Scheme effective from 2020-21
### INDIRA GANDHI UNIVERSITY, MEERPUR REWARI
### SCHEME OF STUDIES AND EXAMINATION
### M.TECH 2nd YEAR (MECHANICAL ENGINEERING)
### SEMESTER 3rd

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course No.</th>
<th>Subject</th>
<th>Teaching Schedule</th>
<th>Examination Schedule (Marks)</th>
<th>Duration of Exam (Hours)</th>
<th>No of hours/week</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MTME231</td>
<td>Tribology &amp; Maintenance Engineering</td>
<td>L:4 T:0 P:4</td>
<td>Marks of Class works:50 Theory:100 Practical:-</td>
<td>3</td>
<td>4</td>
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<tr>
<td></td>
<td>MTME232</td>
<td>Robotics and Automation</td>
<td>L:4 T:0 P:4</td>
<td>Marks of Class works:50 Theory:100 Practical:-</td>
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<td>4</td>
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<tr>
<td></td>
<td>MTME233</td>
<td>Major Project (Dissertation Stage 1)</td>
<td>-</td>
<td>Marks of Class works:100 Practical:- Total:100</td>
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<tr>
<td></td>
<td>MTME234</td>
<td>Tribology &amp; Maintenance Engineering Lab</td>
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<td>Marks of Class works:50 Practical:- Total:100</td>
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<td></td>
<td>MTME235</td>
<td>Open Elective</td>
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<td>6</td>
<td>MTME235</td>
<td>Self Study Paper</td>
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<td>TOTAL</td>
<td></td>
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**NOTE:** Examiner will set nine questions in total. Question One will be compulsory and will comprise of all sections and remaining eight questions to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

**OPEN ELECTIVE**
A candidate has to select this paper from the pool of open electives provided by the University.
## Scheme of Studies and Examination

**M.TECH 2nd Year (Mechanical Engineering)**

**Semester 4th**

CBCS Scheme effective from 2018-19

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course No.</th>
<th>Subject</th>
<th>Teaching Schedule</th>
<th>Examination Schedule (Marks)</th>
<th>No of Credits</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>MTME241</td>
<td>Major Project (Dissertation Stage 2)</td>
<td>L T P Total</td>
<td>Marks of Class works Theory Practical Total</td>
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<td>1.</td>
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<td>- - - - 250</td>
<td>- 500</td>
<td>750</td>
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<td>20</td>
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**Total**

|         |             |         | - - - - 250        | 500                          | 750          |

**NOTE:**

1. Students have to publish a research paper in a UGC-CARE journal/International Conference of the research work done in the semester.
2. Students will have to submit a soft copy of their thesis with the hard copies.
3. Students have to submit a plagiarism report with the thesis report obtained from Turnitin software. This software is available in IGU Library. Upto 25% of similarity of matter is permitted.
MTME231 TRIBOLOGY & MAINTENANCE ENGINEERING

L T P CREDIT
4 0 0 4
Marks
THEORY :100 Marks
TOTAL :150 Marks
SESSIONAL:50
DURATION OF EXAM. :3 Hrs.

UNIT-1
Engineering Tribology
Tribological system, Tribology in industries, friction and wear, lubricants and lubrication, fundamental of bearings, nano Tribology ,Introduction part of friction, theories of friction, adhesion theory of friction and its drawbacks, stick-slip theory of friction, friction measurement methods.

UNIT-2
Wear, lubricants and bearings
Cause, effect, classification and mechanism of wear, quantitative laws of wear, wear and wear rate, objective and properties of lubricants, synthetic lubricants, reasons of degradation of lubricating oils ,lubricant additives, boundary lubrication, hydrodynamic lubrication, mechanism of elasto hydrodynamic lubrication, classification of bearings, hydrostatic bearings, hydrodynamic bearings

UNIT-3
Maintenance Management
Relevance of maintenance, maintenance: an over view, maintenance services, problems of the plant manager, automation and maintenance, maintenance objectives and costs, quality and quality circle in maintenance, Engineering reliability, maintainability Maintenance Types/systems
Planned and unplanned maintenance, breakdown, corrective, opportunistic, routine, preventive, predictive, CBM, Design out maintenance

UNIT-4
Condition monitoring
NDT concepts, visual and temperature monitoring, leakage monitoring, vibration monitoring, lubricant monitoring-methods, equipments, ferrography, spectroscopy, cracks monitoring, thickness monitoring, corrosion monitoring.

Books:
1. Engineering Tribology by Choudhary
2. Maintenance planning and control- Kelly, A. Buttersworth & Co. 1984
List of Experiments.

1. To study the introduction to maintenance techniques, preventive and predictive Maintenance.
2. To study and perform Non-Destructive Testing techniques, liquid dye penetrant and leak testing.
3. To study and perform Eddy current testing & Ultrasonic testing.
4. To study and perform Magnetic particle detection and Particle counter.
5. To study wear Analysis through thermography and Ferrography.
6. To study and perform Pin on wear disc apparatus.
7. To study wear, lubricants and bearings.
8. To study and perform on Journal bearing apparatus, hydro dynamic and hydrostatic bearing apparatus.
UNIT-1
Introduction to Robot Technology: Robot Physical configuration, basic Robot motions.
Types of Manipulators: Constructional features, advantages and disadvantages of various kinematic structures, servo and Non-servo manipulator. Actuators and Transmission System: Pneumatic, Hydraulic and Electrical actuators and their characteristics and Control systems. Feed Back Systems and Sensors: Encoders and other feed back systems, vision, ranging systems, textile sensors.

UNIT-2
Programming Languages: Description of VAN, RAI and other Languages. Artificial Intelligence: Logged Locomotion, Export system. Concept of spatial description and transformations, manipulator Kinematics; Inverse manipulator, Kinematics Jacobians; velocities and static forces; manipulator dynamics, position control of manipulators, force control of manipulators, robot programming languages and systems. Concept of automation in Industry, mechanization and automation classification of automation systems.

UNIT-3
Air Cylinders- their design and mountings, pneumatic and hydraulic valves, flow control valves metering valves, direction control valves, hydraulic servo systems, pneumatic safety and remote control circuits.

UNIT-4

Books:
2. Robot Manipulators by Paul MIT Press. Robotics by Hall & Hall.
3. Robot Motion by Brady MIT Press.
MTME233 MAJOR PROJECT  
(DISSERTATION STAGE-1)

| Marks | Credits | 4 |

L T P Sessional Exam : 100

4

A candidate has to prepare a report covering identification of research topic, literature review, planning of research scheme and systematic documentation. The marks will be given on the basis of a report prepared and presentation given by the candidate covering the above said contents, contents of the presentation, communication and presentation skills.