SYLLABUS

DIPLOMA IN MECHANICAL ENGINEERING
FULL TIME, SANDWICH & PART TIME
Course Code: 1020/2020/3020

2015-2016

M - SCHEME

DIRECTORATE OF TECHNICAL EDUCATION
GOVERNMENT OF TAMILNADU
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

M SCHEME
(Implemented from the Academic year 2015 - 2016 onwards)

Chairperson
Tmt. S.MADUMATHI, I.A.S.,
Director
Directorate of Technical Education
Guindy, Chennai.

Dr. K.SUNDARAMOORTHY, M.E., Phd.,
Additional Director of Technical Education (Polytechnics)
Directorate of Technical Education
Guindy, Chennai.

Co-ordinator & Convener
Dr. M.Isakkimuthu, M.E., Phd.,
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Members

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EMRC- Anna University
Chennai.

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Professor, Dean in-charge
School of Mechanical Engineering
SRM University, Kattankulathur
Kanchipuram (Dt)

Dr. S.Ravichandran
CEO & Chief Scientist
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Thiru N.S.Santhosh
General Manager-Training
Delphi TVS Diesel Systems Ltd.
Mannur Plant, Sriperumbudur
Kanchipuram (Dt).

Thiru A.Ganeshkumar
Director
Arasan Aluminium Industries
Sivakasi

Thiru P.Subramanya Reddy
HOD/Mech.
Murugappa Polytechnic College
S.M.Nagar, Chennai.

Dr. K.Pitchaimani
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T.J.S.Polytechnic College
Peruvoor, Gummudipoondi (Tk)
Thiruvallur (Dt)

Thiru T.Jothiram
HOD/Mech.
NPAC Polytechnic College
Kothagiri, The Nilgiris.

Thiru M.Sugumaran
Workshop Superintendent
Ramakrishna Mission Polytechnic College
Mylapore, Chennai.

Thiru G.Gopu
Lecturer/Mechanical
Central Polytechnic College
Tharamani, Chennai
DIPLOMA COURSES IN ENGINEERING/TECHNOLOGY
(SEMESTER SYSTEM)
(Implemented from 2015-2016)
M – SCHEME

REGULATIONS*

* Applicable to the Diploma Courses other than Diploma in Hotel Management & Catering Technology and the Diploma Courses offered through MGR Film Institute, Chennai.

1. Description of the Course:

a. Full Time (3 years)

The Course for the full Time Diploma in Engineering shall extend over a period of three academic years, consisting of 6 semesters* and the First Year is common to all Engineering Branches.

b. Sandwich (3½ years)

The Course for the Diploma in Engineering (sandwich) shall extend over a period of three and half academic years, consisting of 7 semesters* and the First Year is common to all Engineering Branches. The subjects of three years full time diploma course being regrouped for academic convenience.

During 4th and/or during 7th semester the students undergo industrial training for six months/ one year. Industrial training examination will be conducted after completion of every 6 months of industrial training

c. Part Time (4 years)

The course for the diploma in Engineering shall extend over a period of 4 academic years containing of 8 semesters*, the subjects of 3 year full time diploma courses being regrouped for academic convenience.

* Each Semester will have 15 weeks duration of study with 35 hrs. /Week for Regular Diploma Programme and 18hrs/ week (21 hrs. / Week I year) for Part-Time Diploma Programmes.

The Curriculum for all the 6 Semesters of Diploma courses (Engineering & Special Diploma Courses viz. Textile Technology, Leather Technology, Printing Technology, Chemical Technology etc.) have been revised and revised curriculum is applicable for the candidates admitted from 2015 – 2016 academic year onwards.
2. Condition for Admission:

Condition for admission to the diploma courses shall be required to have passed in:
- The S.S.L.C Examination of the Board of Secondary Education, TamilNadu.
- The Anglo Indian High School Examination with eligibility for Higher Secondary Course in TamilNadu.
- The Matriculation Examination of Tamil Nadu.
- Any other Examination recognized as equivalent to the above by the Board of Secondary Education, TamilNadu.

Note: In addition, at the time of admission the candidate will have to satisfy certain minimum requirements, which may be prescribed from time to time.

3. Admission to Second year (Lateral Entry):

A pass in HSC (Academic) or (Vocational) courses mentioned in the Higher Secondary Schools in TamilNadu affiliated to the TamilNadu Higher Secondary Board with eligibility for university Courses of study or equivalent examination, & Should have studied the following subjects.

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Courses</th>
<th>H.Sc Academic Subjects Studied</th>
<th>H.Sc Vocational Subjects Studied</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Related subjects</td>
<td>Related Vocational subjects</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vocational subjects</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>All the Regular and Sandwich Diploma Courses</td>
<td>Maths, Physics &amp; Chemistry</td>
<td>Maths / Physics / Chemistry</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Related Vocational Subjects</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subjects</td>
<td>Theory &amp; Practical</td>
</tr>
<tr>
<td>2.</td>
<td>Diploma course in Modern Office Practice</td>
<td>English &amp; Accountancy</td>
<td>English &amp; Accountancy,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>English &amp; Elements of Economics</td>
<td>English &amp; Elements of Economics,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>English &amp; Elements of Commerce</td>
<td>English &amp; Management Principles</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&amp; Techniques,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>English &amp; Typewriting</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Accountancy &amp; Auditing,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Banking,</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Business Management,</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Co-operative Management,</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>International Trade,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Marketing &amp; Salesmanship,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Insurance &amp; Material Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Office Secretaryship.</td>
</tr>
</tbody>
</table>
For the diploma Courses related with Engineering/Technology, the related / equivalent subjects prescribed along with Practical may also be taken for arriving the eligibility.

Branch will be allotted according to merit through counseling by the respective Principal as per communal reservation.

For admission to the Textile Technology, Leather Technology, Printing Technology, Chemical Technology and Modern Office Practice Diploma courses the candidates studied the related subjects will be given first preference.

Candidates who have studied Commerce Subjects are not eligible for Engineering Diploma Courses.

4. Age Limit: No Age limit.

5. Medium of Instruction: English

6. Eligibility for the Award of Diploma:

No candidate shall be eligible for the Diploma unless he/she has undergone the prescribed course of study for a period of not less than 3 academic years in any institution affiliated to the State Board of Technical Education and Training, TamilNadu, when joined in First Year and two years if joined under Lateral Entry scheme in the second year and passed the prescribed examination.

The minimum and maximum period for completion of Diploma Courses are as given below:

<table>
<thead>
<tr>
<th>Diploma Course</th>
<th>Minimum Period</th>
<th>Maximum Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Time</td>
<td>3 Years</td>
<td>6 Years</td>
</tr>
<tr>
<td>Full Time(Lateral Entry)</td>
<td>2 Years</td>
<td>5 Years</td>
</tr>
<tr>
<td>Sandwich</td>
<td>3½ Years</td>
<td>6½ Years</td>
</tr>
<tr>
<td>Part Time</td>
<td>4 Years</td>
<td>7 Years</td>
</tr>
</tbody>
</table>

7. Subjects of Study and Curriculum outline:

The subjects of study shall be in accordance with the syllabus prescribed from time to time, both in theory and practical. The curriculum outline is given in Annexure - I

8. Examinations:

Board Examinations in all subjects of all the semesters under the scheme of examinations will be conducted at the end of each semester.
The Internal assessment marks for all the subjects will be awarded on the basis of continuous internal assessment earned during the semester concerned. For each subject 25 marks are allotted for internal assessment and 75 marks are allotted for Board Examination.

9. Continuous Internal Assessment:

A. For Theory Subjects:
The Internal Assessment marks for a total of 25 marks, which are to be distributed as follows:

i. Subject Attendance
(Award of marks for subject attendance to each subject theory/practical will as per the range given below)

<table>
<thead>
<tr>
<th>Range</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>80% - 83%</td>
<td>1 Mark</td>
</tr>
<tr>
<td>84% - 87%</td>
<td>2 Marks</td>
</tr>
<tr>
<td>88% - 91%</td>
<td>3 Marks</td>
</tr>
<tr>
<td>92% - 95%</td>
<td>4 Marks</td>
</tr>
<tr>
<td>96% - 100%</td>
<td>5 Marks</td>
</tr>
</tbody>
</table>

ii) Test 
2 Tests each of 2 hours duration for a total of 50 marks are to be conducted. Out of which the best one will be taken and the marks to be reduced to:

<table>
<thead>
<tr>
<th>Test</th>
<th>Units</th>
<th>When to Conduct</th>
<th>Marks</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
<td>Unit – I &amp; II</td>
<td>End of 6th week</td>
<td>50</td>
<td>2 Hrs</td>
</tr>
<tr>
<td>II</td>
<td>Unit – III &amp; IV</td>
<td>End of 12th week</td>
<td>50</td>
<td>2 Hrs</td>
</tr>
<tr>
<td>III</td>
<td>Model Examination - Compulsory&lt;br&gt;Covering all the 5 Units.&lt;br&gt;(Board Examination-question paper-pattern).&lt;br&gt;</td>
<td>End of 15th week</td>
<td>75</td>
<td>3 Hrs</td>
</tr>
</tbody>
</table>

- From the Academic year 2015-2016 onwards.
Question Paper Pattern for the Periodical Test : (Test - I & Test- II)

With no choice:

PART A type questions: 4 Questions X 2 mark … … 8 marks
PART B type questions: 4 Questions X 3 marks … … 12 marks
PART C type questions: 3 Questions X 10 marks … … 30 marks

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Total
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50 marks

iii) Assignment

10 Marks

For each subject Three Assignments are to be given each for 20 marks and the average marks scored should be reduced for 10 marks

All Test Papers and assignment notebooks after getting the signature with date from the students must be kept in the safe custody in the Department for verification and audit. It should be preserved for 2 Semesters and produced to the flying squad and the inspection team at the time of inspection/verification.

B. For Practical Subjects:

The internal assessment mark for a total of 25 marks which are to be distributed as follows:-

a) Attendance : 5 Marks
   (Award of marks as same as Theory subjects)

b) Procedure/ observation and tabulation/
   Other Practical related Work : 10 Marks

c) Record writing : 10 Marks

TOTAL : 25 Marks

- All the Experiments/exercises indicated in the syllabus should be completed and the same to be given for final board examinations.
- The Record for every completed exercise should be submitted in the subsequent Practical classes and marks should be awarded for 20 for each exercise as per the above allocation.
- At the end of the Semester, the average marks of all the exercises should be calculated for 20 marks and the marks awarded for attendance is to be added to arrive at the internal assessment mark for Practical. (20+5=25 marks)
- The students have to submit the duly signed bonafide record note book/file during the Practical Board Examinations.
• All the marks awarded for assignment, Test and attendance should be entered in the Personal Log Book of the staff, who is handling the subject. This is applicable to both Theory and Practical subjects.

10. Life and Employability Skill Practical:
The Life and Employability Skill Practical with more emphasis is being introduced in IV Semester for Circuit Branches and in V Semester for other branches of Engineering.
Much Stress is given to increase the employability of the students:

Internal assessment Mark ..... 25 Marks

11. Project Work:
The students of all the Diploma Programmes (except Diploma in Modern Office Practice) have to do a Project Work as part of the Curriculum and in partial fulfillment for the award of Diploma by the State Board of Technical Education and Training, Tamilnadu. In order to encourage students to do worthwhile and innovative projects, every year prizes are awarded for the best three projects i.e. institution wise, region wise and state wise. The Project work must be reviewed twice in the same semester.

a) Internal assessment mark for Project Work & Viva Voce:

<table>
<thead>
<tr>
<th></th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Review I</td>
<td>10</td>
</tr>
<tr>
<td>Project Review II</td>
<td>10</td>
</tr>
<tr>
<td>Attendance</td>
<td>05</td>
</tr>
</tbody>
</table>

Total ..... 25 marks

Proper record to be maintained for the two Project Reviews, and it should be preserved for 2 Semesters and produced to the flying squad and the inspection team at the time of inspection/verification.

b) Allocation of Mark for Project Work & Viva Voce in Board Examination:

<table>
<thead>
<tr>
<th></th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viva Voce</td>
<td>30</td>
</tr>
<tr>
<td>Marks for Report Preparation, Demo</td>
<td>35</td>
</tr>
</tbody>
</table>

Total 65 marks

c) Written Test Mark (from 2 topics for 30 minutes duration): $$

i) Environment Management 2 questions X 2 ½ marks = 5 marks

iI) Disaster Management 2 questions X 2 ½ marks = 5 marks

10 marks

$ - Selection of Questions should be from Question Bank, by the External Examiner.
No choice need be given to the candidates.

| Project Work & Viva Voce in Board Examination | -- | 65 Marks |
| Written Test Mark (from 2 topics for 30 minutes duration) | -- | 10 Marks |
| **TOTAL** | -- | **75 Marks** |

A neatly prepared PROJECT REPORT as per the format has to be submitted by individual during the Project Work & Viva Voce Board examination.

12. Scheme of Examinations:

The Scheme of examinations for subjects is given in **Annexure - II**.

13. Criteria for Pass:

1. No candidate shall be eligible for the award of Diploma unless he/she has undergone the prescribed course of study successfully in an institution approved by AICTE and affiliated to the State Board of Technical Education & Training, Tamil Nadu and pass all the subjects prescribed in the curriculum.

2. A candidate shall be declared to have passed the examination in a subject if he/she secures not less than 40% in **theory subjects** and 50% in **practical subject** out of the total prescribed maximum marks including both the internal assessment and the Board Examination marks put together, subject to the condition that he/she secures at least a minimum of 30 marks out of 75 marks in the Board’s Theory examinations and a minimum of 35 marks out of 75 marks in the Board Practical Examinations.

14. Classification of successful candidates:

Classification of candidates who will pass out the final examinations from April 2018 onwards (Joined in first year in 2015-2016) will be done as specified below.

**First Class with Superlative Distinction:**
A candidate will be declared to have passed in **First Class with Superlative Distinction** if he/she secures not less than 75% of the marks in all the subjects and passes all the semesters in the first appearance itself and passes all subjects within the stipulated period of study 3/ 3½/ 4 years (Full Time/Sandwich/Part Time) without any break in study.

**First Class with Distinction:**
A candidate will be declared to have passed in **First Class with Distinction** if he/she secures not less than 75% of the aggregate of marks in all the
semesters put together and passes all the semesters except the I and II semesters in the first appearance itself and passes all the subjects within the stipulated period of study 3/ 3½/ 4 years (Full Time/Sandwich/Part Time) without any break in study.

First Class:
A candidate will be declared to have passed in First Class if he/she secures not less than 60% of the aggregate marks in all semesters put together and passes all the subjects within the stipulated period of study 3/ 3½ / 4 years (Full Time/Sandwich/Part Time) without any break in study.

Second Class:
All other successful candidates will be declared to have passed in Second Class.

The above mentioned classifications are also applicable for the Sandwich / Part-Time students who pass out Final Examination from October 2018 /April 2019 onwards (both joined in First Year in 2015-2016)

15. Duration of a period in the Class Time Table:
The duration of each period of instruction is 1 hour and the total period of instruction hours excluding interval and Lunch break in a day should be uniformly maintained as 7 hours corresponding to 7 periods of instruction (Theory & Practical).

16. Seminar:
For seminar the total seminar 15 hours(15 weeks x 1hour) should be distributed equally to total theory subject per semester(i.e 15 hours divided by 3/4 subject). A topic from subject or current scenario is given to students. During the seminar hour students have to present the paper and submit seminar material to the respective staff member, who is handling the subject. It should be preserved for 2 Semesters and produced to the flying squad and the inspection team at the time of inspection/verification.
## Diploma in Mechanical Engineering

### List of Equivalent Subjects for L - Scheme to M – Scheme

#### THIRD SEMESTER – WITH EFFECT FROM OCTOBER 2016

<table>
<thead>
<tr>
<th>Subject code</th>
<th>Name of the Subject</th>
<th>Subject code</th>
<th>Name of Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>22031</td>
<td>Strength of Materials</td>
<td>32031</td>
<td>Strength of Materials</td>
</tr>
<tr>
<td>22032</td>
<td>Fluid Mechanics &amp; Fluid Power</td>
<td>32043</td>
<td>Fluid Mechanics and Fluid Power</td>
</tr>
<tr>
<td>22033</td>
<td>Renewable Energy Sources</td>
<td>32073</td>
<td>Renewable Energy Sources and Energy Conservation</td>
</tr>
<tr>
<td>22034</td>
<td>Machine Drawing</td>
<td>32033</td>
<td>Machine Drawing</td>
</tr>
<tr>
<td>22035</td>
<td>Mechanical Testing &amp; Quality Control Practical</td>
<td>32045</td>
<td>Strength of Materials and Fluid Mechanics Practical</td>
</tr>
<tr>
<td>22036</td>
<td>Fluid Power Practical</td>
<td>32045</td>
<td>Strength of Materials and Fluid Mechanics Practical</td>
</tr>
<tr>
<td>20001</td>
<td>Computer Applications Practical</td>
<td>32034</td>
<td>Computer Applications and CAD Practical</td>
</tr>
</tbody>
</table>

#### FOURTH SEMESTER – WITH EFFECT FROM APRIL 2017

<table>
<thead>
<tr>
<th>Subject code</th>
<th>Name of the Subject</th>
<th>Subject code</th>
<th>Name of Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>22041</td>
<td>Manufacturing Technology – I</td>
<td>32032</td>
<td>Manufacturing Processes</td>
</tr>
<tr>
<td>22042</td>
<td>Thermal Engineering – I</td>
<td>32041</td>
<td>Heat Power Engineering</td>
</tr>
<tr>
<td>22043</td>
<td>Electrical Drives &amp; Control</td>
<td>32044</td>
<td>Electrical Drives &amp; Control</td>
</tr>
<tr>
<td>22044</td>
<td>Computer Aided Machine Drawing Practical</td>
<td>32034</td>
<td>Computer Applications and CAD Practical</td>
</tr>
<tr>
<td>22045</td>
<td>Manufacturing Technology – I Practical</td>
<td>32036</td>
<td>Lathe and Drilling Practical</td>
</tr>
<tr>
<td>22047</td>
<td>Electrical Drives &amp; Control Practical</td>
<td>32047</td>
<td>Electrical Drives &amp; Control Practical</td>
</tr>
</tbody>
</table>
**FIFTH SEMESTER – WITH EFFECT FROM OCTOBER 2017**

<table>
<thead>
<tr>
<th>Subject code</th>
<th>Name of the Subject</th>
<th>Subject code</th>
<th>Name of Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>22051</td>
<td>Thermal Engineering – II</td>
<td>32052</td>
<td>Thermal and Automobile Engineering</td>
</tr>
<tr>
<td>22052</td>
<td>Manufacturing Technology – II</td>
<td>32042</td>
<td>Special Machines</td>
</tr>
<tr>
<td><strong>Elective - I Theory</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22071</td>
<td>Total Quality Management</td>
<td>32071</td>
<td>Total Quality Management</td>
</tr>
<tr>
<td>22072</td>
<td>Modern Machining Processes</td>
<td>32042</td>
<td>Special Machines</td>
</tr>
<tr>
<td>22073</td>
<td>Power Plant Engineering</td>
<td>32052</td>
<td>Thermal and Automobile Engineering</td>
</tr>
<tr>
<td>22054</td>
<td>Design of Machine Elements</td>
<td>32051</td>
<td>Design of Machine Elements</td>
</tr>
<tr>
<td>22055</td>
<td>Thermal Engineering Practical</td>
<td>32056</td>
<td>Thermal and Automobile Engineering Practical</td>
</tr>
<tr>
<td>22056</td>
<td>Manufacturing Technology – II</td>
<td>32046</td>
<td>Special Machines Practice</td>
</tr>
<tr>
<td>20002</td>
<td>Communication and Life Skills</td>
<td>30002</td>
<td>Life and Employability Skills</td>
</tr>
<tr>
<td></td>
<td>Practical **</td>
<td></td>
<td>Practical **</td>
</tr>
</tbody>
</table>

**SIXTH SEMESTER – WITH EFFECT FROM APRIL 2018**

<table>
<thead>
<tr>
<th>Subject code</th>
<th>Name of the Subject</th>
<th>Subject code</th>
<th>Name of Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>22061</td>
<td>Industrial Engineering and Management</td>
<td>32061</td>
<td>Industrial Engineering and Management</td>
</tr>
<tr>
<td>22062</td>
<td>Computer Integrated Manufacturing</td>
<td>32062</td>
<td>Computer Aided Design and Manufacturing</td>
</tr>
<tr>
<td><strong>Elective - II Theory</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22081</td>
<td>Automobile Engineering</td>
<td>32052</td>
<td>Thermal and Automobile Engineering</td>
</tr>
<tr>
<td>22082</td>
<td>Robotics</td>
<td>32082</td>
<td>Robotics</td>
</tr>
<tr>
<td>22083</td>
<td>Refrigeration and Air-conditioning</td>
<td>32083</td>
<td>Refrigeration and Air-conditioning</td>
</tr>
<tr>
<td>22084</td>
<td>Proto-Typing in Product Design</td>
<td></td>
<td>No Equivalent</td>
</tr>
<tr>
<td>22064</td>
<td>Computer Integrated Manufacturing Practical</td>
<td>32064</td>
<td>Computer Aided Design and Manufacturing Practical</td>
</tr>
<tr>
<td>22065</td>
<td>Process Automation Practical</td>
<td>32055</td>
<td>Process Automation Practical</td>
</tr>
<tr>
<td><strong>Elective - II Practical</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22085</td>
<td>Automobile Engineering Practical</td>
<td>32056</td>
<td>Thermal and Automobile Engineering Practical</td>
</tr>
<tr>
<td>22086</td>
<td>Robotics Practical</td>
<td>32085</td>
<td>Robotics Practical</td>
</tr>
<tr>
<td>22087</td>
<td>Refrigeration and Air-conditioning Practical</td>
<td>32086</td>
<td>Refrigeration and Air-conditioning Practical</td>
</tr>
<tr>
<td>22088</td>
<td>Rapid Proto-Typing Practical</td>
<td></td>
<td>No Equivalent</td>
</tr>
<tr>
<td>22067</td>
<td>Project Work</td>
<td>32067</td>
<td>Project Work</td>
</tr>
</tbody>
</table>
### ANNEXURE - I
**M SCHEME**
Implemented from 2015 – 2016

**1020: DIPLOMA IN MECHANICAL ENGINEERING (FULL TIME)**

**CURRICULUM OUTLINE**

#### THIRD SEMESTER

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**Common to all Diploma Courses**

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### ANNEXURE - II

**M SCHEME**

Implemented from 2015 – 2016

**1020: DIPLOMA IN MECHANICAL ENGINEERING (FULL TIME)**

**SCHEME OF EXAMINATION**

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**Common to all Diploma Courses**
ANNEXURE-I
M SCHEME
Implemented from 2015 – 2016

3020: DIPLOMA IN MECHANICAL ENGINEERING (PART TIME)

CURRICULUM OUTLINE

THIRD SEMESTER

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# ANNEXURE- II
## M SCHEME
Implemented from 2015 - 2016

**3020: DIPLOMA IN MECHANICAL ENGINEERING (PART TIME)**

**SCHEME OF EXAMINATION**

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# ANNEXURE – I
## M SCHEME
Implemented from 2015 – 2016

## 2020: DIPLOMA IN MECHANICAL ENGINEERING (SANDWICH)

### CURRICULUM OUTLINE

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**SIXTH SEMESTER**

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# Examination will be conducted after completion of the training
## ANNEXURE – II
M SCHEME
Implemented from 2015 – 2016

2020: DIPLOMA IN MECHANICAL ENGINEERING (SANDWICH)

### SCHEME OF EXAMINATION

#### THIRD SEMESTER

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** Common to all Diploma Courses
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# Examination will be conducted after completion of the training
Board Examination - Question paper pattern

Common for all theory subjects except Machine Drawing and Design of Machine Elements

**PART A** - (1 to 8) 5 Questions are to be answered out of 8 questions for 2 marks each. (Question No. 8 will be the compulsory question and can be asked from any one of the units) (From each unit maximum of two 2 marks questions alone can be asked)

**PART B** - (9 to 16) 5 Questions are to be answered out of 8 questions for 3 marks each. (Question No. 16 will be the compulsory question and can be asked from any one of the units) (From each unit maximum of two 3 marks questions alone can be asked)

**PART C** - (17 to 21) Five Questions will be in the Either OR Pattern. Students have to answer these five questions. Each question carries 10 marks. (Based on the discretion of the question setter, he/she can ask two five mark questions (with sub division A & sub division B) instead of one ten marks question if required)

Any tables required should be mentioned in the question paper. Steam table, Design Data Book, Mollier chart, Psychometric Chart etc.
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015-2016 onwards

II YEAR
III SEMESTER

32031 – STRENGTH OF MATERIALS

CURRICULUM DEVELOPMENT CENTRE
### M-Scheme
(Implements from the Academic year 2015-2016 onwards)

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#### Teaching and Scheme of Examinations:
No. of Weeks per Semester: 15 Weeks

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<td>MECHANICAL PROPERTIES, SIMPLE STRESSES AND STRAINS</td>
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<td>III</td>
<td>GEOMETRICAL PROPERTIES OF SECTIONS AND THIN SHELLS</td>
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<td>IV</td>
<td>SHEAR FORCE AND BENDING MOMENT DIAGRAMS, THEORY OF SIMPLE BENDING</td>
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<td>V</td>
<td>TORSION AND SPRINGS</td>
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RATIONALE:

Day by day, engineering and technology experience tremendous growth. Design plays a major role in developing engineering and technology. Strength of material is backbone for design. The strength of material deals generally with the behaviour of objects, when they are subject to actions of forces. Evaluations derived from these basic fields provide the tools for investigation of mechanical structure.

OBJECTIVES

- Define various Support reaction and equilibrium.
- Calculate the deformation of materials, which are subjected to axial load and shear.
- Determine the moment of Inertia of various sections used in industries.
- Estimate the stresses induced in thin shells.
- Draw the shear force and bending moment diagram of the beam for different loads.

STRENGTH OF MATERIALS

DETAILED SYLLABUS

Contents: Theory

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External and internal forces - moment of a force - Varignon’s theorem - moment of a couple - equivalent couples - addition of couples - resolution of a force into a force and a couple - Free body diagram - Necessary and sufficient conditions for the equilibrium of rigid bodies in two dimension - Support reaction - types of support - removal of two dimensional supports - Simple problems only.
FRICITION:

II DEFORMATION OF METALS


III GEOMETRICAL PROPERTIES OF SECTIONS AND THIN SHELLS

Properties of sections: Definition – center of gravity and centroid - position of centroids of plane geometrical figures such as rectangle, triangle, circle and trapezium-problems to determine the centroid of angle, channel, T and I sections only - Definition-centroidal axis-Axis of symmetry. Moment of Inertia – Statement of parallel axis theorem and perpendicular axis theorem. Moment of Inertia of lamina of rectangle, circle, triangle, I and channel sections-Definition-Polar moment of Inertia-radius of gyration – Problems computing moment of inertia and radius of gyration for angle, T, Channel and I sections.

Thin Shells: Definition – Thin and thick cylindrical shell – Failure of thin cylindrical shell subjected to internal pressure – Derivation of Hoop and longitudinal stress causes in a thin cylindrical shell subjected to internal pressure – simple problems – change in dimensions of a thin cylindrical shell subjected to internal pressure – problems – Derivation of tensile stress induced in a thin spherical shell subjected to internal pressure – simple problems – change in diameter and volume of a thin spherical shell due to internal pressure – problems.

IV SF AND BM DIAGRAMS OF BEAMS AND THEORY OF BENDING

Classification of beams – Definition – shear force and Bending moment – sign conventions for shear force and bending moment – types of loadings – Relationship between load, force and bending moment at a section – shear force diagram and bending moment diagram of cantilever and simply supported beam subjected to point load and uniformly distributed load (udl) – Determination of Maximum bending moment in cantilever beam and simply supported beam when they are subjected to point load and uniformly distributed load.

V THEORY OF TORSION AND SPRINGS

Theory of torsion – Assumptions – torsion equation $\frac{T}{J} = \frac{f_2}{R} = \frac{C\theta}{l}$ – strength of solid and hollow shafts – power transmitted – Definition – Polar modulus – Torsional rigidity – strength and stiffness of shafts – comparison of hollow and solid shafts in weight and strength considerations – Advantages of hollow shafts over solid shafts – Problems.

Types of springs – Laminated and coiled springs and applications – Types of coiled springs – Difference between open and closely coiled helical springs – closely coiled helical spring subjected to an axial load – problems to determine shear stress, deflection, stiffness and resilience of closed coiled helical springs

Text Books:

Reference Books:
2) Strength of materials, S.S.Rattan, Tata Mcgraw hill, New Delhi,2008, ISBN 97800706668959,
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 - 2016 onwards

II YEAR
IIII SEMESTER

32032 – MANUFACTURING PROCESSES

CURRICULUM DEVELOPMENT CENTRE
M-SCHEME
(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING
Course Code : 1020
Subject Code : 32032
Semester : III
Subject Title : MANUFACTURING PROCESSES

TEACHING AND SCHEME OF EXAMINATIONS:
No. of weeks per semester: 15 Weeks

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Topics and Allocation of Hours:

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<td>THEORY OF METAL CUTTING &amp; LATHE</td>
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</tr>
</tbody>
</table>

RATIONALE:

Manufacturing, the major and the most important aspect in industries needs utmost care and attention. Knowledge about various processes and allied areas will be of great use to the personnel involved in production. This will provide the students an opportunity to skill themselves for the industrial scenario.
OBJECTIVES:

- Acquire Knowledge about types of pattern, casting, and moulding.
- Describe the various casting processes.
- Knowledge about various welding process and its working principle.
- Appreciate the safety practices used in welding.
- Acquire knowledge about various forming technologies.
- Knowledge about the lathe and its working parts.
- Describe the functioning of semi-automatic lathes.
- Study about the drilling process.
- Study about metrology and measuring instruments.

MANUFACTURING PROCESSES
DETAILED SYLLABUS

Contents: Theory

<table>
<thead>
<tr>
<th>Unit</th>
<th>Name of the Topic</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Foundry Technology</td>
<td>17</td>
</tr>
</tbody>
</table>


II  Welding Technology


Types of welded joints – merits and demerits of welded joints – inspection and testing of welded joints – destructive and non-destructive types of tests – magnetic particle test – radiographic and ultrasonic test - defects in welding – causes and remedies.

III  Forming Technology


made by powder metallurgy – design rules for the power metallurgy process.


V Drilling and Metrology


pneumatic comparator – Principles – advantages and disadvantages.


**Text Books:**
2) Introduction of basic manufacturing processes and workshop technology – Rajendersingh – New age International (P) Ltd. Publishers, 4835/24, Ansari Road, Daryaganj, New Delhi -110002

**Reference Books:**
3) Workshop Technology – Raghuvanshi - Khanna Publishers. Jain & Gupta,
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

II YEAR
III SEMESTER

32033 – MACHINE DRAWING

CURRICULUM DEVELOPMENT CENTRE
M-SCHMEME
(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING
Course Code : 1020
Subject Code : 32033
Semester : III
Subject Title : MACHINE DRAWING

TEACHING AND SCHEME OF EXAMINATIONS:
No. of Weeks per Semester: 15 Weeks

<table>
<thead>
<tr>
<th>Subject</th>
<th>Instructions</th>
<th>Examination</th>
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<tr>
<td></td>
<td>Hours/Week</td>
<td>Hours/ Semester</td>
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<tr>
<td>Machine Drawing</td>
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Topics and Allocation of Hours:

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<thead>
<tr>
<th>Unit</th>
<th>Topics</th>
<th>Hours</th>
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<tbody>
<tr>
<td>I</td>
<td>Sectional Views</td>
<td>5</td>
</tr>
<tr>
<td>II</td>
<td>Limits, Fits and Tolerances</td>
<td>5</td>
</tr>
<tr>
<td>III</td>
<td>Surface Texture</td>
<td>5</td>
</tr>
<tr>
<td>IV</td>
<td>Keys, Screw threads and Threaded fasteners</td>
<td>5</td>
</tr>
<tr>
<td>V</td>
<td>Assemble drawing</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>TEST AND REVISION</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>60</td>
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</tbody>
</table>

RATIONALE:
Manufacturing of various parts start from the basic drawing of components. The assembly of components is also carried out from the drawing. So drawing is an important subject to be studied by the students to carry and complete the production and assembly process successfully.
OBJECTIVES:
- Appreciate the need for sectional view and types of sections.
- Draw sectional views using different types of sections.
- Explain the use of threaded fasteners and the types of threads.
- Compare hole basis system with shaft basis system.
- Select different types of fits and tolerance for various types of mating parts.
- Appreciate the importance of fits and tolerance.

MACHINE DRAWING
DETAILED SYLLABUS

Contents: Theory

<table>
<thead>
<tr>
<th>Unit</th>
<th>Name of the Topic</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>I</td>
<td>SECTIONAL VIEWS</td>
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<tr>
<td></td>
<td>Review of sectioning – Conventions showing the section – symbolic representation of cutting plane- types of section – full section, half section, offset section, revolved section, broken section, removed section – section lining.</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>LIMITS, FITS AND TOLERANCES</td>
<td>5</td>
</tr>
<tr>
<td>III</td>
<td>SURFACE TEXTURE</td>
<td>5</td>
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<tr>
<td></td>
<td>Surface texture – importance – controlled and uncontrolled surfaces – Roughness – Waviness – lay – Machining symbols</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>KEYS, SCREW THREADS AND THREADED FASTENERS</td>
<td>5</td>
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</tbody>
</table>
Detailed drawings of following machine parts are given to students to assemble and draw the Elevations / Sectional elevations / Plan / and Side views with dimensioning and bill of materials

1. Sleeve & Cotter joint
2. Knuckle joint
3. Screw Jack
4. Foot step bearing
5. Plummer Block
6. Universal Coupling
7. Simple Eccentric
8. Machine Vice
9. Protected type flanged coupling
10. Swivel bearing.

Books:

3) Mechanical Draughtsmanship, G.L. Tamta, Dhanpat Rai & Sons, Delhi
5) Engineering Drawing, D.N. Ghose, Dhanpat Rai & Sons, Delhi

**BOARD EXAMINATIONS**

**Question Pattern**

Time: 3 Hrs                      Max Marks : 75
Note: All the questions will be answered in drawing sheet only

**PART A: (7 x 5 = 35)**

Theory questions: (1 TO 8)  
Two questions from each unit (I to IV) will be asked.  
Answer any seven questions from the given eight questions.

**PART B: 40 Marks (Either A or B.)**

Answer any one question by selecting either A or B.

9. A. Assemble and Draw any two views and bill of materials.  
   (OR)  
   B. Assemble and Draw any two views and bill of material
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

II YEAR
III SEMESTER

32034 – COMPUTER APPLICATIONS AND
CAD PRACTICAL

CURRICULUM DEVELOPMENT CENTRE
M-SCHEME
(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING
Course Code : 1020
Subject Code : 32034
Semester : III
Subject Title : COMPUTER APPLICATIONS AND CAD PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:
No. of weeks per semester: 15 Weeks

<table>
<thead>
<tr>
<th>Subject</th>
<th>Instructions</th>
<th>Examination</th>
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<tr>
<td>Computer Applications</td>
<td>Hours / Week</td>
<td>Hours / Semester</td>
</tr>
<tr>
<td>and CAD practical</td>
<td>6</td>
<td>90</td>
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</tbody>
</table>

OBJECTIVES:
On completion of the exercises, the students must be able to
- Use the different facilities available in the word processor
- Analyze the data sheet
- Create and manipulate the database
- Prepare PowerPoint presentation
- Practice on CADD commands in making 2D Drawings.
- Draw assembled drawings using CADD.
- Draw sectional views using different types of sections.

PART – A: COMPUTER APPLICATIONS (30 Hrs)

WORD PROCESSING
Exercises
1. Create a news letter of three pages with two columns text. The first page contains some formatting bullets and numbers. Set the document background colour and add ‘confidential’ as the watermark. Give the document a title which should be displayed in the header. The header/ footer of the first page should be different from other two pages. Also, add author name and date/ time in the header. The footer should have the page number.

2. Create the following table using align, border, merging and other attributes.

<table>
<thead>
<tr>
<th>DIRECTORATE OF TECHNICAL EDUCATION</th>
<th>e-governance particulars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Register Number</td>
<td>June</td>
</tr>
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<td>16304501</td>
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<td>16304504</td>
<td></td>
</tr>
<tr>
<td>16304505</td>
<td></td>
</tr>
</tbody>
</table>

SPREADSHEET

Exercises
3. Create a table of records with columns as Name and Donation Amount. Donation amount should be formatted with two decimal places. There should be at least twenty records in the table. Create a conditional format to highlight the highest donation with blue colour and lowest donation with red colour. The table should have a heading.

4. Prepare line, bar and pie chart to illustrate the subject wise performance of the class for any one semester.
DATABASE

Exercises
5. Prepare a payroll for employee database of an organization with the following details: Employee Id, Employee name, Date of Birth, Department and Designation, Date of appointment, Basic pay, Dearness Allowance, House Rent Allowance and other deductions if any. Perform simple queries for different categories.

6. Design a pay slip for a particular employee from the above database.

PRESENTATION

Exercises
7. Make a presentation with atleast 10 slides. Use different customized animation effects on pictures and clip art on any four of the ten slides.

PART – B: CAD (60 Hrs)
INTRODUCTION

DRAWING AIDS AND EDITING COMMANDS

**BASIC DIMENSIONING, HATCHING, BLOCKS AND VIEWS**


**CAD EXERCISES**

Detailed drawings of following machine parts are to be given to students. Draw the assembled views (two views only) and bill of materials. The elevation / sectional elevation / plan / sectional plan / side view with dimensioning.

1. Sleeve & Cotter joint
2. Screw jack
3. Plummer Block
4. Simple Eccentric
5. Machine Vice
6. Protected type flanged coupling

**Reference Books:**

1) Inside AutoCAD - D. Raker and H. Rice - BPB Publications, NewDelhi
3) AutoCAD with Applications - Sham Tickoo - Tata Mcgraw Hill.
Board of Examination

Note: All the exercises have to be completed. Two exercises will be given for examination by selecting one exercise in each PART.
All the exercises should be given in the question paper and students are allowed to select by a lot.
Record note book should be submitted during examination.

ALLOCATION OF MARKS

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<tr>
<td></td>
<td>PART - A</td>
<td>PART - B</td>
</tr>
<tr>
<td></td>
<td>25 marks</td>
<td>45 marks</td>
</tr>
<tr>
<td>Editing / Creation</td>
<td>- 10</td>
<td>Drafting</td>
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<tr>
<td>Formatting</td>
<td>- 10</td>
<td>Assembly</td>
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<tr>
<td>Printout</td>
<td>- 5</td>
<td>Dimensioning</td>
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<tr>
<td>Viva-voce</td>
<td></td>
<td>Printout</td>
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<tr>
<td>Total</td>
<td></td>
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</tr>
</tbody>
</table>

LIST OF EQUIPMENT

1. Personal computer – 30 Nos.
2. Printer – 1 No.
3. Required Softwares:
   Office Package, CAD Package – Sufficient to the strength.
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

II YEAR
III SEMESTER

32035 – FOUNDRY AND WELDING PRACTICAL

CURRICULUM DEVELOPMENT CENTRE
M-SCHEME
(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING
Course Code  : 1020
Subject Code : 32035
Semester     : III
Subject Title: FOUNDRY AND WELDING PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:
No. of weeks per semester: 15 Weeks

<table>
<thead>
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<th>Subject</th>
<th>Instructions</th>
<th>Examination</th>
<th>Duration</th>
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<tbody>
<tr>
<td>Foundry and Welding</td>
<td>Hours/Week</td>
<td>Hours/Semester</td>
<td>Marks</td>
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<tr>
<td>Practical</td>
<td>4</td>
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<td></td>
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<td>Board Examination</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25</td>
<td>75</td>
</tr>
</tbody>
</table>

OBJECTIVES:
- Identify the tools used in foundry.
- Identify the tools and equipment used in welding
- Prepare sand moulds for different patterns.
- Perform welding operation to make different types of joints.
- Identify the different welding defects.
- Appreciate the safety practices used in welding.
- Prepare a record of work for all the exercises.

Foundry Section
1. Introduction of tools and equipment
2. Types of patterns
3. Types of sand
4. Preparation of sand moulds
5. Core sands, preparation of cores
Exercises:
Prepare the green sand mould using the following patterns.

**Solid pattern**
1. Stepped pulley

**Split pattern**
2. Bent Pipe with core print
3. T-pipes with core print
4. Tumbles

**Loose Piece Pattern**
5. Dovetail

**Core preparation**
6. Core preparation for Bent pipe / T-pipe

**Welding Section**
1. Introduction of Safety in welding shop
2. Introduction to hand tools and equipment
3. Arc and gas welding equipment
4. Types of joints

Exercises:
Make the following welding joint / cutting.

**Arc welding (Raw Material: 25 mm x 6mm MS flat)**
1. Lap joint
2. Butt joint
3. T- joint

**Gas Welding (Raw Material: 25mm x 3mm Ms flat)**
4. Lap joint

**Gas cutting: (GI/MS Sheet - 3mm thickness)**
5. Profile cutting – circular profile

**Spot welding: (GI/MS Sheet)**
6. Lap joint
BOARD EXAMINATION

Note: All the exercises in both sections have to be completed. Two exercises will be given for examination by selecting one exercise in each section. All the exercises should be given in the question paper and students are allowed to select by a lot. Record note book should be submitted during examination.

Detailed allocation

<table>
<thead>
<tr>
<th>Foundry</th>
<th>: 35 marks</th>
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<tbody>
<tr>
<td>Preparation of sand</td>
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<tr>
<td>Ramming and vent holes</td>
<td>- 15</td>
</tr>
<tr>
<td>Gate cutting / Finish</td>
<td>- 10</td>
</tr>
<tr>
<td>Welding</td>
<td>: 35 marks</td>
</tr>
<tr>
<td>Edge preparation</td>
<td>- 10</td>
</tr>
<tr>
<td>Welding / Cutting</td>
<td>- 15</td>
</tr>
<tr>
<td>Joint strength / Finish</td>
<td>- 10</td>
</tr>
<tr>
<td>Viva-voce</td>
<td>: 05 marks</td>
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<tr>
<td>Total</td>
<td>: 75 marks</td>
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</tbody>
</table>
LIST OF EQUIPMENT

Welding:
1. Arc welding booth - 2 No’s with welding transformer
2. Gas welding unit - 1 Set
   (Oxygen and acetylene cylinder)
3. Flux - Sufficient quantity
4. Electrode - Sufficient quantity
5. Welding rod - Sufficient quantity
7. Gas welding goggles - 5 Nos.
8. Leather Glows 18” - 10 Sets.
9. Chipping hammer - 10 Nos.
10. Spot welding machine - 1 No.
11. Personal protective equipment - Sufficient quantity
12. Fire safety equipment - Sufficient quantity

Foundry:
1. Moulding board - 15 Nos.
2. Cope box - 15 Nos.
3. Drag box - 15 Nos.
4. Core box - 10 Nos.
5. Shovel - 5 Nos.
7. Slick - 15 Nos.
9. Riddle - 5 Nos.
11. Lifter - 15 Nos.
15. Gate cutter - 15 Nos.
16. Runner & riser - 15 Nos. each
17. Patterns - Sufficient quantity
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

II YEAR
III SEMESTER

32036 – LATHE AND DRILLING PRACTICAL

CURRICULUM DEVELOPMENT CENTRE
M-SCHEME
(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING
Course Code : 1020
Subject Code : 32036
Semester : III
Subject Title : Lathe and Drilling Practical

TEACHING AND SCHEME OF EXAMINATIONS:
No. of weeks per semester: 15 Weeks

<table>
<thead>
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<th>Subject</th>
<th>Instructions</th>
<th>Examination</th>
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<tr>
<td>Lathe and Drilling</td>
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<td>Hours/Semester</td>
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<td>Internal Assessment</td>
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<td>Board Examination</td>
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<td>Total</td>
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</table>

OBJECTIVES:
- Identify the parts of a lathe.
- Identify the work holding devices.
- Set the tools for various operations.
- Operate the lathe and machine a component using lathe.
- Identify the parts of drilling machine.
- Perform the various drilling operations.
- Identify the various tools and its holding devices.
- Identify the work holding devices.
- Prepare the record of work for the exercises.

Lathe section:
1. Introduction of safety in operating machines.
2. Study of lathe and its parts.
3. Types of tools used in lathe work.
4. Study of work holding devices and tool holding devices.
5. Setting of work and tools.
7. Practice on a lathe.
8. Types of measuring instruments and their uses.

Exercises:

Make the following jobs in the lathe. Raw material 32 mm M.S. Rod

1. Facing, Step turning & Chamfering

2. Step turning & Groove cutting

3. Step turning & Taper turning

4. Step turning & Knurling
5. Step turning & Thread cutting (L.H.)

![Diagram of Step turning & Thread cutting (L.H.)]

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Part Name</th>
<th>Actual</th>
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</thead>
<tbody>
<tr>
<td></td>
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</table>

6. Step turning & Thread cutting (R.H)

![Diagram of Step turning & Thread cutting (R.H.)]

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Part Name</th>
<th>Actual</th>
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7. Bush: Turning & Drilling

![Diagram of Bush: Turning & Drilling]

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<th>Sl.No</th>
<th>Part Name</th>
<th>Actual</th>
<th>Obtained</th>
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8. Eccentric turning

![Diagram of Eccentric turning]

<table>
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<th>Sl.No</th>
<th>Part Name</th>
<th>Actual</th>
<th>Obtained</th>
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</table>
Drilling section:
1. Introduction of safety in operating machines.
2. Study of drilling machines and its parts.
3. Study the types of tools used.
4. Study of work holding devices and tool holding devices.
5. Setting of work and tools.
6. Operation and practice.
7. Types of measuring instruments and their uses.

Exercises:

Make the following jobs in the drilling machine.

Raw material 50mm X 50mm X 20 mm thick M.S. Flat

1. Drilling & Tapping

2. Drilling & Counter boring

<table>
<thead>
<tr>
<th>Dimensions</th>
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<table>
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</table>
3. Drilling & Counter sinking

![Diagram of a cylinder with holes and a radial drilling machine]

4. Drilling and Reaming – Radial drilling machine

<table>
<thead>
<tr>
<th>Dimensions</th>
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<tbody>
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**BOARD EXAMINATION**

**Note:** All the exercises in both sections have to be completed. Two exercises will be given for examination by selecting one exercise in each section. All the exercises should be given in the question paper and students are allowed to select by a lot. Record note book should be submitted during examination.

**Lathe** : 45 marks (2 hours)
- Procedure / Preparation : 10
- Machining / Dimensions : 25
- Surface Finishing : 10

**Drilling** : 25 marks (1 hour)
- Procedure / Marking : 10
- Dimensions : 10
- Surface Finishing : 5

**Viva-voce** : 05 marks

**Total** : 75 marks
# LIST OF EQUIPMENT

## Lathe Section

1. Lathe (Minimum 4 ½') - 13 Nos.
2. All geared lathe - 2 Nos.
3. 4 Jaw / 3 Jaw Chucks - Required Numbers
4. Chuck key - Required Numbers
5. Spanner - Sufficient quantity
6. Cutting Tools - Sufficient quantity
7. Pitch gauge - 5 Nos.
8. Thread gauge - 5 Nos.
10. Snap gauges - Sufficient quantity
11. Steel Rule (0-150) - Sufficient quantity
12. Calipers (Inside / Outside / Jenny) - Sufficient quantity
13. Dial Gauge with Magnetic Stand - Sufficient quantity
14. Marking Gauge - Sufficient quantity

## Drilling Section

1. Upright drilling machine - 2 Nos.
2. Radial drilling machine - 1 No.
3. Drill bit & Tap set - Sufficient quantity
4. Reaming bit - Sufficient quantity
5. Counter sinking bit - Sufficient quantity
6. Counter boring bit - Sufficient quantity
7. Plug gauges - Sufficient quantity
8. Vernier Height Gauge - 1 No.
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

II YEAR
III SEMESTER

32037 – METROLOGY AND METALLOGRAPHY
PRACTICAL

CURRICULUM DEVELOPMENT CENTRE
M-SCHÉME
(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING
Course Code : 1020
Subject Code : 32037
Semester : III
Subject Title : METROLOGY & METALLOGRAPHY PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:
No. of weeks per semester: 15 Weeks

<table>
<thead>
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<th>Subject</th>
<th>Instructions</th>
<th>Examination</th>
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<tr>
<td></td>
<td>Hours/Week</td>
<td>Hours/Semester</td>
</tr>
<tr>
<td>Metrology &amp; Metallography Practical</td>
<td>4</td>
<td>60</td>
</tr>
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</table>

OBJECTIVES:
- Familiarize about measuring techniques of Metrology instruments.
- Select the range of measuring tools.
- Obtain accurate measurements.
- Determine the least count of measuring instruments.
- Study the working principle of Microscope.
- Specimen preparation of ferrous and non-ferrous metals.
- Grinding, polishing and mounting of specimen.
- Non-destructive testing of metals for cracks.
- Crack detection – Visual inspection, Die penetration method
- Prepare the record of work for the exercises.

METROLOGY SECTION:
- Introduction to linear measurement.
- Introduction to angular measurement.
• Introduction to geometric measurements.
• Study of Least Count of measuring instruments.
• Study of accuracy of instruments and calibration of instruments.
• Study of Linear Measuring Instruments: Vernier Caliper, Micrometer, Inside Micrometer, Vernier Height gauge, Depth Gauge and Slip Gauge.
• Study of Angular Measuring Instruments – Universal Bevel Protractor, Sine Bar.
• Study of Geometric measurement - Gear tooth Vernier, Thread Micrometer.

**Exercises:**
1. Measure the dimensions of ground MS flat / cylindrical bush using Vernier Caliper compare with Digital / Dial Vernier Caliper.
2. Measure the diameter of a wire using micrometer and compare the result with digital micrometer
3. Measure the thickness of ground MS plates using slip gauges
5. Measure the angle of the machined surface using sine bar with slip gauges.
6. Measure the geometrical dimensions of V-Thread using thread Vernier gauge.
7. Measure the geometrical dimensions of spur gear.

**METALLOGRAPHY SECTION:**
• To study the micro structure of the metals using Metallurgical Microscope.
• Determine the micro structure of the ferrous and nonferrous metals.
• Prepare the specimen to study the microstructure.
• Conduct the liquid penetration test to find the crack.
• Conduct magnetic particle test to find cracks.

**Exercises:**
1. Find the grain structure of the given specimen using the Metallurgical Microscope.
2. Prepare a specimen to examine the micro structure of the Ferrous and Non-ferrous metal.
3. Detect the cracks in the specimen using Visual Inspection and ring test.
5. Detect the cracks in specimen using Magnetic particle test.

**BOARD EXAMINATION**

**Note:** All the exercises in both sections have to be completed. Two exercises will be given for examination by selecting one exercise in each section. All the exercises should be given in the question paper and students are allowed to select by a lot.

**Record note book should be submitted during examination.**

**Detailed allocation**

<table>
<thead>
<tr>
<th>Metrology Section</th>
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<tbody>
<tr>
<td>Procedure / Least Count</td>
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<td>Reading / Calculation</td>
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<td>3.</td>
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<td>Universal bevel protractor.</td>
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<td>Sine bar</td>
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<td>Surface plate</td>
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<td>Vernier height gauge</td>
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<td>12.</td>
<td>Metallurgical Microscope.</td>
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<td>14.</td>
<td>Magnetic particle test</td>
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<tr>
<td>15.</td>
<td>Abrasive belt grinder</td>
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<tr>
<td>16.</td>
<td>Polishing machine</td>
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<td>17.</td>
<td>Mounting machine</td>
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DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

II YEAR
IV SEMESTER

32041 – HEAT POWER ENGINEERING

CURRICULUM DEVELOPMENT CENTRE
M-Scheme
(Implements from the Academic year 2015-2016 onwards)

Course Name: DIPLOMA IN MECHANICAL ENGINEERING
Course Code: 1020
Subject Code: 32041
Semester: IV
Subject Title: HEAT POWER ENGINEERING

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

<table>
<thead>
<tr>
<th>Subject</th>
<th>Instructions</th>
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Topics and Allocation of Hours:

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<tr>
<th>Unit</th>
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<th>Hours</th>
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<tbody>
<tr>
<td>I</td>
<td>BASICS OF THERMODYNAMICS AND THERMODYNAMIC PROCESSES OF PERFECT GASES</td>
<td>17</td>
</tr>
<tr>
<td>II</td>
<td>THERMODYNAMIC AIR CYCLES AND FUELS &amp; COMBUSTION</td>
<td>17</td>
</tr>
<tr>
<td>III</td>
<td>AIR COMPRESSORS AND GAS TURBINES</td>
<td>17</td>
</tr>
<tr>
<td>IV</td>
<td>FORMATION &amp; PROPERTIES OF STEAM AND STEAM CALORIMETERS</td>
<td>16</td>
</tr>
<tr>
<td>V</td>
<td>STEAM BOILERS AND PERFORMANCE OF BOILERS</td>
<td>16</td>
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<td>TEST AND REVISION</td>
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</table>
RATIONALE:
The knowledge on the concept of Thermodynamics, Thermodynamic Processes, Steady flow energy equation and steam properties and performance of Boilers are vital.

OBJECTIVES
- Explain a basics of systems, laws of thermodynamics and thermodynamic processes.
- Explain different types of Air Cycles.
- Explain the fuels ands combustion.
- Explain a air compressors and gas turbines.
- Explain a formation and properties of steam and steam calorimeters.
- Explain a steam boilers and performance of boilers.

HEAT POWER ENGINEERING
DETAILED SYLLABUS

Contents: Theory

<table>
<thead>
<tr>
<th>Unit</th>
<th>Name of the Topic</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>BASICS OF THERMODYNAMICS AND THERMODYNAMIC PROCESSES OF PERFECT GASES</td>
<td>17</td>
</tr>
</tbody>
</table>


Perfect gases: - laws of perfect gases – Boyle’s, Charle’s, Joule’s, Regnault’s and Avogadro’s laws – General Gas Equation - Characteristic gas equation – relation between specific heats and gas constant – Universal gas constant –Change in Internal Energy- enthalpy – change in enthalpy – entropy.
Thermodynamic processes:- Constant volume, Constant pressure, Constant temp.(isothermal), Isentropic (reversible adiabatic) and, Polytropic Processes – p-V and T-s diagrams, work done, change in internal energy, heat transfer, change in enthalpy, change in entropy for above processes – Simple problems – hyperbolic, Free expansion and throttling processes (Description only).


II THERMODYNAMIC AIR CYCLES AND FUELS & COMBUSTION


Fuels & Combustion:

III AIR COMPRESSORS AND GAS TURBINES


Gas turbines – uses - classifications – merits and demerits -

**IV FORMATION & PROPERTIES OF STEAM AND STEAM CALORIMETERS**


**Steam Calorimeter:** Determination of dryness fraction of steam – bucket calorimeter - combined separating and throttling calorimeters.

**V STEAM BOILERS AND PERFORMANCE OF BOILERS**


**Performance of boilers:** Evaporation rate - actual, equivalent and factor of evaporation – boiler efficiency – factors influencing boiler

Text Book:
3) New Delhi .

Reference Books:
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

II YEAR
IV SEMESTER

32042 – SPECIAL MACHINES

CURRICULUM DEVELOPMENT CENTRE
M-Scheme
(Implements from the Academic year 2015-2016 onwards)

Course Name       : DIPLOMA IN MECHANICAL ENGINEERING
Course Code       : 1020
Subject Code      : 32042
Semester          : IV
Subject Title     : SPECIAL MACHINES

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

<table>
<thead>
<tr>
<th>Subject</th>
<th>Hours per Week</th>
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Topics and Allocation of Hours:

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<th>Unit</th>
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<th>Hours</th>
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<tbody>
<tr>
<td>I</td>
<td>Manufacturing of Plastic Components and Composite Manufacturing</td>
<td>14</td>
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<tr>
<td>II</td>
<td>Reciprocating Machines and Broaching Machine</td>
<td>14</td>
</tr>
<tr>
<td>III</td>
<td>Milling Machines and Gear Generating Processes</td>
<td>14</td>
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<tr>
<td>IV</td>
<td>Abrasive Process and Non-Conventional Machining Processes</td>
<td>13</td>
</tr>
<tr>
<td>V</td>
<td>CNC Machine and Its Components</td>
<td>13</td>
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<tr>
<td></td>
<td>TEST AND REVISION</td>
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<td><strong>Total</strong></td>
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RATIONALE:

In the process of manufacturing we should possess adequate and through knowledge about the working of conventional as well as non-conventional machines.
The topics included aim to inculcate in the students the skills of metal cutting, milling, grinding, CNC machines and other machining processes which are very much essential for a technician to at promptly and with precision.

**OBJECTIVES:**

- Understand the plastic components and its process.
- Study the manufacturing of Composite materials.
- Study the working of various machine tools: Planer, Shaper and Slotter.
- Study the various work holding devices
- Study various types of milling cutter.
- Study the different types of grinders and grinding wheels.
- Study the broaching operation and their applications.
- Study the milling procedure for spur, helical and bevel gears.
- Study the various types of gear generating processes
- Study the use of non-conventional machining processes.
- Study the CNC machines working principle and its components.

## SPECIAL MACHINES

**DETAILED SYLLABUS**

**Contents: Theory**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Name of the Topic</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>I</td>
<td>MANUFACTURING OF PLASTIC COMPONENTS</td>
<td>14</td>
</tr>
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</table>


II RECIPROCATING MACHINES


Broaching: Types of broaching machine - horizontal, vertical and continuous broaching - principles of operation - types of broaches – classification - broach tool nomenclature - broaching operations.

III MILLING MACHINES AND GEAR GENERATING PROCESSES


IV ABRASIVE PROCESS AND NON-CONVENTIONAL MACHINING PROCESSES


Non-Conventional Machining Processes: Construction, working and applications of Ultrasonic machining - chemical machining - electro chemical grinding - electrical discharge machining - plasma arc machining - LASER machining - Advantages – Disadvantages.

V CNC MACHINE AND ITS COMPONENTS


Text Book:

Reference Book:
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

II YEAR
IV SEMESTER

32043 – FLUID MECHANICS AND FLUID POWER

CURRICULUM DEVELOPMENT CENTRE
M-SCHEME
(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING
Course Code : 1020
Subject Code : 32043
Semester : IV
Subject Title : FLUID MECHANICS & FLUID POWER

TEACHING AND SCHEME OF EXAMINATIONS:
No. of Weeks per Semester: 15 Weeks

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Topics and Allocation of Hours:

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<th>Unit</th>
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<th>Hours</th>
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<tbody>
<tr>
<td>I</td>
<td>PROPERTIES OF FLUIDS AND PRESSURE MEASUREMENTS</td>
<td>14</td>
</tr>
<tr>
<td>II</td>
<td>FLOW OF FLUIDS AND FLOW THROUGH PIPES</td>
<td>14</td>
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<tr>
<td>III</td>
<td>IMPACT OF JETS, HYDRAULIC TURBINES, CENTRIFUGAL AND RECIPROCATING PUMPS</td>
<td>14</td>
</tr>
<tr>
<td>IV</td>
<td>PNEUMATIC SYSTEMS</td>
<td>13</td>
</tr>
<tr>
<td>V</td>
<td>HYDRAULIC SYSTEMS</td>
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RATIONALE:
The main objective of this subject Fluid mechanics and Fluid power is to study the behavior of fluids under the condition of rest and motion. This chapter deals with
fluid pumps, turbines, hydraulic and pneumatic operation. The overall object is to impart knowledge of pumps, hydraulic and pneumatic operation of tools and equipments.

OBJECTIVES:

- Define the properties of Fluids.
- Explain the working of pressure measuring devices
- Explain continuity equation and Bernoulli’s Theorem
- Assess the impact of frictional loss of head in flow through pipes
- Estimate the discharge through orifices
- Distinguish the working principles of pumps and turbines.
- Explain the working of centrifugal pumps and reciprocating pumps.
- Compare pneumatic system with hydraulic system
- Draw Pneumatic circuits for industrial application.
- State the properties of hydraulic systems
- Develop hydraulic circuit for machine tools applications.

FLUID MECHANICS & FLUID POWER
DETAILED SYLLABUS

Contents: Theory

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<tr>
<th>Unit</th>
<th>Name of the Topic</th>
<th>Hours</th>
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<tbody>
<tr>
<td>I</td>
<td>PROPERTIES OF FLUIDS AND PRESSURE MEASUREMENTS</td>
<td>14</td>
</tr>
</tbody>
</table>

II  FLOW OF FLUIDS AND FLOW THROUGH PIPES

Types of fluid flow - path line and stream line - mean velocity of flow -
discharge of a flowing fluid - equation of continuity of fluid flow -
energies of fluid - Bernoulli’s theorem - statement, assumptions and
proof - applications and limitations of Bernoulli’s theorem - problems
on Bernoulli’s theorem – venturimeter - derivation for discharge -
orifice meter - derivation for discharge - difference between
venturimeter and orifice meter -problems on venturimeter and orifice
meter - Pitot tube – description only – orifice –types – applications -
hydraulic co-efficient - determining hydraulic co-efficient – problems -
discharge through a small orifice discharging freely only - problems –
experimental method of finding Cv, Cc and Cd - Flow through pipes -
laws of fluid friction - hydraulic gradient line - total energy line -
wetted perimeter - hydraulic mean radius - loss of head due to friction
– Darcy - Weisbach equation and Chezy’s formula –problems - minor
losses (description only) - Power transmission through pipes -
problems.

III  IMPACT OF JETS, HYDRAULIC TURBINES, CENTRIFUGAL AND
RECIPROCATING PUMPS

Impact of jet - on a stationary flat plate held normal to the jet and
inclined to the direction of jet - Impact of jet on a flat plate moving in
the direction of jet - Impact of jet on a series of moving plates or
vanes - force exerted and work done by the jet - problems. Hydraulic
turbines – classifications - Pelton wheel - components and working -
speed regulation (theory only) - Francis and Kaplan turbines -
components and working - draft tube - functions and types - surge tank
- differences between impulse and reaction turbines.
Centrifugal Pumps – classifications - construction and working of
single stage centrifugal pumps - components with types - theory only -
multi stage pumps – advantages - priming – cavitation.
Reciprocating Pumps – classifications - construction and working of
single acting and double acting reciprocating pumps - plunger and
piston pumps - discharge of a reciprocating pump - theoretical power
required - coefficient of discharge – slip – problems - negative slip -
indicator diagram – separation - air vessel (functions and working) -
Special pumps - Jet pump - Turbine pump - Submersible pump.

IV PNEUMATIC SYSTEMS

Pneumatic Systems – elements – filter – regulator - lubricator unit -
pressure control valves - pressure relief valves - pressure regulation
valves - directional control valves - 3/2 DCV - 5/2 DCV – 5/3 DCV flow
control valves – throttle valves –shuttle valves – quick exhaust valves –
ISO symbols of pneumatic components – pneumatic circuits – direct
control of single acting cylinder – operation of double acting cylinder –
operation of double acting cylinder with metering-in control - operation
of double acting cylinder with metering-out control – use of shuttle valve
in pneumatic circuits – use of quick exhaust valve in pneumatic circuits
- automatic operation of double acting cylinder single cycle – multiple
cycle – merits and demerits of pneumatic system - applications.

V HYDRAULIC SYSTEMS

Hydraulic system – Merits and demerits – Service properties of
hydraulic fluids  Hydraulic accumulators – Weight of gravity type
accumulator – Spring loaded type accumulator - Gas filled accumulator
– Pressure intensifier – Fluid power pumps – External and internal gear
pump, Vane pump, Radial piston pump – ISO symbols for hydraulic
components – Hydraulic actuators – Cylinders and motors – Valves –
Pressure control valves, Flow control valves and direction control
valves – types – including 4/2 DCV and 4/3 DCV – their location in the
circuit.

Hydraulic operation of double acting cylinder with metering-in and
metering-out control – application of hydraulic circuits – Hydraulic
circuit for - shaping machine - table movement in surface grinding
machine and milling machine – comparison of hydraulic and pneumatic
systems.

Text Books :

1) A Text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines, R.S.
Khurmi, - Edn.18, S.Chand & Co., Ram Nagar, New Delhi – 110 055, Ram
Nagar, New Delhi

Reference Books:
2) Hydraulics, Andrew Parr (A Technician’s and Engineer’s Guide)
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

II YEAR
IV SEMESTER

32044 – ELECTRICAL DRIVES AND CONTROL

CURRICULUM DEVELOPMENT CENTRE
M-SCHEME
(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING
Course Code  : 1020
Subject Code  : 32044
Semester     : IV
Subject Title : ELECTRICAL DRIVES AND CONTROL

TEACHING AND SCHEME OF EXAMINATIONS:
No. of Weeks per Semester: 15 Weeks

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<td>Electrical Drives and Control</td>
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<td>75</td>
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Topics and Allocation of Hours:

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<th>Unit</th>
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<th>Hours</th>
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<tbody>
<tr>
<td>I</td>
<td>DC CIRCUITS AND DC MACHINES</td>
<td>17</td>
</tr>
<tr>
<td>II</td>
<td>AC CIRCUITS AND AC MACHINES</td>
<td>17</td>
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<tr>
<td>III</td>
<td>STEPPER AND SERVO MOTORS &amp; DRIVES</td>
<td>17</td>
</tr>
<tr>
<td>IV</td>
<td>POWER SUPPLIES AND LOGIC GATES</td>
<td>16</td>
</tr>
<tr>
<td>V</td>
<td>CONTROL ELEMENTS AND PLC</td>
<td>16</td>
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<td>TEST AND REVISION</td>
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RATIONALE:
The automation is being the order of the day to improve the production with high quality consciousness. Such automation involves electrically operated switches, sensors controlled through electrically driven motors and actuators. The subject aims in introducing the basic electrical DC and AC circuits and motors and also focuses
on the various special control devices like stepper, servo drives and its controlling elements.

OBJECTIVES:

- Explore fundamental electric circuit laws.
- Explain the working principle of DC and AC Electrical machines.
- Identify the effective uses of drives of Electrical machines.
- Analyze the various power supply circuits.
- Select the field controlled elements.
- Explain the construction and working of Transformer.
- Compare the different types of Logic gates.
- Appreciate the safety practices followed in Electrical system.
- Compare the use of servo motors and stepper motors in electrical driving system
- Identify PLC Input outputs.
- Identify the use of Control elements.

ELECTRICAL DRIVES & CONTROL
DETAILED SYLLABUS

Contents: Theory

<table>
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<tbody>
<tr>
<td>I</td>
<td>DC CIRCUITS AND DC MACHINES</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Definition- Electric current, voltage and resistance -Ohm's law and Kirchhoff's law. Resistance in series and parallel and series, parallel – simple problems electromagnetism(definitions only ) – magnetic flux, flux density magnetic field intensity, MMF, permeability, reluctance, Faraday’s law of electromagnetic induction, electrical and mechanical units</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DC generators – construction, principle of operation, types and application.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DC motors: - construction, principle of operation, types and application.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Necessity of starters: Three point, four point starters.</td>
<td></td>
</tr>
</tbody>
</table>
II  AC CIRCUITS AND AC MACHINES
Fundamentals of AC voltage, and current – peak, average, RMS value of sine wave, frequency, time period, amplitude, power and power factor (definition only)- star and delta connection relationship between phase, line voltage and current in star and delta connections.
Alternator construction – principle of operation – types and applications.
AC machine: AC motors- Principle of operation of single phase capacitor start and universal motor induction motor- applications-
Three phase induction motors – Squirrel cage and slip ring Induction motors (construction and working principle only) - application – speed control of 3Φ Induction motor -Necessity of starters – DOL and star/delta starter.

III  STEPPER AND SERVO MOTORS & DRIVES:
PMDC, Stepper motor- construction and working principle and applications - Servo motor – types: brushless servo motor, permanent magnet servo motor construction and applications.
Industrial drives- types, group drive, individual drive, multi motor drive,
block diagram of Variable frequency drive , stepper motor drive:
single stepping and half stepping. Servo drives.
Electrical safety: - importance of earthing - electric shock: first aid, precautions - causes of accident and their preventive measures.
Energy conservation

IV  POWER SUPPLIES AND LOGIC GATES
Display devices – LED, 7 segment LED, LCD
Logic gates: Positive and negative logic, definition, symbol truth table, Boolean expression for OR, AND, NOT, NOR, NAND, EXOR AND EXNOR gates – Universal logic Gates: NAND, and NOR.

V CONTROL ELEMENTS AND PLC

Sensors: Photo electric sensor, Inductive proximity sensors, Temperature sensors.
Switches: Push button switch, selector switch, limit switch, pressure switch,
temperature switch, float switch and reed switch.
Relays – NO, NC – usage- bimetallic thermal overload relays.
Contactors- usage – necessity of contactor- Solenoid type contactor
Circuit breakers – Miniature case Circuit breaker (MCCB) and Miniature Circuit
breaker (MCB), Oil Circuit breakers (OCB), Earth leakage circuit breaker (ELCB)
Features of PLC-PLC Block diagram- PLC scan - Fixed and modular
PLC Ladder logic-NO, NC contacts-Coils-AND, OR.

Text Books:

Reference Books:
2) Electronic Device and Circuits- An introduction – Allen Mottershed - Prentice Hall of India.
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

II YEAR
IV SEMESTER

32045 – STRENGTH OF MATERIALS AND FLUID MECHANICS PRACTICAL

CURRICULUM DEVELOPMENT CENTRE
M-SCHMIE
(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING
Course Code : 1020
Subject Code : 32045
Semester : IV
Subject Title : STRENGTH OF MATERIALS AND FLUID MECHANICS PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:
No. of Weeks per Semester: 15 Weeks

<table>
<thead>
<tr>
<th>Subject</th>
<th>Instructions</th>
<th>Examination</th>
<th>Duration</th>
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<tbody>
<tr>
<td>Strength of Materials and Fluid</td>
<td>Hours/Week</td>
<td>Hours/Semester</td>
<td></td>
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<tr>
<td>Mechanics Practical</td>
<td>4</td>
<td>90</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Internal Assessment</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Board Examination</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3 Hrs</td>
</tr>
</tbody>
</table>

OBJECTIVES:
- Acquire skills on different types of testing methods of metals.
- Conduct material testing on elasticity, hardness, shear strength
- Determine modulus of rigidity of open spring and closed coil springs.
- Determine the co-efficient of discharge of venturimeter, orifice meter, mouth piece and orifice.
- Determine the co-efficient of friction in pipes.
- Conduct performance test on centrifugal and reciprocating pumps.
- Conduct performance test on impulse and reaction turbines.
Strength of Materials Laboratory

Exercises

1. Test on Ductile Materials:
   Finding Young’s Modulus of Elasticity, yield points, percentage elongation and percentage reduction in area, stress strain diagram plotting, tests on mild steel.

2. Hardness Test:
   Determination of Rockwell’s Hardness Number for various materials like mild steel, high carbon steel, brass, copper and aluminium.

3. Torsion test:
   Torsion test on mild steel – relation between torque and angle of twist-determination of shear modulus and shear stress.

4. Impact test:
   Finding the resistance of materials to impact loads by Izod test and Charpy test.

5. Tests on springs of circular section:
   Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Open / Closed coil spring)

6. Shear test:
   Single or double shear test on M.S. bar to finding the resistance of material to shear load.

Fluid Mechanics Laboratory

Exercises

1. Verify the Bernoulli’s Theorem.

2. Determination of co-efficient of discharge of a mouth piece / orifice by variable head method.

3. Determination of co-efficient of discharge of a venturimeter / orificemeter.

4. Determination of the friction factor in a pipe.

5. Performance test on reciprocating pump / centrifugal pump and to draw the characteristics curves.

6. Performance test on impulse turbine / reaction turbine and to find out the Efficiency.
**BOARD EXAMINATION**

*Note:* All the exercises in both sections have to be completed. Two exercises will be given for examination by selecting one exercise in each section. All the exercises should be given in the question paper and students are allowed to select by a lot. Record note book should be submitted during examination.

### Detailed allocation

**Strength of material lab**

<table>
<thead>
<tr>
<th>Part A</th>
<th>-</th>
<th>35 marks</th>
</tr>
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<tbody>
<tr>
<td>Observation</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td>Tabulation / Calculation</td>
<td>-</td>
<td>20</td>
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<tr>
<td>Result / Graph</td>
<td>-</td>
<td>5</td>
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</table>

**Fluid mechanics lab**

<table>
<thead>
<tr>
<th>Part B</th>
<th>-</th>
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</thead>
<tbody>
<tr>
<td>Observation</td>
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<tr>
<td>Tabulation / Calculation</td>
<td>-</td>
<td>20</td>
</tr>
<tr>
<td>Result / Graph</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>Viva-voce</td>
<td>-</td>
<td>05 marks</td>
</tr>
<tr>
<td>Total</td>
<td>-</td>
<td>75 marks</td>
</tr>
</tbody>
</table>
LIST OF EQUIPMENTS

1. UTM 01
2. Rockwell’s Hardness Testing Machine 01
3. Torsion testing machine 01
4. Impact testing machine 01
5. Spring testing arrangements 01
6. Shear testing machine 01
7. Vernier calliper 02
8. The Bernoulli’s Apparatus 01
9. An Open tank fitted with a small orifice / an external mouth piece and a collecting tank with Piezometer 01
10. A Centrifugal pump having the discharge line with venturimeter / orifice meter arrangement 01
11. An arrangement to find friction factor of pipe 01
12. A reciprocating pump with an arrangement for collecting data to find out the efficiency and plot the characteristics curves. 01
13. A centrifugal pump with an arrangement for collecting tank to find out the efficiency and plot the characteristics curves. 01
14. A impulse turbine with an arrangement for calculating data to find out the efficiency 01
15. A reaction turbine with an arrangement for collecting data to find out the efficiency 01
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

II YEAR
IV SEMESTER

32046 – SPECIAL MACHINES PRACTICAL

CURRICULUM DEVELOPMENT CENTRE
M-SCHEME
(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING
Course Code : 1020
Subject Code : 32046
Semester : IV
Subject Title : SPECIAL MACHINES PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:
No. of weeks per semester: 15 Weeks

<table>
<thead>
<tr>
<th>Subject</th>
<th>Instructions</th>
<th>Examination</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours/Week</td>
<td>Hours/Semester</td>
<td>Marks</td>
</tr>
<tr>
<td>Special Machines</td>
<td>4</td>
<td>60</td>
<td>Internal Assessment</td>
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<tr>
<td>Practical</td>
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<td>Board Examination</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
</tr>
</tbody>
</table>

OBJECTIVES:

- Identify a milling machine and its parts
- Identify a cylindrical grinder, surface grinder and tool and cutter grinder
- Identify shaper, Slotter and its parts
- Identify the tools and instruments used in milling.
- Handle the different types of work holding devices
- Machine a component using different machine tools.
- Calculate the indexing for a work
- Machine a gear using milling machine.
- Machine a cutting tool using Tool and Cutter grinder.
- Machine a plug gauge using Cylindrical grinding machine.
- Machine components by shaping machine
- Machine components by slotting machine
- Prepare a record of work for all the exercises.
EXERCISES:

1. Make ‘V’ Block using shaping machine

2. Make dovetail using shaping machine

3. Make groove cut using slotting machine

4. Make round to square in milling machine.

Raw Material: M.S. / C.I

![Spur Gear Diagram]

<table>
<thead>
<tr>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sl.No</td>
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<tr>
<td>--------</td>
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<tr>
<td></td>
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</tr>
</tbody>
</table>

6. Make Helical Gear using milling machine

![Helical Gear Diagram]

<table>
<thead>
<tr>
<th>Dimensions</th>
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</thead>
<tbody>
<tr>
<td>Sl.No</td>
</tr>
<tr>
<td>--------</td>
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<td></td>
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<td></td>
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</tr>
</tbody>
</table>

7. Make slot cut using milling machine.

![Slot Cut Diagram]

<table>
<thead>
<tr>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sl.No</td>
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<tr>
<td>--------</td>
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<tr>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

8. Make Progressive type Plug gauge using Cylindrical Grinding machine

![Progressive Plug Gauge Diagram]

<table>
<thead>
<tr>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sl.No</td>
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<tr>
<td>--------</td>
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<tr>
<td></td>
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<tr>
<td></td>
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<tr>
<td></td>
</tr>
</tbody>
</table>
9. Make a turning tool using Tool and Cutter Grinder

![Diagram of turning tool]

10. Make plain surfaces (four surfaces) using surface Grinder

![Diagram of surface grinding]

### BOARD EXAMINATION

Note: All the exercises should be given in the question paper and students are allowed to select by a lot. Record note book must be submitted for the examination.

### ALLOCATION OF MARKS

| Job preparation / Marking | 15 |
| Setting / Operations | 30 |
| Dimensions / Surface Finish | 25 |
| Viva voce | 5 |
| **Total** | **75** |

### LIST OF EQUIPMENTS

1. Vertical milling machine /
   - Vertical attachment - 2 Nos.
5. Tool and Cutter Grinder - 1 No.
7. Slotting Machine - 1 No.
8. Tools and Measuring instruments - Sufficient quantity.
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

II YEAR
IV SEMESTER

32047 – ELECTRICAL DRIVES AND CONTROL
PRACTICAL

CURRICULUM DEVELOPMENT CENTRE
M-Scheme
(Implements from the Academic year 2015-2016 onwards)

Course Name: DIPLOMA IN MECHANICAL ENGINEERING
Course Code: 1020
Subject Code: 32047
Semester: IV
Subject Title: ELECTRICAL DRIVES AND CONTROL PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Instructions</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours/Week</td>
<td>Hours/Semester</td>
</tr>
<tr>
<td>Electrical Drives and Control Practical</td>
<td>4</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>75</td>
</tr>
</tbody>
</table>

OBJECTIVES:

- Identify starters for different motors.
- Study and prepare earthing.
- Test the characteristics of DC and AC machines.
- Identify and select controlling elements.
- Explore the performance of ELCB, MCB.
- Design regulated power supplies.
- Identify display devices - LED, 7 segment LED, LCD.
- Identify the drive circuit for special motors.
- Test the speed control circuit of the special motors.
LIST OF EXPERIMENTS:

Part A:
1. Verification of Ohm’s Law
2. Testing of DC starters – 3 point and 4 point starter
3. Load test on DC shunt motor
4. Testing of AC starters - DOL, star - Delta starter
5. Load test on single phase induction motor
6. Load test on three phase squirrel cage motor
7. Testing of relays, contactors, push buttons and limit switch
8. Connection and Testing of MCB, ELCB

Part B
9. Construction and testing of Half wave and Full wave rectifier.
10. Construction and testing of IC voltage regulator using IC 7805.
11. Verification of truth tables for logic gates.
12. Verification of universal gates.
13. Identification and testing of display devices- LED, 7 segment LED, Laser diode.
15. Testing of Servo motor drive.

BOARD EXAMINATION

Note: All the exercises are to be completed. One exercise from Part A and another one from Part B should be given for the Examination.

Part A: 35
- Circuit diagram 05
- Connections & Readings 15
- Calculations & Graph 15

Part B: 35
- Circuit diagram 05
- Connections & Readings 15
- Execution 15
- Viva Voce 5

Total 75
### LIST OF EQUIPMENTS

#### Electrical Lab

<table>
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<tr>
<th>No.</th>
<th>Equipment Description</th>
<th>Quantity</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>DC ammeter 0-5A</td>
<td>1no</td>
</tr>
<tr>
<td>2.</td>
<td>DC ammeter 0-25A</td>
<td>1no</td>
</tr>
<tr>
<td>3.</td>
<td>DC voltmeter 0-30V</td>
<td>1no</td>
</tr>
<tr>
<td>4.</td>
<td>DC voltmeter 0-300V</td>
<td>1no</td>
</tr>
<tr>
<td>5.</td>
<td>Rheostat 10.8 ,8.5A</td>
<td>1no</td>
</tr>
<tr>
<td>6.</td>
<td>AC ammeter 0-5A</td>
<td>1no</td>
</tr>
<tr>
<td>7.</td>
<td>AC ammeter 0-10A</td>
<td>2nos.</td>
</tr>
<tr>
<td>8.</td>
<td>AC voltmeter 0-50V</td>
<td>3nos</td>
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<tr>
<td>9.</td>
<td>AC wattmeter 5A-10A</td>
<td>3nos</td>
</tr>
<tr>
<td></td>
<td>(0-750W,0-600V)</td>
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<tr>
<td>10.</td>
<td>Loading rheostat 5A,230V</td>
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<tr>
<td>11.</td>
<td>Tachometer 0-1000rpm</td>
<td>1no</td>
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<tr>
<td></td>
<td>(Analog type)</td>
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</tr>
<tr>
<td>12.</td>
<td>Variac 20A,250V</td>
<td>2nos</td>
</tr>
<tr>
<td></td>
<td>(Auto transformer )</td>
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</tr>
<tr>
<td>13.</td>
<td>3 point starter 20A,220V</td>
<td>1no</td>
</tr>
<tr>
<td>14.</td>
<td>DOL starter 16A,415V</td>
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<tr>
<td>15.</td>
<td>Star /Delta starter 20a,600V</td>
<td>1no</td>
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<tr>
<td>16.</td>
<td>Over load relay 1 to 2.5A</td>
<td>1no</td>
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<tr>
<td>17.</td>
<td>Air break contactors 20A,220V</td>
<td>4nos</td>
</tr>
<tr>
<td>18.</td>
<td>Push button 2A ,220V</td>
<td>2nos</td>
</tr>
<tr>
<td>19.</td>
<td>Limit switch 20A,220V</td>
<td>1no</td>
</tr>
<tr>
<td>20.</td>
<td>MCB 20A single pole</td>
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<tr>
<td>21.</td>
<td>MCB 20A double pole</td>
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<tr>
<td>22.</td>
<td>ELCB 2pole 20A,100mA</td>
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</tr>
<tr>
<td>23.</td>
<td>ELCB 4POLE 20A,100mA</td>
<td>1no</td>
</tr>
</tbody>
</table>
## Electronics Lab

1. Transformer 230 / 9-0-9V, 1A - 4 nos.
2. Resistor 1 KΩ / ½ W - 3 nos.
3. Capacitor 1000 μF/25V - 4 nos.
4. IC 7805 - 1 no.
5. Logic Gates IC
   7400, 7408, 7432, 7404, 7402, 7486- 1 each
6. Stepper Motor Drive kit - 1 no.
7. Servo Motor Drive Kit - 1 no
8. Digital Multimeter - 1 no.
9. LED, 7Segment LED, Laser Diode - 1 each
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

III YEAR
V SEMESTER

32051 – DESIGN OF MACHINE ELEMENTS

CURRICULUM DEVELOPMENT CENTRE
M-SCHEME
(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING
Course Code : 1020
Subject Code : 32051
Semester : V
Subject Title : DESIGN OF MACHINE ELEMENTS

TEACHING AND SCHEME OF EXAMINATIONS:

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<th>Subject</th>
<th>Instructions</th>
<th>Examination</th>
<th>Duration</th>
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<tbody>
<tr>
<td>Design of Machine Elements</td>
<td>6 Hours/Week</td>
<td>Internal Assessment 25 Marks</td>
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<td>90 Hours/Semester</td>
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Topics and Allocation of Hours:

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<thead>
<tr>
<th>Unit No</th>
<th>Topics</th>
<th>Hours</th>
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<tbody>
<tr>
<td>I</td>
<td>Design of Joints And Fasteners</td>
<td>17</td>
</tr>
<tr>
<td>II</td>
<td>Design of shafts, couplings and keys</td>
<td>17</td>
</tr>
<tr>
<td>III</td>
<td>Design of friction drives (flat belt and v-belt)</td>
<td>17</td>
</tr>
<tr>
<td>IV</td>
<td>Design of bearings</td>
<td>16</td>
</tr>
<tr>
<td>V</td>
<td>Design of levers and spur gears</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>REVISION AND TEST</td>
<td>7</td>
</tr>
<tr>
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<td>Total</td>
<td>90</td>
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</table>

RATIONALE:

The main objective of Machine Design is to create new and better machine components to improve the existing one. A mechanical engineer should have thorough knowledge of design of machine elements to avoid the failure of machines or components.
OBJECTIVES:

- Design riveted joints, welded joints, sleeve and cotter joint and knuckle joint.
- Design eye bolts, cylinder cover studs.
- Design shafts, keys and couplings required for power transmission.
- Compare the different types of couplings.
- Design flat and V-belt for power transmission.
- Study the various types of bearings and their applications.
- Design journal bearings.
- Design spur gear used for power transmission.
- Design hand lever, foot lever and cranked lever.

DESIGN OF MACHINE ELEMENTS

DETAILED SYLLABUS

Contents: Theory

<table>
<thead>
<tr>
<th>Unit</th>
<th>Name of the Topic</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>ENGINEERING MATERIALS, JOINTS AND FASTENERS</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>General Considerations in Machine Design.</td>
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</tr>
<tr>
<td></td>
<td>Engineering materials</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Factors affecting selection of material – BIS designation of Ferrous materials – Preferred number - Factor of safety and allowable stress –</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stresses: Tension, Compression, Shear, Bearing pressure Intensity, Crushing, bending and torsion - problem.</td>
<td></td>
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<tr>
<td></td>
<td>Creep strain and Creep Curve- Fatigue, S-N curve, Endurance Limit - Stress Concentration – Causes &amp; Remedies.</td>
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</tr>
<tr>
<td></td>
<td>Theories of Elastic Failures – Principal normal stress theory, Maximum shear stress theory &amp; maximum distortion energy theory.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Joints</strong>: Design of sleeve and cotter joint, knuckle joint and welded joint.</td>
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</tr>
<tr>
<td></td>
<td><strong>Fasteners</strong>: Design of bolted joints - eye bolts.</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>DESIGN OF SHAFTS, KEYS AND COUPLINGS</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td><strong>Shafts</strong>: Design of shafts subjected to – twisting moment – bending moment – combined twisting and bending moments – fluctuating loads – design of shafts based on rigidity.</td>
<td></td>
</tr>
</tbody>
</table>
**Keys:** Types of keys - design of sunk keys only - Effect of keyways on shaft-problems.

**Couplings:** Requirements of good couplings – types - design of - rigid protected type flange couplings - marine couplings – pin type flexible coupling (Description only).

III **DESIGN OF FLAT BELTS AND V-BELTS**

**Flat Belts:** Types of belts - materials for belt — types of belt drives – Speed ratio – effect of slip - length of flat belts – Tension Ratio $T_1/T_2=e^{\mu_0}$ - centrifugal tension - power transmitted – condition for maximum power - transmission – Initial Tension - problems - design procedure of flat belts - design of flat belt based on manufacturer’s data only – problems.

**V-Belts:** V-belt drive - comparison with flat belt drive - designation of V-belts – length of belt - power transmitted – Design of V-belt using manufacturer’s data only – Problem.

IV **DESIGN OF BEARINGS**

**Bearings:** Classifications of bearings – sliding contact and rolling contact bearings - radial and thrust bearings - roller bearing – types - Designation of ball bearings - materials used for bearings - journal bearings - heat generated - heat dissipated - cooling oil requirement – problems - design of journal bearings –Problems.

Design based on approved data books only.

V **DESIGN OF LEVERS AND SPUR GEARs**

**Levers:** Types of levers – applications - mechanical advantage – leverage - displacement ratio - design of-hand lever-foot lever- cranked lever - problems.

**Spur gears:** Gear drives - merits and demerits over belt drive – Classification of gears - gear materials - spur gear terminology - design of spur gears based on Lewis & Buckingham equation - Problems – speed reducer – types –(Approved data books only).
Text Book:

Reference Book:
2) Machine Design Bandari,

BOARD EXAMINATIONS

QUESTION PATTERN

Note:
1. Five questions will be asked, one question from each unit in either or pattern. All the five questions are to be answered.
2. Each question carries 15 marks. These questions may have sub-divisions also.
3. P.S.G. DESIGN DATA BOOK IS PERMITTED. (Required abstract pages of the P.S.G. Design Data Book Certified by the Chief Supdt. may be permitted.)
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

III YEAR
V SEMESTER

32052 – THERMAL AND AUTOMOBILE ENGINEERING

CURRICULUM DEVELOPMENT CENTRE
M-SCHEME
(Implements from the Academic year 2015-2016 onwards)

Course Name: DIPLOMA IN MECHANICAL ENGINEERING
Course Code: 1020
Subject Code: 32052
Semester: V
Subject Title: THERMAL AND AUTOMOBILE ENGINEERING

TEACHING AND SCHEME OF EXAMINATIONS:
No. of Weeks per Semester: 15 Weeks

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Topics and Allocation of Hours:

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<tr>
<td>II</td>
<td>IC ENGINES AND ITS COMPONENTS</td>
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<td>III</td>
<td>AUTOMOBILE COOLING SYSTEMS, LUBRICATION SYSTEM &amp; FUEL FEED SYSTEMS</td>
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<td>IV</td>
<td>AUTOMOBILE TRANSMISSION AND POWER TRAINS &amp; CHASSIS</td>
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<tr>
<td>V</td>
<td>AUTOMOBILE BRAKE SYSTEM, ELECTRICAL EQUIPMENT AND POLLUTION CONTROL</td>
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RATIONALE:

Study of thermal power plant, turbines and condensers are required to know about the generation of electric power. The study about the Refrigeration and Air-conditioning are required. Automobile is one of the key areas of development in India facilitated by Multinational Companies. As Automobile is the Major sources of employing man power a thorough knowledge on Automobile Engine construction and its functioning is required with due consideration on pollution control.

OBJECTIVES:

- Explain the fundamental of thermal power plant and steam turbines and condensers.
- Explain the refrigeration and air conditioning.
- Explain the components of IC engines.
- Explain the performance tests on IC engines.
- Compare the modes of heat transfer and evaluate the heat transfer by various modes.
- Explain the cooling system and lubrication system of the IC engines.
- Explain the fuel feed system.
- Explain the transmission systems and power trains of automobile.
- Study about the Brake systems and electrical components
- Study the pollution and its standards.

THERMAL AND AUTOMOBILE ENGINEERING

DETAILED SYLLABUS

Contents: Theory

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<td>REFRIGERATION AND AIR CONDITIONING,</td>
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<td>Layout of thermal power plant - merits and demerits of</td>
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<td>cyclone separator – wet scrubber – electrostatic</td>
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<td>precipitator – control of NO₂ and SO₂ - fluidised bed</td>
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<td>combustion.</td>
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II  **IC ENGINES AND ITS COMPONENTS**

*Internal combustion engines*

Classifications of I.C Engines – four stroke cycle petrol and diesel engines – two stroke cycle petrol and diesel engines - comparison of four stroke and two stroke engines.


III  **AUTOMOBILE COOLING SYSTEMS, LUBRICATION SYSTEM & FUEL FEED SYSTEMS**

Cooling systems – purpose – types – air and water cooling systems
– thermo siphon system - pump assisted water cooling systems – merits and demerits – troubles in cooling system.

Fuel Feed Systems:

IV AUTOMOBILE TRANSMISSION AND POWER TRAINS & CHASSIS
Transmission And Power Trains:
Gear box – purpose – types of gear boxes – sliding mesh, constant mesh and synchromesh – floor shift gear changer – gear box troubles and their causes.
Automobile Chassis:
Front axle – Stub axle – Types – Steering system – Ackermann Principle of Steering – Wheel alignment – Factors – Camber ,
Caster, King pin inclination, Toe in and Toe out on turns - 
Steering linkages – Steering gears – Cam and double roller, 
recirculating ball type, Rack and Pinion – Steering troubles and 
causes – power steering – Necessity – types – Layout of any one 
type – Collapsible Steering system.
Suspension system – Functions – Leaf, coil and Torsion bar – 
Front suspension systems – independent front suspension – merits 
and demerits – types – rear end suspension – Air suspension - 
shock absorber – purpose – telescopic type construction and 
working.

V AUTOMOBILE BRAKE SYSTEM, ELECTRICAL EQUIPMENT AND POLLUTION CONTROL

Brake system – functions – classification of brakes – drum brakes – 
leading shoe and trailing shoe – Self energizing action – hydraulic 
brake – brake bleeding - Air assisted hydraulic brakes – Air brake – 
layout – disc brakes – construction and working – brake troubles 
and their causes – anti lock brake system. Wheels – types of 
wheels.
Battery – lead acid battery – Nickel alkaline battery – construction – 
battery rating – charging - testing – starting circuit - construction 
and operation of starter motor – starting motor drives – over running 
clutch and Bendix drive – construction and operation – solenoid 
switch - Charging circuit – alternator construction and operation – 
regulators – Dynamo.
Ignition system – Types – battery coil ignition system –High tension 
magneto – electronic ignition – Ignition system troubles and 
remedies.
Lighting system – circuit – Head light – Aiming and adjustment – 
sealed beam head lights – directional signal circuits – fluorescent 
lamp - Horn circuits – Wind screen wiper.
Pollution – Pollutants – source of pollutants – pollution control 
techniques for petrol and diesel engines emissions – controlling 
crank case emission (PCV) – controlling evaporative emission 
(VRS, VSS, VVR, ECS and EEC) – Treatment of exhaust gas 
(Catalytic converter, EGR) – introduction to automobile electronics
– radio interference – suppressors – audio, video systems.

Text Books:


Reference Books:

5) Internal Combustion engines, M.L.Mathur & R.P.Sharma, Dhanpat Rai & Sons,
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

III YEAR
V SEMESTER

32053 – PROCESS PLANNING AND COST ESTIMATION

CURRICULUM DEVELOPMENT CENTRE
M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING
Course Code  : 1020
Subject Code : 32053
Semester : V
Subject Title : PROCESS PLANNING AND COST ESTIMATION

TEACHING AND SCHEME OF EXAMINATIONS:
No. of Weeks per Semester: 15 Weeks

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Topics and Allocation of Hours:

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<td>III</td>
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<td>IV</td>
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<td>V</td>
<td>MACHINING TIME CALCULATIONS</td>
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</table>
**RATIONALE:**
In the product manufacturing the process selection and planning are important. In this subject the work study, cost estimation and machining time calculations are discussed.

**OBJECTIVES:**
Understand the process planning.
Study the process selection.
Understand the work study and method study.
Study the cost estimation.
Study the machining time calculations.

**PROCESS PLANNING AND COST ESTIMATION**

**DETAILED SYLLABUS**

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<tr>
<td><strong>II Process Selection</strong></td>
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</table>

machinery - selection of machinery - simple problems - preparation of operation planning sheet for simple components.

III Work Study

IV Cost Estimation

V Machining Time Calculations
Elements of metal machining - cutting speed - feed - depth of cut - procedure for assigning cutting variables - calculation of machining time for different lathe operations like - turning - facing - chamfering - parting - knurling and forming - Calculation of machining time for operations on drilling machine - machining time for shaping, planing, slotting, broaching and sawing operations - Machining time for face milling and slab milling operations - timing for thread cutting - estimation of total unit time - Procedure for doing the above machining calculations with formulae used - simple problems.

TEXT BOOKS:
1) Industrial Engineering & Management - O.P Khanna
2) Industrial Engineering & Production Management - Martand Telsang

REFERENCE BOOKS:

2) Production and Costing - GBS Narang and V.Kumar
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

III YEAR
V SEMESTER

ELECTIVE THEORY
32071 – TOTAL QUALITY MANAGEMENT

CURRICULUM DEVELOPMENT CENTRE
M-Scheme
(Implements from the Academic year 2015-2016 onwards)

Course Name: DIPLOMA IN MECHANICAL ENGINEERING
Course Code: 1020
Subject Code: 32071
Semester: V
Subject Title: TOTAL QUALITY MANAGEMENT

TEACHING AND SCHEME OF EXAMINATIONS:
No. of Weeks per Semester: 15 Weeks

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Topics and Allocation of Hours:

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<tbody>
<tr>
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<td>II</td>
<td>Continuous process improvement – Q-7 Tools</td>
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<td>III</td>
<td>Statistical Fundamentals</td>
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RATIONALE:

Quality and customer satisfaction in every product and every activity is the order of the day. As there is a shift from quality control to quality management in all activities, the concept Total Quality Management and the pillars of TQM are to be given to Engineers, who are designing products and production systems.
OBJECTIVES:
- Define quality and appreciate its signature.
- Explain the concept of TQM.
- Appreciate the use of principles of TQM to meet customer satisfaction.
- Solve problem using the Quality control tools.
- Apply Brainstorming and quality circle to solve problems.
- Use PDCA cycle for continuous improvement.
- Appreciate the benefits of implementing 5S concepts.
- Collect, classify and present the data.
- Determine the process capability of a manufacturing process.
- Practice on management planning tools.
- Use Bench Mark and JIT concepts.

TOTAL QUALITY MANAGEMENT
DETAILED SYLLABUS

Contents: Theory

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<td>II</td>
<td>CONTINUOUS PROCESS IMPROVEMENT – Q7 TOOLS</td>
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<td>Input / Output process model – Juran Trilogy – PDCA (Deming Wheel) cycle – 5S Concepts – SEIRI, SEITON, SEISO, SEIKETSU and SHITSUKE – needs and objectives – effective implementation of 5S concepts in an organisation - Housekeeping – Kaizen. Seven tools of quality control (Q-7 tools) – Check sheet – Types of</td>
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</table>
check sheet – Histogram – Cause and effect diagram - Pareto diagram – Stratification Analysis – Scatter diagram-Graph/run charts – Control charts - Construction of above diagrams.
Quality circle - concept of quality circle - Organisation of Quality circle and objectives of Quality circle.

III  STATISTICAL FUNDAMENTALS


IV  CONTROL CHARTS


V  MANAGEMENT PLANNING TOOLS & BENCH MARKING

Affinity diagram – Radar Diagram - Inter Relationship diagram (Inter Relationship diagram) – Tree diagram - Prioritization matrix – Matrix diagram – Decision tree – Arrow diagram – Matrix data analysis diagram - Construction of above diagrams.
Bench marking – Objectives of bench marking – Types – Bench marking process - Benefits of Bench marking – Pit falls of Bench marking-Just In Time(JIT) concepts and its objectives - Total Productive Maintenance(TPM) - Introduction, Objectives of TPM - steps in implementing TPM.
Text Book:
1) Total Quality Management, Date H.Besterfiled, Pearson Education Asia.

Reference Book:
4) Quality Planning and Analysis, Juran J.M and Frank M.Gryna Jr., TMH. India. 1982
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

III YEAR
V SEMESTER

ELECTIVE THEORY
32072 – PRESS TOOLS

CURRICULUM DEVELOPMENT CENTRE
M-SCHME
(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING
Course Code : 1020
Subject Code : 32072
Semester : V
Subject Title : PRESS TOOLS

TEACHING AND SCHEME OF EXAMINATIONS:
No. of Weeks per Semester: 15 Weeks

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<td>Bending and forming dies</td>
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<td>IV</td>
<td>Drawing dies and dies for secondary operations</td>
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<td>V</td>
<td>Fine blanking tool and specialized press tool applications</td>
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<td>REVISION AND TEST</td>
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RATIONALE:
Press working plays a vital role in the metal forming process. The study about the operations in the press work is important method of manufacturing.
OBJECTIVES:

- Explain the fundamentals of press working, to be familiar with the various press working operations and machines.
- Appreciate the safety practices in press working operations.
- Explain with the various press and press tool accessories.
- Compare the different types of Die construction.
- Explain the various bending, forming and other miscellaneous press working operations.
- Demonstrate about the construction and operation of the different bending dies.
- Define the various drawing and other related processes.
- Explain the construction and operating principle of drawing and combination dies.
- Explain the basic concepts and the advantages of fine blanking process.
- Demonstrate the construction and working principle of various fine blanking dies.
- Appreciate the concepts of SMED and quick die changes and its advantages in bringing down the press set up time.
- Troubleshoot in various press tools.

PRESS TOOLS

DETAILED SYLLABUS

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perforating, embossing, coining, bending, forming, drawing, curling, bulging, extrusion, swaging, trimming, and shaving. Safety in press working.


Press operating parameters – Tonnage, shut height, stroke, shut height adjustment, strokes per minute, die space. Special purpose presses – Press brake, transfer press, multi slide machine.

II PRESS & PRESS TOOL ACCESSORIES AND CUTTING DIES

Press Feeding Mechanisms - Uncoilers, Straighteners and recoilers, Hand feed, hitch/grip feed, Roll feed, Hopper feeds, dial feeds, chutes, slides, magazine feeds.

Ejection mechanism – Ejection by Gravity, air ejection, mechanical ejection, semi automatic and automatic ejection, Mechanical hands, ejection by next part.

Parts and functions of a press tool - Punches, Dies, Stoppers, Trigger stops, Strippers – Fixed and Travelling, Gauges, Pilots-Methods of piloting, shanks -Strip layout, Economy factor.

Cutting Dies - Construction and working of Blanking tool, Piercing tool, Progressive tool, Compound tool. Commercially available die components – Die sets, die set attachment devices, punches, die buttons, retainers, springs, fluid springs, die cushion and its types.

III BENDING AND FORMING DIES:


Forming dies – Construction and working principle of solid form dies, pad form dies, curling dies, embossing dies, coining dies, swaging dies, bulging dies, crimping, tube forming. Assembly dies - Riveting,
### IV DRAWING DIES AND DIES FOR SECONDARY OPERATIONS


Dies for secondary operations - Construction and working principle of Semi piercing dies, shear form dies, dies for formed contours, notching die, shaving die, side piercing die.

### V FINE BLANKING TOOL AND SPECIALISED PRESS TOOL APPLICATIONS


Text Books:

Reference Books:
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

III YEAR
V SEMESTER

ELECTIVE THEORY
32073 – RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION

CURRICULUM DEVELOPMENT CENTRE
M-SCHEME
(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING
Course Code : 1020
Subject Code : 32073
Semester : V
Subject Title : RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION

TEACHING AND SCHEME OF EXAMINATIONS:
No. of Weeks per Semester: 15 Weeks

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Topics and Allocation of Hours:

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<td>V</td>
<td>ENERGY CONSERVATION TECHNIQUES AND ENERGY AUDIT</td>
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<td>REVISION AND TEST</td>
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RATIONALE:

Electrical Energy requirement is the major crisis and hence any saving in Electrical energy is equivalent to production of Electrical Energy. Saving can be achieved by the utilization of Renewable Energy Sources.

OBJECTIVES:

- Study about the fundamentals of Energy.
- Study of construction and principle of Wind energy, Solar energy, Tidal energy and Bio energy.
- Understand the PV design and its components.
- Understand the energy management and auditing techniques.
- Study the energy conservation process.

RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION

DETAILED SYLLABUS

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<td>I</td>
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Introduction to Energy-Energy consumption and standard of living-classification of energy resources-consumption trend of primary energy resources-importance of renewable energy sources-energy for sustainable development.

WIND ENERGY

II  SOLAR ENERGY


Solar energy collectors- Classifications-Flat plate collectors - Concentrating collectors-performance parameter-tracking system- compound parabolic concentrator-parabolic trough concentrators- concentrator with point focus-heliostats-comparisons of various collectors-efficiency of collector-selection of collector for various applications.


Solar thermal energy storage: sensible storage-latent heat storage-thermo chemical storage.

III Solar photovoltaic System and Design:

Solar photovoltaic a brief history of PV,PV in silicon: basic principle, crystalline PV; reducing cost and raising efficiency, thin film PV, other innovative technologies, electrical characteristics of silicon PV cells and modules, grid connected PV system, cost of energy from PV ,Environmental impact and safety.


Ocean energy, Tidal & Wave energy

Ocean energy resources – principle's of ocean thermal energy conversion (OTEC) – Methods of Ocean thermal electric power generation – Energy utilisation – basic principle of tidal power – components and operations of tidal power plant – Energy and Power forms of waves – Wave energy conversion devices.
IV BIO – ENERGY


V Energy Management and Audit, Conservation: Definition, Energy audit - need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments

Energy Conservation Techniques- Need and importance of energy conservation -Principles of energy conservation- Methods of energy conservation-Cogeneration and its application-Combined cycle system-Concept of energy management-Study of different energy management techniques like-Analysis of input-Reuse and recycling of waste.

Economic approach of Energy Conservation-Costing of utilities like steam, compressed air, electricity and water-Ways of improving boiler efficiency-Thermal insulation, Critical thickness of insulation-Waste heat recovery systems, their applications, criteria for installing unit-An introductory approach of energy conservation in compressed air, refrigeration, air conditioning, pumps and fans.

Text Books:

5) Industrial energy conservation - D. A. Ray - Pergaman Press
6) Energy resource management - Kirpal Singh Jogi - Sarup and sons
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

III YEAR
V SEMESTER

32055 – PROCESS AUTOMATION PRACTICAL

CURRICULUM DEVELOPMENT CENTRE
M-Scheme
(Impliments from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING
Course Code : 1020
Subject Code : 32055
Semester : V
Subject Title : PROCESS AUTOMATION PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:
No. of Weeks per Semester: 15 Weeks

<table>
<thead>
<tr>
<th>Subject</th>
<th>Instructions</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Automation</td>
<td>Hours/Week</td>
<td>Hours/Semester</td>
</tr>
<tr>
<td>Practical</td>
<td>4</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OBJECTIVES:
- Design and operate pneumatic circuits.
- Design and operate fluid power circuits
- Use PLC system and its elements for process control
- Familiarize the working of function blocks in PLC
- Use ON-Delay timer to control a motor
- Use OFF-Delay timer to control a motor
- Use counter function block (Up counter and Down counter)
- Control the automatic operation of pneumatic cylinder using PLC
- Record of work to be prepared.
Exercises

Pneumatics Lab.
1. Direct operation of single and double acting cylinder.
2. Operation of double acting cylinder with quick exhaust valve.

Hydraulics Lab.
1. Direct operation of double acting cylinder.
2. Direct operation of hydraulic motor.
3. Speed control of double acting cylinder metering-in and metering-out control.

PLC Lab.
1. Direct operation of a motor using latching circuit.
2. Operation of a motor using ‘AND’ logic control.
5. Automatic operation of a Double acting cylinder-single cycle.
6. Automatic operation of a Double acting cylinder-single cycle - forward, time delay, return.
8. Sequential operation of double acting cylinder and a motor.
Board of Examination

Note: All the exercises have to be completed. Two exercises will be given for examination by selecting one exercise from Pneumatics Lab. or Hydraulics lab. and one from PLC lab. All the exercises should be given in the question paper and students are allowed to select by a lot. Record note book should be submitted during examination.

Allocation of Marks

- Part A: Pneumatics/Hydraulics lab by lot - 35 marks
- Part B: One question from PLC lab. - 35 marks
- Viva-voce - 05 marks
- Total - 75 marks

LIST OF EQUIPMENTS

1. Pneumatic Trainer Kit – 2Nos
   (All Cylinders, Control Valves, Limit switches and other accessories)
2. Hydraulics Trainer Kit – 1No.
   (All Cylinders, Control Valves, Limit switches and other accessories)
3. PLC kit. – 2 Nos.
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

III YEAR
V SEMESTER

32056 – THERMAL AND AUTOMOBILE ENGINEERING
PRACTICAL

CURRICULUM DEVELOPMENT CENTRE
M-SCHMEE
(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING
Course Code  : 1020
Subject Code : 32056
Semester     : V
Subject Title: THERMAL AND AUTOMOBILE ENGINEERING PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:
No. of Weeks per Semester: 15 Weeks

<table>
<thead>
<tr>
<th>Subject</th>
<th>Instructions</th>
<th>Examination</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal and Automobile</td>
<td>Hours/Week</td>
<td>Hours/Semester</td>
<td>Marks</td>
</tr>
<tr>
<td>Automobile Engineering</td>
<td>4</td>
<td>60</td>
<td>Internal Assessment Board Examination Total</td>
</tr>
<tr>
<td>Engineering Practical</td>
<td></td>
<td></td>
<td>25 75 100</td>
</tr>
</tbody>
</table>

OBJECTIVES:
- Determine the flash and fire point of oil by using open & closed cup apparatus
- Determine the absolute viscosity by using redwood & saybolt viscometer
- Draw the valve timing diagram of petrol or diesel engines.
- Draw the port timing diagram of petrol or diesel engines.
- Conduct performance test on petrol or diesel engines.
- Prepare a heat balance sheet petrol or diesel engines
- Prepare a Morse test on a petrol or diesel engines
- Identify the various tools and their applications used in Automobile.
- Dismantle and assemble fuel injection pump & fuel injectors.
- Dismantle and assemble of power transmission and differential unit.
- Dismantle and assemble steering gear box.
- Testing and charging of batteries. Overhauling of starter motor, alternator & dynamo.
List of Experiments:

PART-A

1) Determine flash and fire point of the given oil by using open cup apparatus and closed cup apparatus.
2) Determine the absolute viscosity of the given lubricating oil by using Redwood viscometer / say bolt viscometer.
3) Draw a Port timing diagram of two stroke petrol / diesel Engines.
4) Draw a Valve time diagram for four stroke petrol / diesel engines.
5) To conduct a load test on a petrol / diesel Engines.
6) To conduct a Morse test on multi cylinder petrol / diesel engines.
7) To conduct a Heat balance test on a Four Stroke Petrol (or) Diesel engines.

PART-B

1) Dismantling, assembling of pressure plate, clutch plate and steering gear box.
2) Dismantling, inspecting and assembling of gear box and find out the gear ratios.
3) Dismantling, inspecting and assembling of final drive and differential units.
   Adjusting of backlash and correct tooth contact of crown and pinion of differential unit.
4) Removing camshaft, replacing timing gears, removing valves and adjusting valve clearance.
5) Removing, servicing and replacing Solex carburettor (OR) MPFI system.
6) Dismantling and assembling of inline fuel injection pump (OR) CRDI system and Injectors
7) Test a battery with specific gravity test and charge the battery with constant ampere/ voltage method. Dismantling, overhauling and assembling of starter motor and alternator (OR) dynamo.
Board of Examination

**Note:** All the exercises have to be completed. Two exercises will be given for examination by selecting one exercise in each PART. All the exercises should be given in the question paper and students are allowed to select by a lot. Record note book should be submitted during examination.

**Allocation of Marks**

<table>
<thead>
<tr>
<th>Part</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part A</td>
<td>35</td>
</tr>
<tr>
<td>Observation / Tabulation</td>
<td>10</td>
</tr>
<tr>
<td>Reading / Calculation</td>
<td>15</td>
</tr>
<tr>
<td>Result / Graph / Diagram</td>
<td>10</td>
</tr>
<tr>
<td>Part -B</td>
<td>35</td>
</tr>
<tr>
<td>Dismantling</td>
<td>10</td>
</tr>
<tr>
<td>Procedure / Observation</td>
<td>15</td>
</tr>
<tr>
<td>Assembly</td>
<td>10</td>
</tr>
<tr>
<td>Viva-Voce</td>
<td>05</td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
</tr>
</tbody>
</table>

**LIST OF EQUIPMENTS**

**THERMAL PRACTICAL**

1. Open cup apparatus to determine Flash and fire points – 2 No
2. Close cup apparatus to determine Flash and fire points – 2 No
3. Redwood viscometer – 2 No
4. Saybolt viscometer – 2 No
5. 4 stroke cycle petrol / diesel engine Model – 2 No
6. 2 stroke cycle petrol / diesel engine Model – 2 No
7. Petrol / Diesel engine of any make with following arrangements – 2 No
   - Load test arrangement
   - Heat balance test arrangement
8. Multi cylinder petrol engine of any make with Morse test setup – 1 No
## AUTOMOBILE PRACTICAL

1. Automobile Mechanic’s tools-Complete Set - 2 Set
2. 4 stroke petrol engine- with all accessories - 1 No
3. 4 stroke Diesel engine- with all accessories - 1 No
4. Internal circlip plier, bearing puller - 1 No
5. Feeler gauge to check valve clearance, hammer and accessories - 1 No
6. SOLEX carburetor - 1 No
7. MPFI. - 1 No
8. Inline Fuel Injection Pump - 1 No
9. CRDI - 1 No
10. Injectors. - 1 No
11. Clutch set arrangement with tools - 1 No
12. Complete gear box with tools - 1 No
13. Complete steering arrangement - 1 No
14. Differential unit with axles - 1 No
15. Battery - 1 No
16. Battery Charger - 1 No
17. Battery Testing unit (Specific gravity) - 1 No
18. Starter Motor - 1 No
19. Alternator - 1 No
20. Dynamo - 1 No
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

III YEAR
V SEMESTER

30002 – LIFE AND EMPLOYABILITY SKILLS PRACTICAL

CURRICULUM DEVELOPMENT CENTRE
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING – SYLLABUS – M Scheme

(Being implemented from the Academic Year 2016-2017 onwards)

Course Name: All Branches of Diploma in Engineering and Technology and Special Programmes

Subject Code: 30002

Semester: IV / V

Subject Title: LIFE AND EMPLOYABILITY SKILLS PRACTICAL

Teaching and Scheme of Examination:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Instruction</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours/Week</td>
<td>Hours/Semester</td>
</tr>
<tr>
<td>Life and Employability Skills</td>
<td>4 Hours</td>
<td>60 Hours</td>
</tr>
</tbody>
</table>

Topics and Allocation of Hours:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Section</th>
<th>No. of Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Communication, Part – A</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>Entrepreneurship, Project Preparation, Productivity, Occupational Safety, Health, Hazard, Quality Tools &amp; Labour Welfare, Part – B</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>Environment, Global Warming, Pollution, Part – C</td>
<td>10</td>
</tr>
</tbody>
</table>

TOTAL 60
RATIONALE

Against the backdrop of the needs of the Industries, as well as based on fulfilling the expectations of the Industries, the Diploma Level students have to be trained directly and indirectly in toning up their competency levels. Proficiency in Communication only, equips them with confidence and capacity to cope with the employment. Hence, there is a necessity to focus on these in the curriculum. At the end of the Course, the student is better equipped to express himself in oral and written communication effectively.

SPECIFIC INSTRUCTIONAL OBJECTIVES

1. Emphasize and Enhance Speaking Skills

2. Increase Ability to Express Views & Opinions

3. Develop and Enhance Employability Skills

4. Induce Entrepreneurship and Plan for the Future

5. Expose & Induce Life Skills for Effective Managerial Ability
### LIFE AND EMPLOYABILITY SKILLS PRACTICAL

#### SYLLABUS

<table>
<thead>
<tr>
<th>Unit</th>
<th>Topics</th>
<th>Activity</th>
<th>Hours</th>
</tr>
</thead>
</table>
| I    | Communication, Listening, Training, Facing Interviews, Behavioural Skills | -- instant sentence making  
     |                                                                          | – say expressions/phrases--self-introduction/another higher official in company  
     |                                                                          | – describe/explain product  
     |                                                                          | – frame questions based on patterns  
     |                                                                          | – make sentences based on patterns                                                                                                             | 30    |
| II   | Entrepreneurship, Project Preparation, Marketing Analysis, Support & Procurement | -- prepare an outline of a project to obtain loan from bank in becoming an entrepreneur  
     |                                                                          | – prepare a resume                                                                                                                               | 10    |
| III  | Productivity – comparison with developed countries, Quality Tools, Circles, Consciousness, Management, House Keeping | -- search in the website  
     |                                                                          | -- prepare a presentation  
     |                                                                          | – discuss & interact                                                                                                                             | 05    |
     |                                                                          | -- prepare a presentation  
     |                                                                          | – discuss & interact                                                                                                                             | 05    |
| V    | Environment, Global Warming, Pollution                                | -- taking down notes / hints --answering questions  
     |                                                                          | -- fill in blanks the exact words heard                                                                                                         | 10    |
LEARNING STRUCTURE

-- Focus more on Speaking & Listening Skills
-- Attention less on Reading & Writing Skills
-- Apply the skills in fulfilling the Objectives on Focused Topics

<table>
<thead>
<tr>
<th>a) Listening</th>
<th>25 Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Deductive Reasoning Skills (taking down notes/hints)</td>
<td>10 Marks</td>
</tr>
<tr>
<td>2. Cognitive Skills (answering questions)</td>
<td>10 Marks</td>
</tr>
<tr>
<td>3. Retention Skills (filling in blanks with exact words heard)</td>
<td>05 Marks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>b) Speaking Extempore/Prepared</th>
<th>30 Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Personality/Psychological Skills (instant sentence making)</td>
<td>05 Marks</td>
</tr>
<tr>
<td>2. Pleasing &amp; Amiable Skills (say in phrases/expressions)</td>
<td>05 Marks</td>
</tr>
<tr>
<td>3. Assertive Skills (introducing oneself/others)</td>
<td>05 Marks</td>
</tr>
<tr>
<td>4. Expressive Skills (describe/explain things)</td>
<td>05 Marks</td>
</tr>
<tr>
<td>5. Fluency/Compatibility Skills (dialogue)</td>
<td>05 Marks</td>
</tr>
<tr>
<td>6. Leadership/Team Spirit Skills (group discussion)</td>
<td>05 Marks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>c) Writing &amp; Reading</th>
<th>20 Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Creative &amp; Reasoning Skills (frame questions on patterns)</td>
<td>05 Marks</td>
</tr>
<tr>
<td>2. Creative &amp; Composing Skills (make sentences on patterns)</td>
<td>05 Marks</td>
</tr>
<tr>
<td>3. Attitude &amp; Aim Skills (prepare resume)</td>
<td>05 Marks</td>
</tr>
<tr>
<td>4. Entrepreneurship Skills (prepare outline of a project)</td>
<td>05 Marks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>d) Continuous Assessment (Internal Marks)</th>
<th>25 Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>(search, read, write down, speak, listen, interact &amp; discuss)</td>
<td></td>
</tr>
<tr>
<td>1. Cognitive Skills (Google search on focused topics)</td>
<td></td>
</tr>
<tr>
<td>2. Presentation Skills &amp; Interactive Skills (after listening, discuss)</td>
<td></td>
</tr>
<tr>
<td>Note down and present in the Record Note on any 5 topics</td>
<td>10 Marks</td>
</tr>
<tr>
<td>Other activities recorded in the Record note</td>
<td>10 Marks</td>
</tr>
<tr>
<td>Attendance</td>
<td>05 Marks</td>
</tr>
</tbody>
</table>

INTERNAL MARKS 25 MARKS
EXTERNAL MARKS AT END EXAMINATION 75 MARKS
MODEL QUESTION

Time: 3 Hours       Maximum Marks: 75

A. LISTENING          25 Marks

1. Listen to the content and take down notes/hints     10
2. Listen to the content and answer the following questions.    10
3. Listen to the content and fill in the blanks the exact words heard.   05

B. SPEAKING          30 Marks

1. Say in a sentence instantly on hearing the word(5 words, one after another).  05
2. Say any five expressions commonly used in communication. 05
3. Imagine, a consultant has come to your department.
   Introduce him to your subordinates. 05
4. Explain/describe the product you are about to launch in the market. 05
5. Speak with your immediate boss about the progress you have made. 05
6. Discuss within the group on the topic of focus in the syllabus. 05

C. WRITING & READING        20 Marks

1. Frame new questions from the pattern given by changing sets of words with your own.  05

<table>
<thead>
<tr>
<th>a. When do you return?</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. How is his performance?</td>
</tr>
<tr>
<td>c. Where has the manager gone?</td>
</tr>
<tr>
<td>d. What is the progress today?</td>
</tr>
<tr>
<td>e. Why are the machines not functioning?</td>
</tr>
</tbody>
</table>

2. Make sentences from the pattern given by changing sets of words with your own. 05

<table>
<thead>
<tr>
<th>a. The workers are on strike</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. The labourers are paid well in this factory</td>
</tr>
<tr>
<td>c. There is a rest room for the workers</td>
</tr>
<tr>
<td>d. These are the new products launched by our company</td>
</tr>
<tr>
<td>e. Almost everyone come to the company on motorbikes</td>
</tr>
</tbody>
</table>

3. Prepare a resume for the post of Department Manager. 05

4. Prepare an outline of a project to obtain a loan. (Provide headings and subheadings) 05
I. Guidelines for setting the question paper:

A. LISTENING:

ONLY TOPICS related to POLLUTION / ENVIRONMENT / GLOBAL WARMING are to be taken. These topics are common for all the three types of evaluation.

B. SPEAKING:

1. WORDS of common usage
2. Fragments – expression of politeness, courtesy, cordiality
3. Introduce yourself as an engineer with designation or Introduce the official visiting your company/department
4. Describe/Explain the product/machine/department
5. Dialogue must be with someone in the place of work.
6. Group of six/eight Discuss the focused topic prescribed in syllabus

C. WRITING & READING:

1. Provide five different structures. Students are to substitute at least one with some other word/words
2. Provide five different structures. Students are to substitute at least one with some other word/words
3. Provide some post related to industries.
4. Outline of the project (skeleton/structure) Only the various headings and subheadings Content is not needed

II. Guidelines for recording the material on the Focused Topics in the Record note.

Write in the record note, on any five topics, from the list of topics given below. 10 Marks (5 topics x 10 marks = 50 marks. Thus, the Average of 5 topics is 10 Marks)

1. Productivity in Industries – Comparison with developed countries
2. Quality Tools, Quality Circles and Quality Consciousness
3. Effective Management
4. House Keeping in Industries
5. Occupational Safety and Hazard
6. Occupational Accident and First Aid
7. Labour Welfare Legislations
8. Labour Welfare Acts and Rights
9. Entrepreneurship
10. Marketing Analysis, Support and Procurement

**LABORATORY REQUIREMENT:**

1. An echo-free room
2. Necessary furniture and comfortable chairs
3. A minimum of two Computers with internet access
4. A minimum of two different English dailies
5. A minimum of Three Mikes with and without cords
6. Colour Television (minimum size – 29”)
7. DVD/VCD Player with Home Theatre speakers
8. Smart board
9. Projector

**Suggested Reading:**

1. Production and Operations Management by S.N. Chary, TMH
2. Essentials of Management by Koontz & Weihrich, TMH
5. Productions and Operations Management by A. Muhlemann, J. Oakland and K. Lockyer, Macmillan
8. Business Correspondence & Report Writing by R.C. Sharma and K. Mohan, TMH
9. How to prepare for Group Discussion & Interview (With Audio Cassette) by Prasad, TMH
10. Spoken English – A self-learning guide to conversation practice (with Cassette)
11. Introduction to Environmental Engineering by Mackenzie, L. Davis and A. David, Cornwell, McgrawHill, 3rd Ed.
12. Environmental Engineering by Peary, Rowe and Tchobanoglous, McgrawHill
13. Total Quality Management – An Introductory Text by Paul James, Prentice Hall
14. Quality Control and Applications by Housen & Ghose
15. Industrial Engineering Management by O.P. Khanna
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

III YEAR
VI SEMESTER

32061 – INDUSTRIAL ENGINEERING AND MANAGEMENT

CURRICULUM DEVELOPMENT CENTRE
M-SCHEME
(Implemented from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING
Course Code : 1020
Subject Code : 32061
Semester : VI
Subject Title : Industrial Engineering and Management

TEACHING AND SCHEME OF EXAMINATIONS:
No. of Weeks per Semester: 15 Weeks

<table>
<thead>
<tr>
<th>Subject</th>
<th>Instructions</th>
<th>Examination</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Engineering</td>
<td>Hours/Week</td>
<td>Hours/Semester</td>
<td>Marks</td>
</tr>
<tr>
<td>and Management</td>
<td>6</td>
<td>90</td>
<td>Internal Assessment</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>25</td>
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</tbody>
</table>

Topics and Allocation of Hours:

<table>
<thead>
<tr>
<th>UNIT NO.</th>
<th>TOPIC</th>
<th>HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>PLANT ENGINEERING AND PLANT SAFETY</td>
<td>17</td>
</tr>
<tr>
<td>II</td>
<td>WORK STUDY, METHOD STUDY AND WORK MEASUREMENT</td>
<td>17</td>
</tr>
<tr>
<td>III</td>
<td>PRODUCTION PLANNING AND QUALITY CONTROL</td>
<td>17</td>
</tr>
<tr>
<td>IV</td>
<td>PRINCIPLES, PERSONNEL MANAGEMENT AND ORGANIZATIONAL BEHAVIOR:</td>
<td>16</td>
</tr>
<tr>
<td>V</td>
<td>FINANCIAL AND MATERIAL MANAGEMENT</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>REVISION AND TEST</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>90</td>
</tr>
</tbody>
</table>
RATIONALE:
In the Indian Economy, Industries and Enterprises always find prominent place. After globalization, the students should be trained not only in manufacturing processes but also in managing activities of industries. The knowledge about plant, safety, work study techniques, personnel management and financial management will definitely mould the students as managers to suit the industries.

OBJECTIVES:
- To study the different types of layout.
- To study the safety aspects and its impacts on an organization.
- To study different work measurement techniques.
- To study production planning and control and its functions.
- To study basic and modern management techniques.
- To study the staff selection procedure and training of them.
- To study capital and resources of capital.
- To study inventory control system.
- To study about organization and it's behavior.

INDUSTRIAL ENGINEERING AND MANAGEMENT
DETAILED SYLLABUS

Contents: Theory

<table>
<thead>
<tr>
<th>UNIT</th>
<th>NAME OF THE TOPIC</th>
<th>HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>PLANT ENGINEERING AND PLANT SAFETY</td>
<td>17</td>
</tr>
</tbody>
</table>


II WORK STUDY, METHOD STUDY AND WORK MEASUREMENT

Work Study: Productivity – Standard of living – method of improving productivity
– Objectives – Importance of good working conditions.


III PRODUCTION PLANNING AND QUALITY CONTROL


IV PRINCIPLES, PERSONNEL MANAGEMENT AND ORGANIZATIONAL BEHAVIOR:


Organizational behavior: Definition – organization--Types of Organization – Line, Staff, Taylor’s Pure functional types – Line and staff and committee type –Organizational Approaches, individual behavior—causes—Environmental effect—Behavior and Performance, Perception-organizational implications.

V FINANCIAL AND MATERIAL MANAGEMENT


Text Books:

Reference Books:
3) S.Chandran, Organizational Behaviours, Vikas Publishing House Pvt. Ltd. Latest
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

III YEAR
VI SEMESTER

32062 – COMPUTER AIDED DESIGN AND
MANUFACTURING

CURRICULUM DEVELOPMENT CENTRE
M-SCHEME
(Implements from the Academic year 2015-2016 onwards)

Course Name: DIPLOMA IN MECHANICAL ENGINEERING
Course Code: 1020
Subject Code: 32062
Semester: VI
Subject Title: COMPUTER AIDED DESIGN AND MANUFACTURING

TEACHING AND SCHEME OF EXAMINATIONS:
No. of weeks per semester: 15 Weeks

<table>
<thead>
<tr>
<th>Subject</th>
<th>Instructions</th>
<th>Examination</th>
<th>Duration</th>
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<tbody>
<tr>
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<td>3 Hrs</td>
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Topics and Allocation of Hours:

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<th>Unit</th>
<th>Topics</th>
<th>Hours</th>
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<tbody>
<tr>
<td>I</td>
<td>COMPUTER AIDED DESIGN</td>
<td>14</td>
</tr>
<tr>
<td>II</td>
<td>COMPUTER AIDED MANUFACTURING</td>
<td>14</td>
</tr>
<tr>
<td>III</td>
<td>CNC PROGRAMMING, RAPID PROTOTYPING</td>
<td>14</td>
</tr>
<tr>
<td>IV</td>
<td>COMPUTER INTEGRATED MANUFACTURING, FLEXIBLE MANUFACTURING SYSTEMS,</td>
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<td></td>
<td>AUTOMATIC GUIDED VEHICLE, ROBOT</td>
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<td>V</td>
<td>CONCURRENT ENGINEERING, QUALITY FUNCTION DEPLOYMENT, PRODUCT</td>
<td>13</td>
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<tr>
<td></td>
<td>DEVELOPMENT CYCLE, AUGMENTED REALITY</td>
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<td></td>
<td>REVISION AND TEST</td>
<td>7</td>
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<tr>
<td>Total</td>
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</table>
RATIONALE:

As per the latest requirements in the Industries this enables to learn the assistance of computer in the field of design and manufacturing areas. It’s able to learn the latest manufacturing concepts of in the shop floors and manufacturing methods like RPT. They are able to know about the CNC programming techniques are included.

OBJECTIVES:

- Understand the concept and requirement of the integration of the design and manufacturing.
- Acquire knowledge about the computer assistance in the design process and analysis.
- Understand the concepts of manufacturing with computer assistance in the shop floor.
- Understand the principle of latest manufacturing machines like RPT.
- Acquire the knowledge in the material handling equipment and robot.
- Understand the Computer Integrated Manufacturing and FMS.
- Study of Concurrent Engineering and its tools and Augmented Reality.

COMPUTER AIDED DESIGN AND MANUFACTURING

DETAILED SYLLABUS

Contents: Theory

<table>
<thead>
<tr>
<th>Unit</th>
<th>Name of the Topic</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>COMPUTER AIDED DESIGN</td>
<td>14</td>
</tr>
</tbody>
</table>

**Computer Aided Design:** Introduction – definition – Shigley’s design process – Ohsuga Model - CAD activities – benefits of CAD - CAD software packages.

**Transformations:** 2D & 3D transformations – translation, scaling, rotation and concatenation.

operations - Boundary representation – Constructive Solid Geometry – Comparison.

**Graphics standard:** Definition – Need - GKS – OpenGL - IGES – DXF.

**Finite Element Analysis:** Introduction – Development - Basic steps – Advantage.

## II COMPUTER AIDED MANUFACTURING

**Computer Aided Manufacturing:** Introduction - Definition – functions of CAM – benefits of CAM.

**Group technology:** Part families - Parts classification and coding - coding structure – Optiz system, MICLASS system and CODE System.

**Process Planning:** Introduction – Computer Assisted Process Planning (CAPP) – Types of CAPP - Variant type, Generative type – advantages of CAPP.

**Production Planning and Control (PPC):** Definition – objectives - Computer Integrated Production management system – Master Production Schedule (MPS) – Capacity Planning – Materials Requirement Planning (MRP) – Manufacturing Resources Planning (MRP-II) – Shop Floor Control system (SFC) - Just In Time manufacturing philosophy (JIT) - Introduction to Enterprise Resources Planning (ERP).

## III CNC PROGRAMMING, RAPID PROTOTYPING


**Rapid prototyping:** Classification – subtractive – additive – advantages and applications - materials. Types - Stereo lithography (STL) – Fused deposition model (FDM) – Selective laser sintering (SLS) - three dimensional printing (3D) – Rapid tooling.
IV COMPUTER INTEGRATED MANUFACTURING, FLEXIBLE MANUFACTURING SYSTEMS, AUTOMATIC GUIDED VEHICLE, ROBOT


V CONCURRENT ENGINEERING, QUALITY FUNCTION DEPLOYMENT, PRODUCT DEVELOPMENT CYCLE, AUGMENTED REALITY.

Concurrent Engineering: Definition – Sequential Vs Concurrent engineering – need of CE – benefits of CE.


Augmented Reality (AR) – Introduction - concept – Applications.

Text Books :
1) CAD/CAM/CIM , R.Radakrishnan, S.Subramanian, New Age International Pvt. Ltd.
2) CAD/CAM , Mikell P.Groover, Emory Zimmers, Jr.Prentice Hall of India Pvt., Ltd.
Reference Books:
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

III YEAR
VI SEMESTER

ELECTIVE THEORY - II

32081 – MECHANICAL INSTRUMENTATION

CURRICULUM DEVELOPMENT CENTRE
M-SCHEME  
(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING  
Course Code : 1020  
Subject Code : 32081  
Semester : VI  
Subject Title : MECHANICAL INSTRUMENTATION

TEACHING AND SCHEME OF EXAMINATIONS:  
No. of Weeks per Semester: 15 Weeks

<table>
<thead>
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<th>Subject</th>
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<th>Examination</th>
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<th>Topics and Allocation of Hours:</th>
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<tr>
<td><strong>Unit</strong></td>
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<td>---------</td>
</tr>
<tr>
<td>I</td>
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<td>II</td>
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<td>III</td>
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<td>IV</td>
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<td>V</td>
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<td><strong>TOTAL</strong></td>
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</table>

RATIONALE:  
Measurements are more important for the quality of the product. In this subject various methods of measurements are discussed.
OBJECTIVES

- Study about the different instruments, errors.
- Impart knowledge on displacement measurements
- Understand about temperature measurement
- Study about miscellaneous measurement
- Understand the application of measurement system

MECHANICAL INSTRUMENTATION

DETAILED SYLLABUS

Contents: Theory

<table>
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<tr>
<th>Unit</th>
<th>Name of the Topic</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Types of measurement, classification of instruments - Static terms and characteristics - Range and Span, Accuracy and Precision, Reliability, Calibration, Hysteresis and Dead zone, Drift, Sensitivity, Threshold and Resolution, Repeatability and Reproducibility, Linearity. Dynamic characteristics - Speed of response, Fidelity and Dynamic errors, overshoot. Measurement of error - Classification of errors, environmental errors, signal transmission errors, observation errors, operational errors Transducers : Classification of transducers, active and passive, resistive, inductive, capacitive, piezo-resistive, thermo resistive.</td>
<td>14</td>
</tr>
<tr>
<td>II</td>
<td><strong>Displacement Measurement</strong>: Capacitive transducer, Potentiometer, LVDT, RVDT, Specification, Selection &amp; application of displacement transducer. Optical measurement scale and encoders <strong>Pressure Measurement</strong>: Low pressure gauges- McLeod Gauge, Thermal conductivity gauge, Ionization gauge, Thermocouple vacuum gauge, Pirani gauge. High Pressure gauge-Diaphragm, Bellows, Bourdon tube, Electrical resistance type, Photoelectric pressure transducers, piezoelectric type, Variable capacitor type</td>
<td>14</td>
</tr>
</tbody>
</table>
Flow Measurements: Variable area meter - Rota meter, Variable velocity meter – Anemometer, Special flow meter - Hot wire anemometer, Electromagnetic flow meter, Ultrasonic flow meter, Turbine meter, Vortex shedding flow meter

IV Miscellaneous Measurement:
Introduction to sound measurement and study of Electro dynamic microphone and Carbon microphone.
Humidity measurement – Hair hygrometer, Sling psychrometer, Liquid level measurement – direct and indirect methods.
Force & Shaft power measurement - Tool Dynamometer (Mechanical Type), Eddy Current Dynamometer, Strain Gauge Transmission Dynamometer. Speed measurement - Eddy current generation type tachometer, incremental and absolute type, Mechanical Tachometers, Revolution counter & timer, Slipping Clutch Tachometer, Electrical Tachometers, Contact less Electrical tachometer, Inductive Pick Up, Capacitive Pick Up, Stroboscope, Strain Measurement - Stress-strain relation, types of strain gauges, strain gauge materials, resistance strain gauge- bonded and unbounded, types (foil, semiconductor, wire wound gauges), selection and installation of strain gauges load cells, rosettes.

V Control Systems:
Block diagram of automatic control system, closed loop system, open loop system, feedback control system, feed forward control system, servomotor mechanism.
Comparison of hydraulic, pneumatic, electronic control systems, Control action: Proportional, Integral, derivative, PI, PD, PID. Applications of measurements and control for setup for boilers, airconditioners, motor speed control.

Text Books:
1) Mechanical Measurements & Control-D.S.Kumar-Metropolitan Publications, New Delhi.
2) Mechanical & Industrial Measurements-R.K.Jain-Khanna Publications, New Delhi,


DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

III YEAR
VI SEMESTER

ELECTIVE THEORY - II

32082 – ROBOTICS

CURRICULUM DEVELOPMENT CENTRE
M-SCHEME  
(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING  
Course Code  : 1020  
Subject Code : 32082  
Semester     : VI  
Subject Title: ROBOTICS

TEACHING AND SCHEME OF EXAMINATIONS:

<table>
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<th>Duration</th>
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Topics and Allocation of Hours:

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<tr>
<td>I</td>
<td>FUNDAMENTALS OF ROBOT TECHNOLOGY</td>
<td>14</td>
</tr>
<tr>
<td>II</td>
<td>ROBOT CONTROLLER, DRIVE SYSTEMS AND END EFFECTERS</td>
<td>14</td>
</tr>
<tr>
<td>III</td>
<td>SENSORS AND MACHINE VISION</td>
<td>14</td>
</tr>
<tr>
<td>IV</td>
<td>ROBOT KINEMATICS AND ROBOT PROGRAMMING</td>
<td>13</td>
</tr>
<tr>
<td>V</td>
<td>ROBOT APPLICATIONS IN MANUFACTURING</td>
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<tr>
<td></td>
<td>REVISION AND TEST</td>
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</tr>
<tr>
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<td><strong>Total</strong></td>
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</table>

RATIONALE:

Rapid industrialization and globalization needs industries to be more competitive and deliver cost effective quality products. This needs industries to
OBJECTIVES:

- Understand fundamentals of robotics
- Acquire knowledge structure and elements of robot
- Gain knowledge on controller and various drives used in robotics
- Develop knowledge on role of sensors and vision system
- Acquire skill to program and control robot
- Understand to adopt robot to various industrial applications.

ROBOTICS

DETAILED SYLLABUS

Theory contents:

<table>
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<th>Unit</th>
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<tbody>
<tr>
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<td>14</td>
</tr>
<tr>
<td>II</td>
<td>ROBOT CONTROLLER, DRIVE SYSTEMS AND END EFFECTERS</td>
<td>14</td>
</tr>
</tbody>
</table>
Three fingered Grippers, Internal and External Grippers – End Of Arm Tooling (EOAT)- Selection and Design considerations.

III SENSORS AND MACHINE VISION


IV ROBOT KINEMATICS AND ROBOT PROGRAMMING


V ROBOT APPLICATIONS IN MANUFACTURING

Text Books:


Reference Books:

DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

III YEAR
VI SEMESTER

ELECTIVE THEORY - II

32083 – REFRIGERATION AND AIRCONDITIONING

CURRICULUM DEVELOPMENT CENTRE
M-SCHEME
(Implements from the Academic year 2016-2017 onwards)

Course Name : Diploma in Mechanical Engineering
Course Code : 1020
Subject Code : 32083
Semester : VI
Subject Title : Refrigeration and Air-Conditioning

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

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Topics and Allocation of Hours:

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<th>Unit</th>
<th>Topics</th>
<th>Hours</th>
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<tbody>
<tr>
<td>I</td>
<td>REFRIGERATION SYSTEM AND REFRIGERATION EQUIPMENTS</td>
<td>14</td>
</tr>
<tr>
<td>II</td>
<td>VAPOUR COMPRESSION &amp; ABSORPTION REFRIGERATION SYSTEM AND CRYOGENIC REFRIGERATION SYSTEMS</td>
<td>14</td>
</tr>
<tr>
<td>III</td>
<td>REFRIGERATION FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATIONS OF REFRIGERATION</td>
<td>14</td>
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<tr>
<td>IV</td>
<td>PSYCHOMETRICS AND COMFORT AIR CONDITIONING SYSTEMS</td>
<td>13</td>
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<tr>
<td>V</td>
<td>COOLING LOAD CALCULATIONS AND DUCT DESIGN , ENERGY CONSERVATION TECHNIQUES</td>
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<td>Total</td>
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</table>
RATIONALE:
Hence the study of refrigeration principles, system and its effectiveness are essential. Comfort is the basic requirement of customers and machines through air-conditioning and hence learning the concept of air-conditioning and methods of air-conditioning facilitates quality design of air conditioners.

OBJECTIVES:
- Explain the working of open and closed air system of refrigeration.
- Describe the working and construction of compressors used for air conditioning.
- Explain vapour compression refrigeration system.
- Explain vapour absorption refrigeration system.
- Compare the properties and applications of various refrigerants.
- Define the parameters used in psychrometry.
- Use Psychrometry chart
- Describe the equipment used for air conditioning.
- Estimate the cooling load for the given requirement.
- Explain the industrial application of refrigeration.

REFRIGERATION AND AIR-CONDITIONING
DETAILED SYLLABUS

Contents: Theory

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<th>Unit</th>
<th>Name of the Topic</th>
<th>Hours</th>
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<tbody>
<tr>
<td>I</td>
<td>REFRIGERATION SYSTEM AND REFRIGERATION EQUIPMENTS</td>
<td>14</td>
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</tbody>
</table>

Compressor – principle of working and constructional details of reciprocating and rotary compressors, hermetically and semi hermetically sealed compressors- condensers-principle of working and
constructional details of air cooled and water cooled condensers, evaporative condensers- advantages and disadvantages - natural and forced draught cooling towers.
Evaporators- natural circulation and forced circulation type – principle of working constructional details.

II VAPOUR COMPRESSION REFRIGERATION SYSTEM, VAPOUR ABSORPTION REFRIGERATION SYSTEM AND CRYOGENIC REFRIGERATION SYSTEMS


Simple absorption system – Electrolux system - solar absorption refrigeration system- absorption system comparison with mechanical refrigeration system.

Refrigerators for above 2 K- Philips Refrigerator--Giffered Mc Mohan refrigerator- refrigerators for below 2 K - Magnetic refrigeration systems.

III REFRIGERATION FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATIONS OF REFRIGERATION

Capillary tube-automatic expansion valve-thermostatic expansion valve-electronic expansion valve-solenoid valve-evaporator pressure regulator –suction pressure regulator-classification of refrigerants- selection of a refrigerant-properties and applications of following refrigerants $\text{SO}_2$, $\text{CH}_4$, $\text{F}_22$, and $\text{NH}_3$ –CFCs refrigerants- equivalent of CFCs refrigerants (R-123a,R-143a,R-69S)- blends of refrigerants(R400 and R500 Series) - lubricants used in refrigeration and their applications.

Slow freezing –quick freezing- cold storage-frozen storage-freeze drying –dairy refrigeration –ice cream cabinets-ice making – water
cooler, milk cooler, bottle cooler-frost free refrigeration.

**IV PSYCHOMETRICS AND COMFORT AIR CONDITIONING**


**V COOLING LOAD CALCULATIONS AND DUCT DESIGN, ENERGY CONSERVATION TECHNIQUES**


Classification of duct systems - Duct design – equal friction method – velocity reduction method – problems. Chilled water Systems -Air handling Units.


**Text books :**


2) Refrigeration and air conditioning, V.K. Jain,

3) Industrial Refrigeration Hand Book, Wilbert F. Steocker
Reference Books:

1) A course in refrigeration and air conditioning, Domkundwar,
2) Principles of refrigeration, Dossat,
4) Refrigeration and air conditioning, C.P Arora,
5) Cryogenic systems Randell Fd Barron.
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

III YEAR
VI SEMESTER
32064 – COMPUTER AIDED DESIGN AND MANUFACTURING PRACTICAL

CURRICULUM DEVELOPMENT CENTRE
M-Scheme
(Implements from the Academic year 2015-2016 onwards)

Course Name: DIPLOMA IN MECHANICAL ENGINEERING
Course Code: 1020
Subject Code: 32064
Semester: VI
Subject Title: COMPUTER AIDED DESIGN AND MANUFACTURING PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:
No. of Weeks per Semester: 15 Weeks

<table>
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<th>Subject</th>
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<th>Hours/Semester</th>
<th>Marks</th>
<th>Duration</th>
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<td>Computer Aided Design and Manufacturing</td>
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<td></td>
<td>25</td>
<td>75</td>
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</table>

OBJECTIVES:

- Study of parametric modeling.
- Understand the part modeling and assembly of parts.
- Create the views of the solid model and parts list.
- Study the working principle of CNC machines.
- Study the datum points and offsets.
- Differentiate incremental System with absolute system.
- Study the simulation software package.
- Write program and simulate in the Lathe software and Milling software.
- Prepare a part program, edit and execute in CNC Turning centre.
- Prepare a part program, edit and execute in CNC Machining centre.
- Produce components in the CNC Turning centre and CNC Machining centre.
PART A: Solid modeling (30 Hrs.)

Introduction

Exercises
3D Drawing
1. Geneva Wheel
2. Bearing Block
3. Bushed bearing
4. Gib and Cotter joint
5. Screw Jack
6. Connecting Rod

Note: Print the orthographic view and sectional view from the above assembled 3D drawing.

PART B: CNC Programming and Machining (45 Hrs.)

Introduction:
1. Study of CNC lathe, milling.
2. Study of international standard codes: G-Codes and M-Codes
5. Editing the program in the CNC machines.
6. Execute the program in the CNC machines.
Exercises

Note: Print the part program from the simulation software and make the component in the CNC machine.

CNC Turning Machine       Material: M.S / Aluminum / Acrylic fibre / Plastic

1. Using Linear and Circular interpolation - Create a part program and produce component in the Machine.

2. Using Stock removal cycle – Create a part program for multiple turning operations and produce component in the Machine.

3. Using canned cycle - Create a part program for thread cutting, grooving and produce component in the Machine.
**CNC Milling Machine**

**Material:** M.S / Aluminum / acrylic fibre / plastic

4. Using Linear interpolation and Circular interpolation – Create a part program for grooving and produce component in the Machine.

![Diagram of CNC Milling Machine](image1)

5. Using canned cycle - Create a part program for drilling, tapping, counter sinking and produce component in the Machine.

![Diagram of CNC Milling Machine](image2)

6. Using subprogram - Create a part program and produce component in the Machine.

![Diagram of CNC Milling Machine](image3)

**Reference:**

BOARD EXAMINATION

Note: All exercises should be completed. Two exercises should be carried out by selecting one exercise in each section. The printouts must be kept along with the examination paper.

Allocation of marks for Board Examination

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<th>PART – A: SOLID MODELING</th>
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<tr>
<td>Assembly</td>
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<table>
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<th>PART – B: CNC PROGRAMING</th>
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<td>Program editing and creation</td>
<td>15</td>
</tr>
<tr>
<td>Component manufacturing</td>
<td>10</td>
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<tr>
<td>Finish</td>
<td>10</td>
</tr>
<tr>
<td>Viva voice</td>
<td>5</td>
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</table>

Total: 75

LIST OF EQUIPMENTS

1. Personal computer - 30 Nos.
2. CNC programming software - Sufficient to the strength. (Lathe and Milling)
3. Modelling package - Sufficient to the strength. (Solid works / Pro-E / Catia / Unigraphics / Autocad etc…)
4. CNC Turning Machine - 1 No.
5. CNC Milling Machine - 1 No.
7. Consumables - Sufficient quantity.
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

III YEAR
VI SEMESTER
32065 – MACHINE TOOL TESTING AND MAINTENANCE PRACTICAL

CURRICULUM DEVELOPMENT CENTRE
M-Scheme
(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING
Course Code : 1020
Subject Code : 32065
Semester : VI
Subject Title : MACHINE TOOL TESTING AND MAINTENANCE PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

<table>
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<tr>
<th>Subject</th>
<th>Instructions</th>
<th>Examination</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine Tool Testing and</td>
<td>Hours/Week: 4</td>
<td>Internal Assessment: 25</td>
<td>3 Hrs</td>
</tr>
<tr>
<td>Maintenance Practical</td>
<td>Hours/Semester: 60</td>
<td>Board Examination: 75</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total: 100</td>
<td></td>
</tr>
</tbody>
</table>

OBJECTIVES:

2. Set up instrument for machine tool testing.
3. Observe the machine tool alignment and results.
4. Observe the manufacturing accuracy of machine tools.
5. Study the maintenance of the machine components.
6. Study the trouble shooting procedures and methods.
7. Prepare the record of work for all the exercises.

MACHINE TOOL TESTING

- Conduct geometrical test on machines with permissible deviations.
- Study the testing instruments and calibration to the standards.
- Prepare a test chart for the various tests and mention the errors.
Part A: Machine Tool Alignment

EXERCISES

1. Conduct the following test for the lathe machine and prepare a test chart.
   - Check the level of slideways.
   - Check the straightness of carriage movement.
   - Check the parallelism of tailstock movement to carriage movements.
   - Check the run-out of the spindle.
   - Check the parallelism of the axis of the outside of tailstock sleeve to carriage movement.

2. Conduct the following test for the shaping machine and prepare a test chart.
   - Check the flatness of table top face.
   - Check the parallelism of table top face to its transverse movement.
   - Check the parallelism of table top face to the ram movement.
   - Check the parallelism of T-slot of top face to the ram movement.
   - Check the squareness of table side face to its transverse movement.

3. Conduct the following test for the drilling machine and prepare a test chart.
   - Check the level of the machine.
   - Check the flatness of the table surface.
   - Check the run-out of the internal taper of the spindle.
   - Check the straightness of the pillar and squareness of the spindle axis.
   - Check the squareness of the table surface to the vertical movement of the spindle housing

4. Conduct the following test for the surface grinding machine and prepare a test chart.
   - Verify the levelling of slideways.
   - Verify the straightness of slideways in a horizontal plane.
   - Verify the flatness of the table surface.
   - Verify the parallelism of the table surface.
   - Check the run-out of the wheel spindle nose.

5. Conduct the following test for the milling machine and prepare a test chart.
   - Check the straightness of the vertical movement of the knee.
   - Check the squareness of the table surface to the column ways for knee.
   - Check the flatness of the table surface.
   - Check the parallelism of the table surface to its movement.
   - Check the run-out of the internal taper of the spindle.
6. Conduct the following test for the slotting machine and prepare a test chart.
   - Check the flatness of the table top face.
   - Check the run-out of the central locating bore.
   - Check the parallelism of table surface to its movement in longitudinal direction.
   - Check the squareness of the longitudinal and transverse movements of table.
   - Check the squareness of ram movement to the table surface in the transverse direction.

**Part B: Maintenance**
Dismantle, inspect and assemble the following machine components.
   1. Lead screw and nut
   2. Tailstock
   3. Bench vice
   4. Three jaw chuck
   5. Four jaw chuck
   6. Drill chuck

**BOARD EXAMINATION**

Note: Examinations will be conducted in both Part A and Part B. Students should be given exercises by selecting one exercise from each part by lot.

All the exercises should be given in the question paper and students are allowed to select by a lot.

<table>
<thead>
<tr>
<th>Machine Tool Alignment</th>
<th>45</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedure / Drawing</td>
<td>15</td>
</tr>
<tr>
<td>Geometrical test</td>
<td>20</td>
</tr>
<tr>
<td>Result &amp; Test Chart</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maintenance</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dismantling</td>
<td>10</td>
</tr>
<tr>
<td>Trouble shooting procedure</td>
<td>10</td>
</tr>
<tr>
<td>Assembling / Report</td>
<td>5</td>
</tr>
</tbody>
</table>

| Viva-voce              | 5  |
| TOTAL                  | 75 |
LIST OF EQUIPMENTS

**Machine**
1. Lathe machine - 1 No.
2. Shaping machine - 1 No.
3. Drilling machine - 1 No.
4. Surface grinding machine - 1 No.
5. Milling machine - 1 No.

**Tools**
7. Dial gauge - 5 Nos.
8. Magnetic stand - 5 Nos.
9. Surface gauges - 5 Nos.
10. Spirit level - 5 Nos.
11. Spanners (DE/Ring/Box) - Sufficient quantity
12. Screw drivers - Sufficient quantity
13. Allen screw sets - Sufficient quantity
14. Hammer - Sufficient quantity
15. Test mandrels - Sufficient quantity
16. Squares / Blocks - Sufficient quantity

**Machine components**
17. Lead screw and nut - 1 No.
18. Tailstock - 1 No.
20. Three jaw chuck - 1 No.
21. Four jaw chuck - 1 No.
22. Drill chuck - 1 No.
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

III YEAR
VI SEMESTER
ELECTIVE PRACTICAL - II
32084 – MECHANICAL INSTRUMENTATION PRACTICAL

CURRICULUM DEVELOPMENT CENTRE
M-SCHEME
(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING
Course Code : 1020
Subject Code : 32084
Semester : VI
Subject Title : MECHANICAL INSTRUMENTATION PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:
No. of Weeks per Semester: 15 Weeks

<table>
<thead>
<tr>
<th>Subject</th>
<th>Instructions</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours/ Week</td>
<td>Hours/ Semester</td>
</tr>
<tr>
<td>Mechanical Instrumentation Practical</td>
<td>4</td>
<td>60</td>
</tr>
<tr>
<td></td>
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</tbody>
</table>

OBJECTIVES:
- Handle various instruments
- Analyze the result of calibration of thermister
- Interpret calibration curve of a rotameter
- Evaluate the stress induced in a strain gauge
- Test and calibration of a thermocouple
- Draw the calibration curves of rotameter and thermister
- Measure various parameters using instruments
- Study of control system with the help of suitable practical application by arranging
- Know the measurement and control laboratory and study the specifications of measuring Instruments/devices.
EXERCISES

1. Find the static characteristics of instruments with demonstration of any one measuring instrument.
2. Measure displacement by using inductive transducer. (Linear variable displacement transducer i.e. LVDT) and verify its characteristics.
3. Measure negative pressure or vacuum using McLeod gauge / Bourdon tube pressure gauge.
4. Measure temperature by thermocouple and verifying by thermometer.
5. Measure flow of liquid by rotameter.
6. Measure liquid level by capacitive transducer system.
7. Measure speed of rotating shaft by stroboscope / magnetic / inductive pick up.
8. Measure force or weight by load cell.
9. Measure strain by using basic strain gauge and verify the stress induced.

BOARD EXAMINATION

Duration: 3hrs       Max marks: 75

All the exercises should be given and students are allowed to select an exercise by lot.

ALLOCATION OF MARKS

Block Diagram       15
Reading and graph   35
Execution of circuit 20
Viva voce          5

TOTAL       75
LIST OF EQUIPMENTS

1. Thermometer  2 nos
2. Temperature gauge / Temperature transducer  2 nos
3. Pressure measuring setup using
   McLeod gauge / Bourdon tube pressure gauge.  2 no
4. Strain measurement module using Strain gauge  2 nos
5. Displacement measurement module using LVDT  2 nos
6. 3 wire RTD (PT-50 / PT-100) with industrial standard  2 nos
7. Thermocouple (J-type / K-type) with industrial standard  2 nos
8. Water bath with heater arrangement  3 nos
9. Furnace with blower arrangement  1 no
10. Load cell instruments and measurement setup  2 nos
11. Torsion meter/strain gauge torque transducers  2 nos
12. Capacitance transducers, water level trainer kit  2 nos
13. Multi meter  2 nos
14. DC Motor, photoelectric pick up kit, CRO connecting  2 nos
15. Stroboscope  2 nos
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

III YEAR
VI SEMESTER
ELECTIVE PRACTICAL - II
32085 – ROBOTICS PRACTICAL

CURRICULUM DEVELOPMENT CENTRE
M-Scheme
(Implements from the Academic year 2015-2016 onwards)

Course Name: DIPLOMA IN MECHANICAL ENGINEERING
Course Code: 1020
Subject Code: 32085
Semester: VI
Subject Title: ROBOTICS PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:
No. of Weeks per Semester: 15 Weeks

<table>
<thead>
<tr>
<th>Subject</th>
<th>Instructions</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours/Week</td>
<td>Hours/Semester</td>
</tr>
<tr>
<td>Robotics Practical</td>
<td>4</td>
<td>60</td>
</tr>
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</tbody>
</table>

Objectives
- Study of Robot / Study of robot simulation software
- To study the components required.
- To study the techniques of programming
- Study of machine vision system
- Prepare a record of work done.

Exercises
1. Position recording using Cartesian co-ordinate system - (No. of positions to be specified - 9)
2. Position recording using Polar co-ordinate system - (No. of positions to be specified - 9)
3. Pick and place the objects - No. of objects to be specified - 6)
4. Pick and stack the objects - (No. of objects to be specified - 6)
5. Spray painting practice - (Area to be specified - 300mm x 300mm)
6. Spot welding practice - (No. of spots to be specified - 9)
7. Arc welding practice – (Length of weld to be specified)
8. Assembling practice - (Simple assembling)
9. Profile cutting practice - (Complicated profile – combination of lines and arcs)
10. Machine loading and unloading practice with time delay - (No. of times to be specified- 9)

BOARD EXAMINATIONS

Duration: 3hrs                                           Max marks: 75

All the exercises should be given and students are allowed to select an exercise by lot.

Allocation Marks

<table>
<thead>
<tr>
<th></th>
<th>Marks</th>
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</thead>
<tbody>
<tr>
<td>Procedure / Algorithm</td>
<td>15</td>
</tr>
<tr>
<td>Create and edit the program</td>
<td>25</td>
</tr>
<tr>
<td>Execution</td>
<td>20</td>
</tr>
<tr>
<td>Result / Finish</td>
<td>10</td>
</tr>
<tr>
<td>Viva-Voce</td>
<td>05</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>75</strong></td>
</tr>
</tbody>
</table>

LIST OF EQUIPMENTS

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer with Accessories</td>
<td>15 Nos.</td>
</tr>
<tr>
<td>Compatible Software</td>
<td>Sufficient quantity</td>
</tr>
<tr>
<td>Hardware</td>
<td>6 Axis Robot / Separate device for the individual task. Teach Pendant control or PC based control through Software.</td>
</tr>
</tbody>
</table>
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

III YEAR
VI SEMESTER
ELECTIVE PRACTICAL - II

32086 – REFRIGERATION AND AIRCONDITIONING PRACTICAL

CURRICULUM DEVELOPMENT CENTRE
M-SCHEME  
(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING  
Course Code : 1020  
Subject Code : 32086  
Semester : VI  
Subject Title : Refrigeration and Air-Conditioning Practical

TEACHING AND SCHEME OF EXAMINATIONS:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Instructions</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours/ Week</td>
<td>Hours/ Semester</td>
</tr>
<tr>
<td>Refrigeration and Air-Conditioning</td>
<td>4</td>
<td>60</td>
</tr>
<tr>
<td>Practical</td>
<td></td>
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</tbody>
</table>

OBJECTIVES:

- Identify the various tools used in R & AC
- Demonstrate the construction and working of window air conditioner
- Demonstrate the construction and working of split type air conditioner
- Set parameters for comfortable operation of an air conditioner.
- Determine the C.O.P of air conditioner.
- Determine the capacity of window air conditioner.
- Describe the wiring of refrigerator and coolers.
- Perform servicing on air conditioner.

PART- A

1. BASIC REFRIGERATION WORKSHOP OPERATION

(a) Copper and steel tubing
   - To study the various sizes of copper and steel tubing.
   - To study the various tools used for operations.
   - To become familiar with various operations on copper and steel tubing—Flaring, Swaging.

(b) Soldering methods used in R & A.C
2. TO STUDY THE CONSTRUCTION FEATURES OF THE FOLLOWING:
   (a) Domestic refrigerators  (b) Water coolers (c) Window Air Conditioner
   (d) Split Type Air-Conditioner
3. PROPER METHODS OF SETTING AND ADJUSTING OF
   (a) Thermostats
   (b) Low pressure and high pressure cut-outs
   (c) Thermostatic expansion valve
   (d) Automatic Expansion Valve

PART-B

TEST PROCEDURES
1. To determine the refrigerating effect, C.O.P and the compressor capacity of a
   open type system with Thermostatic expansion valve, Capillary tube, Automatic
   Expansion Valve
2. To determine the C.O.P of sealed system by using electrical measurements
   To determine the capacity of a window air conditioner.
   To determine the efficiency of a cooling tower.
   Wiring of refrigerator, water cooler, desert cooler, room air conditioner –packaged
   air conditioner, panel board etc.

SERVICE PROCEDURES
1. To change refrigerant into service cylinder from storage cylinder.
2. To evaluate the entire system
3. To Pump down the system
4. To Purge air from the system
5. To locate the leaks in a system.
6. To charge the system
7. To check the oil level in the compressor.
8. Tracing the common faults in R& A.C units and their remedies.

BOARD EXAMINATION
1. One Question from Part A : 25 Marks
2. One Question from Part B : 45 Marks
3. Viva voice : 5 Marks
   Total : 75 Marks
LIST OF EQUIPMENTS

WORKING MODELS OF THE FOLLOWING WITH ARRANGEMENTS FOR CONDUCTING TESTS
1. Refrigerator with test rig
2. Water cooler
3. Window A/C with test rig
4. Split A/C
5. Cooling tower

WORKING MODEL OF THE FOLLOWING TO CONDUCT EXPERIMENTS
1. Thermostat units
2. Cut off units
3. Thermostatic expansion valve unit
4. Automatic expansion valve unit
5. Sealed compressor with experimental setup

TOOLS:
1. Mechanics tool set
2. Tube cutter
3. Tube bender type
4. Tube bender spring
5. Swaging tool
6. Flaring block
7. Flaring nut
8. Pinching tool
9. Capillary tube testing gauge
10. Blow Lamp

SERVICE TOOLS:
1. Gas cylinder with receiver valve and key
2. Charging System
3. Blow lamp
4. Stem key
5. Spring remover
6. Service valve
7. ‘t’ connector
8. High pressure gauge
9. Compound gauge
10. Leak detector
11. Soldering and Brazing kit.
DIRECTORATE OF TECHNICAL EDUCATION
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
2015 -2016 onwards

III YEAR
VI SEMESTER

32067 – PROJECT WORK

CURRICULUM DEVELOPMENT CENTRE
M-SCHEME
(Implements from the Academic year 2015-2016 onwards)

Course Name: DIPLOMA IN MECHANICAL ENGINEERING
Course Code: 1020
Subject Code: 32067
Semester: VI
Subject Title: Project Work

TEACHING AND SCHEME OF EXAMINATIONS:
No. of Weeks per Semester: 15 Weeks

<table>
<thead>
<tr>
<th>Subject</th>
<th>Instruction</th>
<th>Examination</th>
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<tbody>
<tr>
<td></td>
<td>Hours/ Week</td>
<td>Hours/ Semester</td>
</tr>
<tr>
<td>PROJECT WORK</td>
<td>4</td>
<td>60</td>
</tr>
</tbody>
</table>

Minimum Marks for Pass is 50 out of which minimum 35 marks should be obtained out of 75 marks in the board Examination alone.

OBJECTIVES:

- Implement the theoretical and practical knowledge gained through the curriculum into an application suitable for a real practical working environment preferably in an industrial environment.
- Get exposure on industrial environment and its work ethics.
- Understand what entrepreneurship is and how to become an entrepreneur.
- Learn and understand the gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.
- Carry out cooperative learning through synchronous guided discussions within the class in key dates, asynchronous document sharing and discussions, as well as to prepare collaborative edition of the final project report.
- Understand the facts and importance of environmental management.
- Understand and gain knowledge about disaster management.
INTERNAL ASSESSMENT:
The internal assessment should be calculated based on the review of the progress of the work done by the student periodically as follows.

<table>
<thead>
<tr>
<th>Detail of assessment</th>
<th>Period of assessment</th>
<th>Max. Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Review</td>
<td>6th week</td>
<td>10</td>
</tr>
<tr>
<td>Second Review</td>
<td>12th week</td>
<td>10</td>
</tr>
<tr>
<td>Attendance</td>
<td>Entire semester</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>25</strong></td>
</tr>
</tbody>
</table>

EVALUATION FOR BOARD EXAMINATION:

<table>
<thead>
<tr>
<th>Details of Mark allocation</th>
<th>Max Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marks for Report Preparation, Demo, Viva-voce</td>
<td>65</td>
</tr>
<tr>
<td>Marks for answers of 4 questions which is to be set by the external examiner from the given question bank consisting of questions in the following two topics Disaster Management and Environmental Management. Out of four questions two questions to appear from each of the above topics i.e. 2 questions x 2 topics = 4 questions 4 questions x 2 ½ marks = 10 Marks</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>75</strong></td>
</tr>
</tbody>
</table>

DETAILED SYLLABUS
ENVIRONMENTAL & DISASTER MANAGEMENT

1. ENVIRONMENTAL MANAGEMENT

Introduction – Environmental Ethics – Assessment of Socio Economic Impact – Environmental Audit – Mitigation of adverse impact on Environment – Importance of Pollution Control – Types of Industries and Industrial Pollution.
Solid waste management – Characteristics of Industrial wastes – Methods of Collection, transfer and disposal of solid wastes – Converting waste to energy – Hazardous waste management Treatment technologies.

Waste water management – Characteristics of Industrial effluents – Treatment and disposal methods – Pollution of water sources and effects on human health.

Air pollution management – Sources and effects – Dispersion of air pollutants – Air pollution control methods – Air quality management.

Noise pollution management – Effects of noise on people – Noise control methods.

2. DISASTER MANAGEMENT

Introduction – Disasters due to natural calamities such as Earthquake, Rain, Flood, Hurricane, Cyclones etc – Man made Disasters – Crisis due to fires, accidents, strikes etc – Loss of property and life..


LIST OF QUESTIONS

1. ENVIRONMENTAL MANAGEMENT

1. What is the responsibility of an Engineer-in-charge of an Industry with respect to Public Health?

2. Define Environmental Ethic.

3. How Industries play their role in polluting the environment?

4. What is the necessity of pollution control? What are all the different organizations you know, which deal with pollution control?

5. List out the different types of pollutions caused by a Chemical / Textile / Leather / Automobile / Cement factory.

6. What is meant by Hazardous waste?

7. Define Industrial waste management.

8. Differentiate between garbage, rubbish, refuse and trash based on their composition and source.
9. Explain briefly how the quantity of solid waste generated in an industry could be reduced.

10. What are the objectives of treatments of solid wastes before disposal?

11. What are the different methods of disposal of solid wastes?

12. Explain how the principle of recycling could be applied in the process of waste minimization.

13. Define the term ‘Environmental Waste Audit’.

14. List and discuss the factors pertinent to the selection of landfill site.

15. Explain the purpose of daily cover in a sanitary landfill and state the minimum desirable depth of daily cover.


17. What actions, a local body such as a municipality could take when the agency appointed for collecting and disposing the solid wastes fails to do the work continuously for number of days?

18. Write a note on Characteristics of hazardous waste.

19. What is the difference between municipal and industrial effluent?

20. List few of the undesirable parameters / pollutants anticipated in the effluents from oil refinery industry / thermal power plants / textile industries / woolen mills / dye industries / electroplating industries / cement plants / leather industries (any two may be asked)

21. Explain briefly the process of Equalization and Neutralization of waste water of varying characteristics discharged from an Industry.

22. Explain briefly the Physical treatments “Sedimentation” and “Floatation” processes in the waste water treatment.

23. Explain briefly when and how chemical / biological treatments are given to the waste water.

24. List the four common advanced waste water treatment processes and the pollutants they remove.

25. Describe refractory organics and the method used to remove them from the effluent.

26. Explain biological nitrification and de-nitrification.

27. Describe the basic approaches to land treatment of Industrial Effluent.

28. Describe the locations for the ultimate disposal of sludge and the treatment steps needed prior to ultimate disposal.

29. List any five Industries, which act as the major sources for Hazardous Air Pollutants.

30. List out the names of any three hazardous air pollutants and their effects on human health.

31. Explain the influence of moisture, temperature and sunlight on the severity of air pollution effects on materials.

32. Differentiate between acute and chronic health effects from Air pollution.

33. Define the term Acid rain and explain how it occurs.

34. Discuss briefly the causes for global warming and its consequences.
35. Suggest suitable Air pollution control devices for a few pollutants and sources.
36. Explain how evaporative emissions and exhaust emissions are commonly controlled.
37. What are the harmful elements present in the automobile smokes? How their presence could be controlled?
38. What is the Advantage of Ozone layer in the atmosphere? State few reasons for its destruction.
39. Explain the mechanism by which hearing damage occurs.
40. List any five effects of noise other than hearing damage.
41. Explain why impulsive noise is more dangerous than steady state noise.
42. Explain briefly the Source – Path – Receiver concept of Noise control.
43. Where silencers or mufflers are used? Explain how they reduce the noise.
44. Describe two techniques to protect the receiver from hearing loss when design / redress for noise control fail.
45. What are the problems faced by the people residing along the side of a railway track and near to an Airport? What provisions could be made in their houses to reduce the problem?

2. DISASTER MANAGEMENT

1. What is meant by Disaster Management? What are the different stages of Disaster management?
2. Differentiate Natural Disasters and Man made Disasters with examples.
3. Describe the necessity of Risk identification and Assessment Surveys while planning a project.
4. What is Disasters recovery and what does it mean to an Industry?
5. What are the factors to be considered while planning the rebuilding works after a major disaster due to flood / cyclone / earthquake? (Any one may be asked)
6. List out the public emergency services available in the state, which could be approached for help during a natural disaster.
7. Specify the role played by an Engineer in the process of Disaster management.
8. What is the cause for Earthquakes? How they are measured? Which parts of India are more vulnerable for frequent earthquakes?
9. What was the cause for the Tsunami 2004 which inflicted heavy loss to life and property along the coast of Tamilnadu? Specify its epicenter and magnitude.
10. Specify the Earthquake Hazard Zones in which the following towns of Tamilnadu lie: (a) Chennai (b) Nagapattinam (c) Coimbatore (d) Madurai (e) Salem.
11. Which parts of India are experiencing frequent natural calamities such as (a) heavy rain fall (b) huge losses due to floods (c) severe cyclones
12. Define basic wind speed. What will be the peak wind speed in (a) Very high damage risk zone – A, (b) High damage risk zone, (c) Low damage risk zone.
13. Specify the minimum distance from the Sea shore and minimum height above the mean sea level, desirable for the location of buildings.

14. Explain how the topography of the site plays a role in the disasters caused by floods and cyclones.

15. Explain how the shape and orientation of buildings could reduce the damages due to cyclones.

16. What is a cyclone shelter? When and where it is provided? What are its requirements?

17. What Precautionary measures have to be taken by the authorities before opening a dam for discharging the excess water into a canal/river?

18. What are the causes for fire accidents? Specify the remedial measures to be taken in buildings to avoid fire accidents.

19. What is a fire escape in multistoried buildings? What are its requirements?

20. How the imamates of a multistory building are to be evacuated in the event of a fire/Chemical spill/Toxic Air Situation/Terrorist attack, (any one may be asked).

21. Describe different fire fighting arrangements to be provided in an Industry.

22. Explain the necessity of disaster warning systems in Industries.

23. Explain how rescue operations have to be carried out in the case of collapse of buildings due to earthquake/blast/Cyclone/flood.

24. What are the necessary steps to be taken to avoid dangerous epidemics after a flood disaster?

25. What relief works have to be carried out to save the lives of workers when the factory area is suddenly affected by a dangerous gas leak/sudden flooding?

26. What are the difficulties faced by an Industry when there is a sudden power failure? How such a situation could be managed?

27. What are the difficulties faced by the Management when there is a group clash between the workers? How such a situation could be managed?

28. What will be the problems faced by the management of an Industry when a worker dies because of the failure of a mechanical device due to poor maintenance? How to manage such a situation?

29. What precautionary measures have to be taken to avoid accidents to labourers in the Industry in a workshop/during handling of dangerous Chemicals/during construction of buildings/during the building maintenance works.

30. Explain the necessity of medical care facilities in an Industry/Project site.

31. Explain the necessity of proper training to the employees of Industries dealing with hazardous products, to act during disasters.

32. What type of disaster is expected in coal mines, cotton mills, Oil refineries, ship yards and gas plants?

33. What is meant by Emergency Plan Rehearsal? What are the advantages of such Rehearsals?

34. What action you will take when your employees could not reach the factory site because of continuous strike by Public Transport workers?
35. What immediate actions you will initiate when the quarters of your factory workers are suddenly flooded due to the breach in a nearly lake / dam, during heavy rain?

36. What steps you will take to avoid a break down when the workers union of your Industry have given a strike notice?

37. List out few possible crisis in an organization caused by its workers? What could be the part of the middle level officials in managing such crisis?

38. What types of warning systems are available to alert the people in the case of predicted disasters, such as floods, cyclone etc.

39. Explain the necessity of Team work in the crisis management in an Industry / Local body.

40. What factors are to be considered while fixing compensation to the workers in the case of severe accidents causing disability / death to them?

41. Explain the legal / financial problems the management has to face if safely measures taken by them are found to be in adequate.

42. Describe the importance of insurance to men and machinery of an Industry dealing with dangerous jobs.

43. What precautions have to be taken while storing explosives in a match/ fire crackers factory?

44. What are the arrangements required for emergency rescue works in the case of Atomic Power Plants?

45. Why residential quarters are not constructed nearer to Atomic Power Plants?

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1. Introduction

The main objective of the sandwich Diploma course is to mould a well rounded technician acclimated with industrial environment while being a student in the institution.

The Sandwich Diploma Course study is pursued by students, in 7 Semesters of 3 ½ years duration, the subjects of 3 years-Full Time Diploma Course being regrouped for academic convenience.

While in the 4th semester students under Industrial Training for 6 months (December through May). They also do course work in the institution for one day in a week, While in the 7th semester they undergo another spell of 6 months (June through November) Industrial training.

The Apprenticeship (Amendment) Act 1973 is followed in regulating the Industrial training procedure for Sandwich Course.

2. Attendance Certification

Every month students have to get their attendance certified by industrial supervisor in the prescribed form supplied to them. Students have also to put their signature on the form and submit it to the institution supervisor. Regularity in attendance and submission of report will be duly considered while awarding the Internal Assessment mark.

3. Training Reports

The students have to prepare two types of reports:

- Weekly report in the form of diary to be submitted to the concerned staff in-charge of the institution. This will be reviewed while awarding Internal Assessment marks.

- Comprehensive report at the end of each spell which will be used for Board Examination.

3.1 Industrial Training Diary

Students are required to maintain the record of day-to-day work done. Such record is called Industrial training Diary. Students have to write this report regularly. All days for the week should be accounted for clearly giving attendance particulars (Presence, absence, Leave,
Holidays etc). The concern Industrial supervisor is to check periodically these progress reports.

3.2 Comprehensive Training Report

In addition to the diary, students are required to submit a comprehensive report on training with details of the organisation where the training was undergone after attestation by the supervisors. The comprehensive report should be incorporating study of plant/product/process/construction along with intensive in-depth study on any one of the topics such as processes, methods, tooling, construction and equipment, highlighting aspects of quality, productivity and system. The comprehensive report should be completed in the last week of Industrial training. Any data, drawings etc should be incorporated with the consent of the Organisation.

a. Scheme of Evaluation

1.1 Internal Assessment Marks

First Review (during 3\textsuperscript{rd} month) : 10 marks
Second Review (during 5\textsuperscript{th} month) : 10 marks
Attendance * : 05 marks (Awarded same as in Theory)
Total : 25 marks

1.2 Board Examination

Presentation about Industrial Training : 20 marks
Comprehensive Training Report : 30 marks
Viva-voce : 25 marks
Total : 75 marks

* For awarding marks to attendance, the Industrial Training attendance has to be considered.