

**DEPARTMENT OF PRODUCTION ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI-620015**

| COURSE OUTLINE | | | |
|---|------------------------|-------------------------------------|--------------------|
| Course Title | TRIBOLOGY | | |
| Course Code | PR 624 | No. of Credits | 03 |
| Department | Production Engineering | Faculty | Dr. M. DURAISELVAM |
| Pre-requisites Course Code | -NIL- | | |
| Course Coordinator(s) (if, applicable) | — | | |
| Other-Course Teacher(s)/Tutor(s) E-mail | | Research Scholar/ Temporary Faculty | |
| Contact No. | | Contact No. | |
| Course Type | Elective course | | |
| Course Overview | | | |
| <ul style="list-style-type: none"> • A broad understanding of the interdisciplinary subject 'Tribology' and its technological significance • Gaining theoretical and practical knowledge about friction, wear and lubrication processes on the macro- and microscopic scale that takes place in mechanical engineering systems • Materials and lubricant selection from the point of minimization and elimination of losses resulting from friction and wear | | | |
| Course Objectives | | | |
| <ul style="list-style-type: none"> • To describe the nature of engineering surfaces, their topography and learn about surface characterisation techniques • To understand the surface phenomena related to relative motion, the nature of friction, and mechanisms of wear • To understand the genesis of friction, the theories/laws of sliding and rolling friction • To learn about consequences of wear, wear mechanisms and wear theories • To explain the principles of lubrication, lubrication regimes, theories of hydrodynamic, elastohydrodynamic and mixed/ boundary lubrication • To gain knowledge on emerging areas such as micro/nano tribology | | | |
| Course Outcomes | | | |
| <ul style="list-style-type: none"> • Exploring the design of tribological surfaces and troubleshoot problems • Ability to identify the type of friction, wear and its effects • Ability to select a suitable lubricant based on the application | | | |

| COURSE TEACHING AND LEARNING ACTIVITIES | | | | |
|---|-----------------------------------|------|---|------------------|
| S. No. | Week | Date | Topic | Mode of delivery |
| UNIT I - INTRODUCTION TO TRIBOLOGY | | | | |
| 1. | 1 st Week | | Introduction to Tribology | Lecture C&T/PPT |
| 2. | 1 st Week | | Industrial significance of tribology | |
| 3. | 1 st Week | | Strength and deformation properties of solids | |
| 4. | 2 nd Week | | Physio- chemical characteristics of solid surfaces | |
| 5. | 2 nd Week | | Fracture and mode of fracture | |
| 6. | 2 nd Week | | Ductile and brittle fracture | |
| 7. | 3 rd Week | | Analysis of surface roughness | |
| 8. | 3 rd Week | | Surface measurement | |
| UNIT II – FRICTION | | | | |
| 9. | 3 rd Week | | Friction and classification | Lecture C&T/PPT |
| 10. | 4 th Week | | Adhesion theory of friction | |
| 11. | 4 th Week | | Elastic, plastic and visco theory of friction | |
| 12. | 4 th Week | | Elastic effects in friction | |
| 13. | 5 th Week | | Sliding and rolling friction | |
| 14. | 5 th Week | | Friction of materials alloys, ceramics and polymers | |
| 15. | 5 th Week | | Interface temperature of sliding surfaces | |
| 16. | 6 th Week | | Measurement of friction | |
| UNIT- III WEAR | | | | |
| 17. | 6 th Week | | Wear and forms of wear | Lecture C&T/PPT |
| 18. | 6 th Week | | Abrasive wear and adhesive wear | |
| 19. | 7 th Week | | Erosive wear and cavitation wear | |
| 20. | 7 th Week | | Corrosive wear | |
| 21. | 7 th Week | | Oxidative wear fatigue wear | |
| A. | 4th Week of SEP | | CYCLE TEST I | |
| 22. | 8 th Week | | Melting wear and diffusive wear | Lecture C&T/PPT |
| 23. | 8 th Week | | Wear mechanisms | |
| 24. | 9 th Week | | Wear of non-metallic materials | |

| UNIT- IV LUBRICATION | | | | |
|---|-----------------------------------|--|---|-----------------|
| 25. | 9 th Week | | Introduction to lubrication and types | Lecture C&T/PPT |
| 26. | 9 th Week | | Hydro dynamic lubrication | |
| 27. | 10 th Week | | Reynolds equation | |
| 28. | 10 th Week | | Hydrostatic lubrication | |
| 29. | 10 th Week | | Bearing analysis | |
| 30. | 11 th Week | | Elastohydrodynamic lubrication | |
| 31. | 11 th Week | | Solid lubrication | |
| 32. | 11 th Week | | Boundary lubrication | |
| UNIT- V MICRO AND NANO TRIBOLOGY | | | | |
| 33. | 12 th Week | | Micro and Nano tribology | Lecture C&T/PPT |
| 34. | 12 th Week | | Measurement techniques | |
| 35. | 12 th Week | | Surface force apparatus (SFA) | |
| B. | 4th Week of OCT | | CYCLE TEST 2 | |
| 36. | 14 th Week | | Scanning probe microscopy | Lecture C&T/PPT |
| 37. | 14 th Week | | Atomic force microscopy (AFM) | |
| 38. | 14 th Week | | Nano mechanical properties of solid surfaces and thin films | |
| 39. | 15 th Week | | Computer simulations of nanometer | |
| 40. | 15 th Week | | Scale indentation and friction | |

Text Books

1. K.C. Ludema, "Friction, wear, lubrication: A text book in tribology", CRC Press, 1996.
2. I. M. Hutchings, "Tribology: Friction and Wear of Engineering Materials", Elsevier Limited, 1992.

References

1. G. W. Stachowiak, A. W. Batchelor, "Engineering Tribology", Elsevier Limited, 2005.
2. Bharat Bhushan, "Principles and applications of tribology", John Wiley & Sons, 1999.

| COURSE ASSESSMENT METHOD | | | | |
|---------------------------------|---|--------------------------|-----------------------|---------------------|
| S.No. | Mode of Assessment | Week/Date | Duration (min) | % Weightage |
| 1. | Assignment 1 / Seminar | | | 5 |
| 2. | Cycle Test 1 | 4 th Week SEP | 60 | 20 |
| 3. | Assignment 2 / Seminar | | | 5 |
| 4. | Cycle Test 2 | 4 th Week OCT | 60 | 20 |
| CPA | Compensation Assessment | 1 st Week NOV | 60 | Refer course policy |
| 5. | Descriptive Type Examination (End Semester) | 3 rd Week NOV | 180 | 50 |
| Total Assessment | | | | 100 |

COURSE EXIT SURVEY (mention the ways in which the feedback about the course is assessed and indicate the attainment also)

- Feedback from the students during class committee meetings
- Anonymous feedback through questionnaire

COURSE POLICY (including plagiarism, academic honesty, attendance, etc.)

CORRESPONDENCE

1. All the students are advised to check their NITT WEBMAIL regularly. All the correspondence (schedule of classes/ schedule of assessment/ course material/ any other information regarding this course) will be done through their webmail only.
2. Queries (if required) to the course teacher shall be emailed to the email id specified by the teacher and may be contacted over phone

ATTENDANCE

1. Attendance will be taken by the faculty in all contact hours. Every student should maintain minimum 75 % physical attendance in these contact hours along with assessment criteria to attend the end semester examination.
2. Any student, who fails to maintain 75% attendance may not be allowed to write the end-semester examination

ACADEMIC HONESTY & PLAGIARISM

1. All the students are expected to be genuine during the course work. Taking of information by means of copying assignments, looking or attempting to look at another student's paper or bringing and using study material in any form for copying during any assessments is considered dishonest.
2. Preventing or hampering other students from pursuing their academic activities is also

considered as academic dishonesty.

3. Any evidence of such academic dishonesty will result in the loss of marks on that assessment. Additionally, the names of those students so penalized will be reported to the class committee chairperson and HoD of the concerned department.
4. Students who honestly producing ORIGINAL and OUTSTANDING WORK will be REWARDED.

ADDITIONAL COURSE INFORMATION

The faculty is available for consultation at times as per the intimation given by the faculty.

FOR APPROVAL

Course Faculty  CC-Chairperson  HOD 