirement and types of isolators
- Difference between isolators & CB
- Types of fuses and their characteristic

Chapter – 6 Protection Schemes
- Abnormalities and faults in a power system and its effects
- Protection schemes for alternator
- Protection against prime mover failure and unbalance loading
• Protection of transformers
• Protection of transmission line and feeders
• Protection of induction motors

9. SUGGESTED IMPLEMENTATION STRATEGIES

Some sections of this course like relays and instrument transformers could be taught in the classrooms by actually bringing the real things and explaining the various aspects. Some of the other aspects like circuit interrupting devices could be taught in the classrooms showing photographs and transparencies and taking them for field visits later. This will enhance the understanding.

10. SUGGESTED LEARNING RESOURCES

a) Textbooks mentioned in the references.
b) Laboratory manuals
c) Laboratory workbook, worksheet etc.

11. SUGGESTED REFERENCES

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<td>5</td>
<td>Power System Protection and Switchgear</td>
<td>1994</td>
<td>Badriram/ Tata McGraw-Hill, New Delhi</td>
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</table>
12. PRACTICAL EXPERIENCES

a) Use overload relay and obtain it’s time-current characteristic
b) Use Buchholz relay for transformer protection
c) Use thermal overload relay for protection of motor and set the relay property
d) Check the polarity of CT & PT and connect it with the relay
e) Apply the balance current protection scheme using appropriate switch gear
f) Find the fusing factor of a given fuse material
g) Operate air break switch in a simulated condition
h) Read and interpret the protection scheme for an alternator in power station (from blue print and visit)
i) Read and interpret various protective scheme used for transmission lines and feeders (from blue print and visit)
j) Draw schematic diagram of protective schemes for 66KV, 132KV, 220KV sub station (after visit)
k) Visit a substation and prepare its technical report emphasizing on control side.

******
1. SEMESTER : VI
2. SUBJECT TITLE : ELECTRICAL INSTALLATION MAINTENANCE & TESTING
3. CODE : 224613 (24)
4. BRANCH DISCIPLINE : ELECTRICAL ENGINEERING

5. TEACHING AND EXAMINATION SCHEME

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6. DISTRIBUTION OF MARKS AND PERIODS:

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7. RATIONALE

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

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

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

8. DETAILED COURSE CONTENTS

Chapter – 1 Installation
- 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.

Chapter – 2 Commissioning
Tests required before commissioning procedure to be adopted for commissioning the electrical equipment in respect of:
- Mechanical fixture and alignment.
- Electrical tests.
- Initial precautions for starting.

Chapter – 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.

Chapter – 4 Insulation testing and maintenance
- Instruments used for measuring insulation resistance.
- Reasons for deterioration of insulation resistance.
- Improving insulation resistance.
- Drying insulation.
- Measurement of internal temperature of winding
- Vacuum impregnation/ filtering of insulating oil.
- Testing of insulating oil.

Chapter—5 Preventive maintenance & Environmental pollution prevention
- Concepts of preventive maintenance.
- Advantages preventive maintenance schedule for transformer induction motor.
- Transmission line
- Circuit breaker and underground cable.
• Preventive measures to control environmental pollution results due to production of smokes gases.
• Flow of waste material and atomic reactions in research stations.
• Plants electrical & electronic equipments and accessories.

Chapter—6  Trouble Shooting
• Normal performance of equipment
• Trouble shooting internal and external faults
• Instruments and accessories for trouble shooting
• Trouble shooting charts.

Chapter—7  Electrical Accident & Safety measures
• Electrical accidents,
• Safety regulation,
• Treatment of shock,
• Fire extinguishers.

Chapter—8  Testing & Maintenance of relays & 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.

Chapter—9  Hot Line Maintenance
• Meaning and advantages
• Special type of non-conducting material used for preparing tools,
• Tools for hot line maintenance.

9. SUGGESTED IMPLEMENTATION STRATEGIES

The implementation strategy to teach this course should be a good mix of various teaching methods like lecture, question answer, assignment and lab work. This course is intended to develop the testing and maintenance skills very much required by the industry. Therefore more practical exercises need to be given to the students.

10. SUGGESTED LEARNING RESOURCES

a) Textbooks mentioned in the references.
b) Catalogue, manuals.

SUGGESTED REFERENCES

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<tr>
<td>1</td>
<td>Electrical Installation work</td>
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<td>Electrical Installations Maintenance &amp; fault location workbook</td>
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### SUBJECT TITLE – ELECTRICAL INSTALLATION MAINTENANCE & TESTING LAB

**Practical Code:** 224624 (24)

**Periods:** 32

#### 11. PRACTICAL EXPERIENCES

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

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. Shut down and energizing procedure.
6. Accident reports writing.
7. Permit to work.
8. Fire extinguisher.
9. Insulation oil testing.
10. Earth resistance testing.
11. Test report of electrical installation.
12. Maintenance schedule.
13. Trouble shooting.
CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

1. SEMESTER : VI
2. SUBJECT TITLE : UTILIZATION OF ELECTRICAL POWER
3. CODE : 224614 (24)
4. BRANCH DISCIPLINE : ELECTRICAL ENGINEERING

4. TEACHING AND EXAMINATION SCHEME

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<td>3</td>
<td>3</td>
<td>Electric Welding System</td>
<td>16</td>
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<td>4</td>
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<td>Illumination</td>
<td>14</td>
<td>25</td>
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<td>5</td>
<td>5</td>
<td>Power factor improvement</td>
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<td>TOTAL</td>
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7. RATIONALE

This course is under applied technology group is intended to enable the student understand the facts, concepts, principles and procedures related to the utilization of electric power so that he can acquire supervisory skills, which will help him to discharge his role as a supervisor when he starts working in the industry.
8. **DETAILED COURSE CONTENTS**

**Chapter – 1  Principles of Selection of Electrical Drive System**
- Requirements of mechanical load
- Review of the electrical motor operation
- Duty cycle
- Principles of selection of motor
- Power transmission system
- Procedure to select the motor i.e. type, size & rating
- Procedure to operate & control the motor i.e. starting running braking, speed, load fluctuation

**Chapter – 2  Electric Heating System**
- Principal, Advantages and Disadvantages of electric heating system
- Modes of transfer of heat
- Principle of the resistance, induction and dielectric heating
- Principle of heat conversion in resistance, induction, dielectric heating
- Types of Furnaces – Arc and Induction Furnaces

**Chapter – 3  Electric Welding System**
- Concepts of the resistance, induction, arc metallic & carbon welding.
- Principles of welding
- Principle of TIG and MIG welding
- AC and DC Arc Welding

**Chapter – 4  Illumination**
- Electromagnetic Wave spectrum
- Law of illumination
- Definitions of terms used lighting
- Types of lighting scheme and their calculation
- Types of lamps and their uses and fittings

**Chapter—5  Power factor improvement**
- Causes & ill effects of low power factor
- Methods of improvement of power factor & its economics

9. **SUGGESTED IMPLEMENTATION STRATEGIES**

1. Lecture session with question and answer
2. Use of audio visual aids
3. Assignments on various topics.

Moreover, when teaching this course, some of the actual devices need to be brought to the class and demonstrated to the students
10. SUGGESTED LEARNING RESOURCES
   a) Textbooks mentioned in the references.
   b) Laboratory manuals
   c) Periodicals like, news magazines, journals etc.

11. SUGGESTED REFERENCES

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Title</th>
<th>Ed./Year</th>
<th>Author/Publisher</th>
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<tbody>
<tr>
<td>1</td>
<td>Electrical power</td>
<td>1992</td>
<td>Gupta J. B.; Kataria &amp; Sons Pub. New Delhi</td>
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<td>3</td>
<td>A Course in Electrical power</td>
<td>1987</td>
<td>Soni, M.L. et al; Dhanpat Rai &amp; Sons, New Delhi</td>
</tr>
</tbody>
</table>

SUBJECT TITLE – UTILIZATION OF ELECTRICAL POWER LAB
   Practical Code: 224625 (24)
   Periods: 32

12. PRACTICAL EXPERIENCES
   1. Visit to the medium size manufacturing industry and observe the drive, arrangement, instrumentation & control system, procedures, instrumentation, tools, machines & sequencing of operation.
   2. Write report. Draw the plant layout. State the principles of the operation and control of the manufacturing system.
   3. Select the heating procedure for the study.
   4. Select welding process, either visit or video demonstration.
   5. Visit to the railway maintenance section and report of operation, control, switchgear and protection and maintenance of locomotive and other traction equipment, power supply, return supply and wiring system.

******
CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

1. SEMESTER : VI
2. COURSE TITLE : ENTREPRENEURSHIP DEVELOPMENT
3. CODE : 200615 (37)
4. BRANCH/DISCIPLINE : ELECTRICAL ENGINEERING

5. TEACHING AND EXMINATION SCHEME:

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5. DISTRIBUTION OF MARKS AND PERIODS:

<table>
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<th>Chapter Name</th>
<th>Periods</th>
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<td>10</td>
<td>12</td>
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<tr>
<td>2.</td>
<td>2.</td>
<td>Forms of business organization</td>
<td>10</td>
<td>10</td>
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<td>3.</td>
<td>3.</td>
<td>Institutional support for SSI</td>
<td>10</td>
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<td>4.</td>
<td>4.</td>
<td>Planning a small scale industry</td>
<td>10</td>
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<td>5.</td>
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<td>Management of small business firms</td>
<td>10</td>
<td>12</td>
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<td>6.</td>
<td>6.</td>
<td>Project selection, formulation and appraisal</td>
<td>10</td>
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<td>7.</td>
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<td>Problems of small industries</td>
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<td>8.</td>
<td>8.</td>
<td>Entrepreneurial motivation training</td>
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</table>

6. RATIONALE

It has been experienced in most parts of the world that entrepreneurship development is a means of rapid economic development vis-à-vis creation of gainful employment of masses. The myth that entrepreneurs are born and not made no longer holds good. Experiences of last few decades in India show that it is possible to develop entrepreneurs through planned efforts. These designed efforts are more essentially required in polytechnics where increasing unemployment has necessitated promoting self-employment/entrepreneurship as career option thereby creating more job providers than job seekers. This course focuses on inputs required for students to undertake entrepreneurial activities as career option.
7. DETAILED COURSE CONTENTS:

CHAPTER-1   Entrepreneurial Development

➢ Definition of entrepreneurship,
➢ Characteristics of entrepreneurs,
➢ Factors influencing entrepreneurship,
➢ Need for promotion of entrepreneurship and small business
➢ Entrepreneurial Environment
➢ Environmental analysis.
➢ Government policies for setting up new small enterprises
➢ Opportunities in service industries.

CHAPTER – 2   Forms of Business Organization

➢ Forms of ownership
➢ Sole Proprietorship
➢ Partnership
➢ Cooperative society
➢ Joint – stock company
➢ Private Limited Companies
➢ Public Limited Companies

CHAPTER – 3   Institutional support to SSI

➢ Institutional set up
➢ Industries centers,
➢ Industrial estates
➢ Institutional support at National level
➢ Institutional support at State level
➢ Commercial banks and financial institutions

CHAPTER – 4   Planning a SSI

➢ What is planning?
➢ Types of planning
➢ Importance of planning
➢ Steps in planning
➢ Steps in planning a SSI
➢ Technical dimensions for setting up an enterprise
CHAPTER-5 Management of Small Business Firm

- Functional areas of small business firm
- Fundamentals of Management
- Managerial effectiveness
- Essential data for effective control of small business
- Resource management
- Office management
- Employees Welfare & safety
- Factory rules and Labour Laws related to SSIs
- Sales Tax and Income Tax laws related to SSIs

CHAPTER-6 Project selection, Formulation & Appraisal

- Project selection & formulation
- Scope of project report
- Content & Format of Project report
- Need of Project Appraisal
- Steps of Project Appraisal

CHAPTER-7 Problems of Small industries

- Power shortages
- Project planning
- Finance
- Raw material
- Production constraints
- Marketing
- Personal constraints
- Regulations

CHAPTER-8 Entrepreneurial Motivation Training

- Achievement Motivation
- Creative thinking
- Risk taking abilities

8. SUGGESTED INSTRUCTIONAL STRATEGIES:

- Lecture Method.
- Industrial visits.
- Simulation
- Role play
- Interaction with successful entrepreneurs
- Demonstration.
- Games

9. **SUGGESTED LEARNING RESOURCES:**

(a) **Reference Books:**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Title</th>
<th>Author, Publisher, Edition &amp; Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>Entrepreneurship Development in small scale proceedings of National Seminar, DCSSI, New Delhi</td>
<td>Patel V.G.</td>
</tr>
<tr>
<td>6.</td>
<td>Entrepreneurship development in India</td>
<td>Dr. C.B. Gupta Dr. N.P. Srinivasan Sultan Chand &amp; Sons</td>
</tr>
</tbody>
</table>

10. **LIST OF TEAM WORK**

Team Work will consist of collecting following information by the students:

1. Collect State industrial policy
2. Report of interaction with successful entrepreneurs/industrial visits
3. Prepare list of opportunities for business, service and industrial ventures
4. Whom to approach for What?
5. Facilities and incentives available from various support agencies
1. **SEMESTER**: VI
2. **COURSE TITLE**: PROJECT - INDUSTRY BASED
3. **CODE**: 224621 (24)
4. **BRANCH/DISCIPLINE**: ELECTRICAL ENGINEERING

### 4. TEACHING AND EXMINATION SCHEME:

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|                | 70 | 3 |

### 5. RATIONALE

Project work is a consolidation of various problem statements, which has undertaken during the preceding semesters. Therefore, the given project is intended to integrate as many acquired skills as possible. The project work will not only consist of practical skills, but it could also consist of application of various cognitive skills as well as demonstration of certain desirable attitudes by the student relevant to the implementation of the chosen/given project.

### 6. SCHEDULE OF PROJECT WORK

For a period of one semester, the project work could contain the following broad schedule for implementing the project and writing the project report.

- **Title of Project**
- **Project Description**
- **Methods of doing the project and choice of method adopted for doing this project.**
- **Action Plan**
- **Prototype design on paper**
- **Testing Methodology**
  - Resources Required
  - Procedure in steps
  - Precautions
  - Observations and calculations
  - Results
Interpretation of results
Conclusions
References.

7. ASSESSMENT OF PROJECT WORK

Some broad criteria for assessing the project are given here. Minor modifications depending on the type of project could be done.

a. **Process – 70% weightage**

Criteria considered

i. Preparation of action plan - 5%
ii. Selection of proper method - 5%
iii. Selection of proper resources - 10%
iv. Experimentation - 30%
v. Group working and leadership - 10%
vi. Following safe practices - 5%
vii. Recording in log-book - 5%

b. **Product – 30% weightage**

Criteria considered

viii. Completed project -10%
ix. Project report -20%

7. SUGGESTED IMPLEMENTATION STRATEGIES

a) Project could be performed by group of two to five students.
b) Project should integrate all problem statements, which could consist of practical skills, intellectual skills, interpersonal skills, Market survey skills etc.
c) Monitoring the project at every stage.
d) Project guide should carry out progressive assessment for every stage of project.

8. SUGGESTED REFERENCES

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<th>Author/ Publisher</th>
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<tbody>
<tr>
<td>1</td>
<td>Design Suitable Learning Experiences for Laboratory Work and Direct Laboratory Experiences to Achieve Specified Aims - Competency-based Self-learning Module.No.4; REC-British Council India Project</td>
<td>1999</td>
<td>Earnest, Joshua; Mathew, Susan S.; Shrivastava, M.K.; Banthiya, N.K.; TTTI, Bhopal</td>
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