

Spring 1-1-2020

## **MET 302-102: Analysis and Design of Machine Elements II**

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**New Jersey Institute of Technology**  
**Department of Engineering Technology**  
**MET 302 Analysis & Design of Machine Elements II**

<b>COURSE NUMBER</b>	MET 302
<b>COURSE NAME</b>	Analysis & Design of Machine Elements II
<b>COURSE STRUCTURE</b>	(3-0-3) (lecture hr/wk - lab hr/wk – course credits)
<b>COURSE COORDINATOR/INSTRUCTOR</b>	Dr. A. Sengupta/ Ahmed Belal
<b>COURSE DESCRIPTION</b>	A continuation of MET 301, including analysis and design of power screws, brakes, clutches, belts, chain drives, gears, gear trains, bearings, and other machine elements.
<b>PREREQUISITE(S)</b>	MET 301
<b>COREQUISITE(S)</b>	
<b>REQUIRED, ELECTIVE OR SELECTED ELECTIVE REQUIRED MATERIALS</b>	Text: Design of Machine Elements, 8 <sup>th</sup> Ed. by M.F. Spotts, T.E. Shoup and L.E. Hornberger, Prentice-Hall, 2004, ISBN 9780130489890
<b>COMPUTER USAGE</b>	
<b>COURSE LEARNING OUTCOMES (CLO)</b>	By the end of the course students should be able to: <ol style="list-style-type: none"><li>1. Design a helical spring (to determine standard wire diameter, mean helix radius, minimum volume of spring material and number of active coils) if maximum stress, static load and deflection are given.</li><li>2. Calculate permissible values of maximum and minimum loads, if a helical spring is carrying fluctuating load.</li><li>3. Calculate the stress in a bolt when it is designed to carry an impact load.</li><li>4. Determine the pitch of a power screw to raise a given load at a given speed with a given power consumption.</li><li>5. Determine the torque a cone clutch can exert, the engaging force required for steady operation and the friction power for a given speed.</li><li>6. Determine angle of contact between lining and drum of a band brake exerting certain amount of torque, if the maximum pressure between the lining and the drum and the coefficient of pressure are given.</li><li>7. Find the length of leg of a system of fillet welds used to weld a bracket/beam to a support, if the bracket/beam is loaded (steady &amp; fluctuating) eccentrically.</li><li>8. Find the permissible load for a riveted joint if the resultant shearing stress for the most highly stressed rivet is given.</li><li>9. Evaluate load carrying capacity of 120°, 180° and 360° central partial journal bearings.</li><li>9. Compute rating life of a ball bearing subjected to steady load and variable load.</li></ol>

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10. Find the contact ratio for a spur gear pair if diametral pitch and pressure angle are specified.
11. Find the helix angle of a worm gear set if worm and wheel pitch diameters are given.
12. Find the value of the diametral interference between the shaft and the hub when they are press fitted.
13. Evaluate the maximum stress in the material of a disk fly wheel and the kinetic energy delivered due to fluctuation of speed.

**CLASS TOPICS**

Springs, Screws, Belts, Clutches, Brakes and Chains, Welded Connections, Riveted Connections, Lubrication, Ball Bearings, Spur Gears, Helical, Bevel and Worm Gears, Shrink fit, Disk Flywheel

**STUDENT OUTCOMES**

The Course Learning Outcomes support the achievement of the following MET Student Outcomes and TAC of ABET Criterion 9 requirements

**Student outcome a** - an ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities

**Course Learning Outcome** – evaluate load carrying capacity of 120°, 180° and 360° central partial journal bearings.

**Student outcome b** - an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies

**Course Learning Outcome** – determine the pitch of a power screw to raise a given load at a given speed with a given power consumption.

**Student outcome f** - an ability to identify, analyze, and solve broadly-defined engineering technology problems

**Course Learning Outcome** – determine the torque a cone clutch can exert, the engaging force required for steady operation and the friction power for a given speed.

**Student outcome m** - technical expertise having added technical depth in mechanical design, solid mechanics, and electro-mechanical devices and controls.

**Course Learning Outcome** – determine angle of contact between lining and drum of a band brake exerting certain amount of torque, if the maximum pressure between the lining and the drum and the coefficient of pressure are given.

**GRADING POLICY**

Homework	15 %
Tests	54 %

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Note: Grading Policy may be modified by Instructor for each Section in the Course)

Final Exam                      31 %

**Note:** Cannot pass course if you having failing grades on tests and final exam.

There are three tests during the semester. The lowest grade will be dropped. However, if you achieve an A for all three tests, you will not be excused from the final. There will be no makeup tests – if you miss one test, then that is the test you will drop.

**ACADEMIC INTEGRITY**

NJIT has a zero-tolerance policy regarding cheating of any kind and student behavior that is disruptive to a learning environment. Any incidents will be immediately reported to the Dean of Students. In the cases the Honor Code violations are detected, the punishments range from a minimum of failure in the course plus disciplinary probation up to expulsion from NJIT with notations on students' permanent record. Avoid situations where honorable behavior could be misinterpreted. For more information on the honor code, go to <http://www.njit.edu/academics/honorcode.php>

**STUDENT BEHAVIOR**

- No eating or drinking is allowed at the lectures, recitations, workshops, and laboratories.
- Cellular phones must be turned off during the class hours – if you are expecting an emergency call, leave it on vibrate.
- No headphones can be worn in class.
- Unless the professor allows the use during lecture, laptops should be closed during lecture.
- During laboratory, if you are finished earlier, you must show the professor your work before you leave class
- Class time should be participative. You should try to be part of a discussion

**MODIFICATION TO COURSE**

The Course Outline may be modified at the discretion of the instructor or in the event of extenuating circumstances. Students will be notified in class of any changes to the Course outline.

**PREPARED BY**

Ahmed Belal

**COURSE COORDINATED BY**

Dr. A. Sengupta

**CLASS HOURS**

Tuesday            6:00 PM – 8:50 PM            CKB 217

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**OFFICE HOURS:**

By Appointment: asb62@njit.edu

**HOMEWORK - IMPORTANT**

1. Homework practice problems will be assigned each class. These problems will not be collected. A Quiz based on the lecture and practice problems will be given each class.
2. Quiz problems should be done using the "Given and Find" format and all equations should be defined symbolically prior to calculating any values.

**GRADING LEGEND**

<b>GRADE</b>	<b>NUMERIC RANGE</b>
A	90 to 100
B+	85 to 89
B	80 to 84
C+	75 to 79
C	70 to 74
D	60 to 69
F	0 to 59

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**COURSE OUTLINE**

<b>WEEK</b>	<b>DATE</b>	<b>TOPICS</b>	<b>SECTIONS</b>	<b>ASSIGNMENTS</b>
1	Jan 21	Springs	4-1 thru 4-12, 4-17	4.1, 4, 9, 10, <b>12</b>
2	Jan 28	Screws	5-1 thru 5-9	5.2, 3, 4, 9, <b>16</b>
3	Feb 4	Belts, Clutches, Brakes, and Chains	6-1 thru 6-8	6.1, 3, 8, 10, <b>11</b>
4	Feb 11	Belts, Clutches, Brakes, and Chains, (Cont.) <b>Quiz No. 1</b>	6-9 thru 6-18	6.13, 15, 27, 28
5	Feb 18	Welded Connections	7-1 thru 7-12	7.2, 3, <b>5</b> , 8, <b>9</b>
6	Feb 25	Riveted Connections	7-13 thru 7-18	<b>7.15</b> , 17, 19, 20, <b>27</b>
7	Mar 3	Lubrication <b>Quiz No. 2</b>	8-1 thru 8-10	8.1, 2, 3, 5, <b>7</b>
8	Mar 10	Lubrication (Cont.)	8-11 thru 8-17	8.10, 15, 19, 25
<b>SPRING BREAK 3/15-3/22</b>				
9	Mar 24	Ball and Roller Bearings	9-1 thru 9-15	9.1, 5, 6, 9
10	Mar 31	Spur Gears	10-1 thru 10-16	10.3, 5, 6
11	Apr 7	Spur Gears (Cont.)	10-18 thru 10-22	10.10, 13, 25
12	Apr 14	Helical, Bevel and Worm Gears <b>Quiz No. 3</b>	11-1 thru 11-8	<b>11.4</b> , 12, 16, 19, <b>21</b>
13	Apr 21	Impact Stress Curved Beams	12.7 to 12.10 12.14 to 12.16	12.20, 21, 22, 29
14	Apr 28	Shrink & Press Fits Gaskets & Seals	12-2 12-11	
15	TBD	<b>FINAL EXAM</b>		