1. General Information

1a. Submitted by the College of: ENGINEERING

Date Submitted: 12/17/2013

1b. Department/Division: Mechanical Engineering

1c. Contact Person

Name: Dr. Tingwen Wu

Email: wu@uky.edu

Phone: 218-0644

Responsible Faculty ID (if different from Contact)

Name:

Email:

Phone:

1d. Requested Effective Date: Semester following approval

1e. Should this course be a UK Core Course? No

2. Designation and Description of Proposed Course

2a. Will this course also be offered through Distance Learning?: Yes [4]

2b. Prefix and Number: ME 515

2c. Full Title: Rotordynamics of Turbomachinery

2d. Transcript Title:

2e. Cross-listing: MFS 515

2f. Meeting Patterns

LECTURE: 3

2g. Grading System: Letter (A, B, C, etc.)

2h. Number of credit hours: 3

2i. Is this course repeatable for additional credit? No

If Yes: Maximum number of credit hours:

If Yes: Will this course allow multiple registrations during the same semester?

2j. Course Description for Bulletin: Review of dynamic characteristics unique to high speed rotating shafts in turbomachinery. Equations of motion for a rotor, including gyroscopic effects; computational methods, including finite element; effects of bearings and nonlinearities, stability; application to design situations in high-speed equipment, including aerospace, energy generation, and other industrial applications.

2k. Prerequisites, if any: Prerequisite EM 313 and Engineering standing; pre/co-requisite for Western Kentucky University students:ME 415 and ME 344; pre/co-requisites for UK students: ME 344 and ME 501; or Graduate Standing or consent of instructor.

2l. Supplementary Teaching Component:

3. Will this course taught off campus? No

If YES, enter the off campus address:

4. Frequency of Course Offering: Spring,

Will the course be offered every year?: Yes

If No, explain:

5. Are facilities and personnel necessary for the proposed new course available?: Yes

If No, explain:

6. What enrollment (per section per semester) may reasonably be expected?: 20

7. Anticipated Student Demand

Will this course serve students primarily within the degree program?: Yes

Will it be of interest to a significant number of students outside the degree pgm?: No

If Yes, explain:

8. Check the category most applicable to this course: Traditional – Offered in Corresponding Departments at Universities Elsewhere,

If No, explain:

9. Course Relationship to Program(s).

a. Is this course part of a proposed new program?: No

If YES, name the proposed new program:

b. Will this course be a new requirement for ANY program?: No

If YES, list affected programs:

10. Information to be Placed on Syllabus.

a. Is the course 400G or 500?: Yes

b. The syllabus, including course description, student learning outcomes, and grading policies (and 400G-/500-level grading differentiation if applicable, from **10.a** above) are attached: Yes

Distance Learning Form

Instructor Name: Dr. Keith Rouch

Instructor Email: rouch@engr.uky.edu

Internet/Web-based: Yes

Interactive Video: Yes

Hybrid: Yes

1.How does this course provide for timely and appropriate interaction between students and faculty and among students? Does the course syllabus conform to University Senate Syllabus Guidelines, specifically the Distance Learning Considerations? Use of LMS, email, and web-conferencing provides this interaction.

2.How do you ensure that the experience for a DL student is comparable to that of a classroom-based student's experience? Aspects to explore: textbooks, course goals, assessment of student learning outcomes, etc. Student learning outcomes are assessed for all sections of the course, along with the usual TCE evaluations.

3.How is the integrity of student work ensured? Please speak to aspects such as password-protected course portals, proctors for exams at interactive video sites; academic offense policy; etc. Standard university policy will be followed in all academic aspects, and all quizzes and exams will be proctored on-site, or off-site if delivered in online format.

4.Will offering this course via DL result in at least 25% or at least 50% (based on total credit hours required for completion) of a degree program being offered via any form of DL, as defined above? No

If yes, which percentage, and which program(s)? No

5.How are students taking the course via DL assured of equivalent access to student services, similar to that of a student taking the class in a traditional classroom setting? Access to student services will be the same as for other web-based courses in the university.

6.How do course requirements ensure that students make appropriate use of learning resources? Students will be required to access resources through on-line or similar venues.

7.Please explain specifically how access is provided to laboratories, facilities, and equipment appropriate to the course or program. No laboratories, facilities, or equipment are required. Software access is available at nominal cost if not otherwise available.

8.How are students informed of procedures for resolving technical complaints? Does the syllabus list the entities available to offer technical help with the delivery and/or receipt of the course, such as the Information Technology Customer Service Center (http://www.uky.edu/UKIT/)? Syllabus provides the access information.

9.Will the course be delivered via services available through the Distance Learning Program (DLP) and the Academic Technology Group (ATL)? YES

If no, explain how student enrolled in DL courses are able to use the technology employed, as well as how students will be provided with assistance in using said technology. yes

10.Does the syllabus contain all the required components? YES

11.I, the instructor of record, have read and understood all of the university-level statements regarding DL.

Instructor Name: Dr. Keith Rouch

SIGNATURE|STEPHEN|L S Stephens|ME 515 NEW Dept Review|20131217

SIGNATURE|CHE202|Kimberly W Anderson|ME 515 NEW College Review|20140213

SIGNATURE|JMETT2|Joanie Ett-Mims|ME 515 NEW Undergrad Council Review|20141002

SIGNATURE|ZNNIKO0|Roshan N Nikou|ME 515 NEW Graduate Council Review|20141015

Courses	Request Tracking

New Course Form

https://myuk.uky.edu/sap/bc/soap/rfc?services=

Generate R

Open in full window to print or save

Attachments:

Browse... Upload File

	ID	Attachment
Delete	3753	syllabus_ME515DL_revised.doc

First 1 Last

Select saved project to retrieve... Get New

(*denotes required fields)

1. General Information

a. * Submitted by the College of: ENGINEERING Submission Date: 12/17/2013

b. * Department/Division: Mechanical Engineering

c.

* Contact Person Name: Dr. Tingwen Wu Email: wu@uky.edu Phone: 218-0644

* Responsible Faculty ID (if different from Contact) Email: Phone:

d. * Requested Effective Date: (•) Semester following approval OR ( ) Specific Term/Year [1]

e.

Should this course be a UK Core Course? ( ) Yes (•) No

If YES, check the areas that apply:

☐ Inquiry - Arts & Creativity	☐ Composition & Communications - II
☐ Inquiry - Humanities	☐ Quantitative Foundations
☐ Inquiry - Nat/Math/Phys Sci	☐ Statistical Inferential Reasoning
☐ Inquiry - Social Sciences	☐ U.S. Citizenship, Community, Diversity
☐ Composition & Communications - I	☐ Global Dynamics

2. Designation and Description of Proposed Course.

a. * Will this course also be offered through Distance Learning? (•) Yes [1] ( ) No

b. * Prefix and Number: ME 515

c. * Full Title: Rotordynamics of Turbomachinery

d. Transcript Title (if full title is more than 40 characters):

e. To be Cross-Listed [2] with (Prefix and Number): MFS 515

f. * Courses must be described by at least one of the meeting patterns below. Include number of actual contact hours[3] for each meeting pattern type.

3	Lecture		Laboratory[1]		Recitation		Discussion
	Indep. Study		Clinical		Colloquium		Practicum
	Research		Residency		Seminar		Studio
	Other	If Other, Please explain:					

g. * Identify a grading system:

(•) Letter (A, B, C, etc.)

( ) Pass/Fail

( ) Medicine Numeric Grade (Non-medical students will receive a letter grade)

( ) Graduate School Grade Scale

h. * Number of credits: 3

i. * Is this course repeatable for additional credit? ( ) Yes (•) No

If YES: Maximum number of credit hours:

If YES: Will this course allow multiple registrations during the same semester? ( ) Yes ( ) No

j. * Course Description for Bulletin:

Review of dynamic characteristics unique to high speed rotating shafts in turbomachinery. Equations of motion for a rotor, including gyroscopic effects; computational methods, including finite element; effects of bearings and nonlinearities, stability; application to design situations in high-speed equipment, including aerospace, energy generation, and other industrial applications.

k. Prerequisites, if any:

Prerequisite EM 313 and Engineering standing; pre/co-requisite for Western Kentucky University students:ME 415 and ME 344; pre/co-requisites for UK students: ME 344 and ME 501; or Graduate Standing or consent of instructor.

l. Supplementary teaching component, if any: ○ Community-Based Experience ○ Service Learning ○ Both

3. * Will this course be taught off campus? ○ Yes ◉ No

If YES, enter the off campus address:

4. Frequency of Course Offering.

a. * Course will be offered (check all that apply): ☑ Fall ☑ Spring ☐ Summer ☐ Winter

b. * Will the course be offered every year? ◉ Yes ○ No

If No, explain:

5. * Are facilities and personnel necessary for the proposed new course available? ◉ Yes ○ No

If No, explain:

6. * What enrollment (per section per semester) may reasonably be expected? 20

7. Anticipated Student Demand.

a. * Will this course serve students primarily within the degree program? ◉ Yes ○ No

b. * Will it be of interest to a significant number of students outside the degree pgm? ○ Yes ◉ No

If YES, explain:

8. * Check the category most applicable to this course:

☑ Traditional – Offered in Corresponding Departments at Universities Elsewhere
☐ Relatively New – Now Being Widely Established
☐ Not Yet Found in Many (or Any) Other Universities

9. Course Relationship to Program(s).

a. * Is this course part of a proposed new program? ○ Yes ◉ No

If YES, name the proposed new program:

b. * Will this course be a new requirement for ANY program? ○ Yes ◉ No

If YES, list affected programs::

10. Information to be Placed on Syllabus.

a. * Is the course 400G or 500? ◉ Yes ○ No
If YES, the *differentiation for undergraduate and graduate students must be included* in the information required in **10.b.** You must include: (i) identification of add assignments by the graduate students; and/or (ii) establishment of different grading criteria in the course for graduate students. (See SR 3.1.4.)

b. ☑ * The syllabus, including course description, student learning outcomes, and grading policies (and 400G-/500-level grading differentiation if applicable, from **10** attached.

Distance Learning Form

This form must accompany every submission of a new/change course form that requests distance learning delivery. This form may be required when changing a course already approved for DL
fields are required!

Introduction/Definition: For the purposes of the Commission on Colleges Southern Association of Colleges and Schools accreditation review, ***distance learning*** is defined as a fo educational process in which the majority of the instruction (interaction between students and instructors and among students) in a course occurs when students and instructors the same place. Instruction may be synchronous or asynchronous. A distance learning (DL) course may employ correspondence study, or audio, video, or computer technologies

A number of specific requirements are listed for DL courses. **The *department* proposing the change in delivery method is responsible for ensuring that the requiremer are satisfied at the individual course level.** It is the responsibility of the instructor to have read and understood the university-level assurances regarding an equivalent expe students utilizing DL (available at http://www.uky.edu/USC/New/forms.htm).

Course Number and Prefix:	ME/MFS 515	Date:	12/11/2013
Instructor Name:	Dr. Keith Rouch	Instructor Email:	rouch@engr.uky.edu

Check the method below that best reflects how the majority of the course content will be delivered.

Internet/Web-based ☑ Interactive Video ☑ Hybrid ☑

Curriculum and Instruction

1. How does this course provide for timely and appropriate interaction between students and faculty and among students? Does the course syllabus conform to University Syllabus Guidelines, specifically the Distance Learning Considerations?
   Use of LMS, email, and web-conferencing provides this interaction.

2. How do you ensure that the experience for a DL student is comparable to that of a classroom-based student's experience? Aspects to explore: textbooks, course goals, of student learning outcomes, etc.
   Student learning outcomes are assessed for all sections of the course, along with the usual TCE evaluations.

3. How is the integrity of student work ensured? Please speak to aspects such as password-protected course portals, proctors for exams at interactive video sites; academi policy; etc.
   Standard university policy will be followed in all academic aspects, and all quizzes and exams will be proctored on-site, or off-site if delivered in online format.

4. Will offering this course via DL result in at least 25% or at least 50%* (based on total credit hours required for completion) of a degree program being offered via any f as defined above?
   No

   Which percentage, and which program(s)?
   No

   *As a general rule, if approval of a course for DL delivery results in 50% or more of a program being delivered through DL, the effective date of the course's DL delivery months from the date of approval.

5. How are students taking the course via DL assured of equivalent access to student services, similar to that of a student taking the class in a traditional classroom setting
   Access to student services will be the same as for other web-based courses in the university.

Library and Learning Resources

6. How do course requirements ensure that students make appropriate use of learning resources?
   Students will be required to access resources through on-line or similar venues.

7. Please explain specifically how access is provided to laboratories, facilities, and equipment appropriate to the course or program.
   No laboratories, facilities, or equipment are required. Software access is available at nominal cost if not otherwise available.

Student Services

8. How are students informed of procedures for resolving technical complaints? Does the syllabus list the entities available to offer technical help with the delivery and/or r the course, such as the Information Technology Customer Service Center (http://www.uky.edu/UKIT/)?
   Syllabus provides the access information.

9. Will the course be delivered via services available through the Distance Learning Program (DLP) and the Academic Technology Group (ATL)?
   ◉ Yes
   ○ No

   If no, explain how students enrolled in DL courses are able to use the technology employed, as well as how students will be provided with assistance in using said techn
   yes

10. Does the syllabus contain all the required components, below? ☑ Yes
    - Instructor's ***virtual*** office hours, if any.
    - The technological requirements for the course.
    - Contact information for Distance Learning programs (http://www.uky.edu/DistanceLearning) and Information Technology Customer Service Center (http://www.uky.edu/UKIT/Help/; 859-218-HELP).
    - Procedure for resolving technical complaints.
    - Preferred method for reaching instructor, e.g. email, phone, text message.
    - Maximum timeframe for responding to student communications.
    - Language pertaining academic accommodations:

- "If you have a documented disability that requires academic accommodations in this course, please make your request to the University Disability Resour The Center will require current disability documentation. When accommodations are approved, the Center will provide me with a Letter of Accommodatior details the recommended accommodations. Contact the Disability Resource Center, Jake Karnes, Director at 859-257-2754 or jkarnes@email.uky.edu."

- Specific dates of face-to-face or synchronous class meetings, if any.
- Information on Distance Learning Library Services (http://www.uky.edu/Libraries/DLLS)
  - Carla Cantagallo, DL Librarian
  - Local phone number: 859 257-0500, ext. 2171; long-distance phone number: (800) 828-0439 (option #6)
  - Email: dllservice@email.uky.edu
  - DL Interlibrary Loan Service: http://www.uky.edu/Libraries/libpage.php?lweb_id=253&llib_id=16

11. I, the instructor of record, have read and understood all of the university-level statements regarding DL.
    Instructor Name:
    Dr. Keith Rouch

Abbreviations: DLP = Distance Learning Programs ATG = Academic Technology Group Customer Service Center = 859-218-HELP (http://www.uky.edu/UKIT/Help)

~~Revised 8/09~~

[1] Courses are typically made effective for the semester following approval. No course will be made effective until all approvals are received.

[2] The chair of the cross-listing department must sign off on the Signature Routing Log.

[3] In general, undergraduate courses are developed on the principle that one semester hour of credit represents one hour of classroom meeting per week for a semester, exclusive of any laboratory meeting. La meeting, generally, represents at least two hours per week for a semester for one credit hour. (from SR 5.2.1)

[4] You must also submit the Distance Learning Form in order for the proposed course to be considered for DL delivery.

[5] In order to change a program, a program change form must also be submitted.

Rev 8/09

Submit as New Proposal Save Current Changes

COURSE SYLLABUS SPRING 2015
Rotordynamics of Turbomachinery
ME/MFS 515 (proposed)

Instructor: Lexington: Dr. Keith E. Rouch, P.E.; Email: keith.rouch@uky.edu; keith.rouch@wku.edu
Department of Mechanical Engineering
163 Ralph G. Anderson Building (RGAN)
University of Kentucky, Lexington, KY 40506-0503
Ph. 859-218-0637; FAX 859-257-3304

Faculty Office Hours: Normally Available 10AM to 4PM Eastern Time

Class Time and Place: ME 599-2xx TR 12:10 to 1:30 AM ET RMB 309

1. COURSE INFORMATION

1.1 Course Description. RotorDynamics of Turbomachinery: review of dynamic characteristics unique to high speed rotating shafts in turbomachinery. Equations of motion for a rotor, including gyroscopic effects; computational methods, including finite element; effects of bearings and nonlinearities, stability; application to design situations in high-speed equipment, including aerospace, energy generation, and other industrial applications. Prerequisite EM 313 and Engineering standing; pre/co-requisite (WKU) ME 344; (UK) ME 501 and ME 344; or Graduate Standing or consent of instructor.

1.2 Course Materials

Textbook (optional) Turbomachinery Rotordynamics with Case Studies, Dara W. Childs, ISBN 978-0-615-85272-0, 2013, Minter Spring Publishing (available on Amazon)

Textbook (optional): Machinery Vibration and Rotordynamics, John Vance, Fouad Zeidan, Brian Murphy, 2010, John Wiley and Sons, ISBM 978-0-471-46213-2.

Textbook (optional) ANSYS Workbench Tutorial Release 14: Structure & Thermal Analysis Using the Ansys Workbench Release 14 Environment, Kent Lawrence, Publisher SDC Publications, 2012
ISBN 1585037540, 9781585037544 Length 304 pages

Textbook (optional) ANSYS Tutorial Release 14: Structural & Thermal Analysis Using the ANSYS Mechanical APDL Release 14 Environment, Kent Lawrence, Publisher-- SDC Publications, 2012,
ISBN 1585037613, 9781585037612, Length 178 pages

1.3 References:

1. Rotating Machinery Vibration: From Analysis to Troubleshooting, Second Edition Maurice L. Adams, Jr. 2009, CRC Press, ISBN 1439807175 (includes software CD).

2. Mechanical Engineering Design text, eg by Shigley and Mitchell, or by Juvinall & Marschek
3. Copies of most audiovisual materials used in class to be made available online (LMS).

4. ANSYS Documentation, online help in ANSYS

5. http://www.rotordynamics.org/

6. GE ORBIT magazine: http://www.ge-mcs.com/en/orbit-magazine.html

2. LEARNING OUTCOMES

Students will be able to:

a. Analyze the fundamentals of dynamic response and vibration of translational and torsional systems.

b. Calculate the basic response characteristics of rotordynamic systems, including resonance, whirl, amplification, gyroscopics, and stability.

c. Understand the interaction of foundations, bearings and seals with rotating elements, including asymmetry and cross-coupling.

d. Be able to develop models of rotor-bearing systems using computational approaches.

e. Be able to analyze experimental results for rotor-bearing system response characteristics.

f. Be familiar with the historical developments of rotating systems, and the interaction with system efficiency and power density.

3. COURSE TOPICS

Fundamentals of machine vibration and classical solutions of lateral and torsional vibration

Rotordynamics analysis contrasted with classical non-rotating systems, including foundations, bearings, seals, gyroscopics.

Computational approaches for modeling rotor systems – undamped, damped/stability, unbalance response, transient.

Modeling of foundations, bearings, seals, gyroscopics

Experimental Methods and data Acquisition in rotating machinery

Historical developments and applications

4. LEARNING MANAGEMENT SYSTEM (LMS) ACCESS

The basic information on the course will be maintained on the selected LMS (BLACKBOARD, CANVAS, etc) course website of the university, including course assignments, lecture notes, grades, and other documents. As of this semester, information on accessing that site is located at http://www.uky.edu/IT/CustomerService/docs/blackboard/. For UK students, the Blackboard website is located at https://elearning.uky.edu/, or is more directly accessible through myUK. WKU students can access their Blackboard site for identical material.

Students enrolled in the course should be automatically included for access. Be sure to verify LMS access

during the first week of the semester.

5. STUDENT INTERACTION

5.1 Students are expected to maintain communication with the instructor through various means:

Personal Meetings (by arrangement or during scheduled office hours)
E-mail or Phone
Web-Conferencing (Adobe Connect)
LMS Discussion Board (Instructor or other students)

These interactions are expected to be conducted in a professional manner. It is essential that students check e-mail on a daily basis. The LMS-based e-mail address will be used by default, so students must activate e-mail forwarding if they prefer another primary e-mail address. In any communications with the instructor or other students, be sure to follow e-mail etiquette, for example: http://office.microsoft.com/en-us/outlook/HA012054101033.aspx.

5.2 The instructor will normally respond to e-mail or phone calls (received during daytime hours) within four hours of receipt.

5.3 Students are expected to have internet access, and appropriate computer hardware, along with access to software for document creation and editing, and for preparation of presentations. The university recommendations on computer hardware are listed at http://www.uky.edu/ukit/hardwareguide.
This access is provided at a number of on-campus locations. Students at WKU are provided a room for office hour and Adobe Connect access. Online students will need to have appropriate access and hardware and software.

6. COURSE GRADING

The assigned problems are selected to illustrate the concepts and techniques involved in the course, and assignments will be collected on the due date, and returned with grading and feedback. The homework collected will count 20 percent of the final course grade. For homework turned in within a one week period after due date, grades will be reduced by 50 percent (unless related to an excused absence). No homework will be credited if more than one week past due (unless related to an excused absence). Each student will select a design problem (see discussion) to be solved using the finite element method, and this will count 20 percent of the final course grade. A brief typed summary of the proposed problem is to be submitted (see due date below), and a written report on the project is due the last day of the regular semester. Project grade is weighted 90 percent on final report, and 10 percent on proposal. Additional credit for undergraduates will be given for an optional in-class presentation the last week of class. A presentation is required for students receiving graduate credit. Presentations can be made by in-class or online formats.

The remaining 60 percent of the grade will be based equally on each of the two exams. The exams are intended to assess the student's understanding of the basic concepts and learning outcomes of the course. Exams are closed-book unless advised otherwise, and only the reference material provided by the instructor can be used. Individual work by students is required.

A numerical score will be assigned for each of the three categories, and weighted per the 20/20/60 above to determine the final score. Typically undergraduate letter grades (A, B, C, D, E) will be assigned on the basis of 90, 80, 70, 60 percent cutoffs, and for graduate students letter grades (A, B, C, E) on the basis of 92, 82, 70 percent cutoffs. The level of difficulty in the course project is also expected to be higher for graduate students. Mid-term grades (for UK undergraduates) will be posted in myUK by the deadline established in

the Academic Calendar (http://www.uky.edu/Registrar/AcademicCalendar.htm)

7. FINITE ELEMENT ACCESS

The assigned work will include some manual calculations. Some problems are also to be solved using a finite element program, and access to a FEM program is also required for the course project. The following options exist:

1. The full ANSYS version, including heat transfer and nonlinear capability, is available in a number of computer labs on the UK campus. (Contact the instructor if other options need to be explored – other finite element software may be suitable).

2. Students may purchase a copy of the ANSYS ED Student edition (current price $25), per the following procedure:

a. Go to: https://support.ansys.com/portal/site/AnsysCustomerPortal/student/template.
b. REGISTER:
Fill out the registration information - be sure to use your school email address, and provide some information about the school's account
UK account number is 227106, with Keith Rouch as Professor
WKU account number is 316722, with Robert Choate as Professor
Professor Name - you can choose any name from the drop down menu.
c. Once you have registered, you will see the information about the Student License in the lower center of the homepage. Please read through the information carefully. You will be required to provide credit card information and specific information about the computer where you are going to install the license. There are no refunds or rehosts available for the Student License.

8. COURSE PROJECT

Early in the semester, begin giving some thought to a project you could do this semester which will make use of the contents of this course. Per the syllabus, this will count as a portion of the course grade, and the level of effort should reflect this. Some possible sources for your topic include:

- design projects from other courses which could benefit from design analysis tools

- problems or geometries from other courses which you have taken earlier

- convergence or accuracy studies on specific elements and geometries

- problems from your present employment or research efforts

By mid-semester please submit a written summary of the topic you plan to pursue. If you want to discuss your topic prior to that time, please see the instructor. You should begin work on it as soon as possible to avoid the end-of-semester crunch.

A written report on your project will be expected at the end of the semester and will be retained by the instructor. A concise listing of your input commands or other software file may be included, along with a discussion of your results and their significance. (Do not include output listings, only significant results). A presentation of your project at the end of the semester (in person or online) is encouraged (extra credit for

undergraduate credit, required for graduate credit), but you need to have your results early for this to be possible.

9. SUBMISSION OF ASSIGNMENTS:

Assignments can be submitted by paper copy or the appropriate Learning Management System submission, as directed (typically Blackboard, CANVAS, or as directed)

10. OTHER TOPICS

10.1 Academic Integrity

Per university policy, students shall not plagiarize, cheat, or falsify or misuse academic records. Students are expected to adhere to University policy on cheating and plagiarism in all courses. The minimum penalty for a first offense is a zero on the assignment on which the offense occurred. If the offense is considered severe or the student has other academic offenses on their record, more serious penalties, up to suspension from the university may be imposed.

Plagiarism and cheating are serious breaches of academic conduct. Each student is advised to become familiar with the various forms of academic dishonesty as explained in the Code of Student Rights and Responsibilities. Complete information can be found at the following website: http://www.uky.edu/Ombud. A plea of ignorance is not acceptable as a defense against the charge of academic dishonesty. It is important that you review this information as all ideas borrowed from others need to be properly credited.

Part II of *Student Rights and Responsibilities* (available online http://www.uky.edu/StudentAffairs/Code/part2.html) states that all academic work, written or otherwise, submitted by students to their instructors or other academic supervisors, is expected to be the result of their own thought, research, or self-expression. In cases where students feel unsure about the question of plagiarism involving their own work, they are obliged to consult their instructors on the matter before submission.

When students submit work purporting to be their own, but which in any way borrows ideas, organization, wording or anything else from another source without appropriate acknowledgement of the fact, the students are guilty of plagiarism. Plagiarism includes reproducing someone else's work, whether it be a published article, chapter of a book, a paper from a friend or some file, or something similar to this. Plagiarism also includes the practice of employing or allowing another person to alter or revise the work which a student submits as his/her own, whoever that other person may be.

Students may discuss assignments among themselves or with an instructor or tutor, but when the actual work is done, it must be done by the student, and the student alone. When a student's assignment involves research in outside sources of information, the student must carefully acknowledge exactly what, where and how he/she employed them. If the words of someone else are used, the student must put quotation marks around the passage in question and add an appropriate indication of its origin. Making simple changes while leaving the organization, content and phraseology intact is plagiaristic. However, nothing in these Rules

shall apply to those ideas which are so generally and freely circulated as to be a part of the public domain (Section 6.3.1).

Please note: Any assignment you turn in may be submitted to an electronic database to check for plagiarism.

10. 2 Verification of Absences

Students need to notify the professor of absences prior to class when possible. S.R. 5.2.4.2 defines the following as acceptable reasons for excused absences: (a) serious illness, (b) illness or death of family member, (c) University-related trips, (d) major religious holidays, and (e) other circumstances found to fit "reasonable cause for nonattendance" by the professor. Students have one week following the excused absence to contact the instructor for makeup of assignments.

Students anticipating an absence for a major religious holiday are responsible for notifying the instructor in writing of anticipated absences due to their observance of such holidays no later than the last day in the semester to add a class. Information regarding dates of major religious holidays may be obtained through the religious liaison, Mr. Jake Karnes (859-257-2754). Students are expected to withdraw from the class if more than 20% of the classes scheduled for the semester are missed (excused or unexcused) per university policy.

Note that the attendance policy for the class will not apply when offered online. Instead, completion of assigned work per the semester schedule is expected. If any delays are associated with the above absence policy, contact the instructor as required.

10.3 Accommodations due to disability

If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide the instructor with a Letter of Accommodation from the Disability Resource Center (Room 2, Alumni Gym, 257-2754, email address: jkarnes@email.uky.edu) for coordination of campus disability services available to students with disabilities.

10.4 Homework Format for Submission: Homework to be submitted must meet the following guidelines for full credit to be given:

1. Use standard 8 ½ by 11 paper, lined or unlined. Do not use paper from a spiral bound notebook.
2. Handwritten material must be legible, and suitable for scanning, copying, or electronic submission; a scanned copy must be legible as well. Use a suitably dark pen or pencil.
3. Use only one side of the paper.
4. If hard copy, paperclip or staple your submission in the top left corner, name legibly included in upper right corner of each page.

10.5 Technical Support

If students at a remote site experience any difficulty with delivery of course material, contact the support personnel at the location, and inform the instructor. For difficulties with the LMS or logins, contact the Teaching and Academic Support Center http://www.uky.edu/ukit/atg/tasc, or the Information Technology Customer Support Center at https://www.uky.edu/ukit/help, and inform the instructor. If students experience any difficulty with software, contact technical support for the software, and inform the instructor.

10.6 Library Support

For library support, contact Distance Learning Library Services http://libraries.uky.edu/DLLS, local phone (859)-257-0500 ext 2171, long distance (800)-828-0439 (option #6), email dllservice@email.uky.edu. For Interlibrary Loan service http://libraries.uky.edu/ILL

11.0 Other on-line resources

A. Web-based display of material

Recorded lectures may be posted on the Learning Management System website, as appropriate.

B. Audio-Conferencing

Adobe Connect Pro Web-Conferencing

Adobe Connect is a web-conferencing system, licensed by UK for course interaction. It complements course management systems such as Blackboard. Electronic office hours will be offered to students. Login at http://www.uky.acrobat.com. Instructions and login info will be provided. For additional information, navigate to http://www.uky.edu/acadtrain/connect. From that site, you can test your connection for Adobe Connect.

Adobe Connect allows you to share information in a web-conferencing mode. Any of those connected can display their computer screen, window, or specific applications. There is a chat function, and files can be uploaded for viewing by others. A "room" for the course will be established, and should be available at all times through the Adobe Connect website for the class at http://ukconnect.acrobat.com.

There are three options for audio:

1. Use a separate phone connection, typically with a speakerphone

2. Adobe Connect has a built-in audio/webcam capability, allowing those connected to talk and (optionally) display their image with a webcam. A webcam/microphone connection or a headset is needed. Because of potential difficulties with feedback, check this out in advance. To activate, click on the TALK icon at the bottom of the screen. It is recommended that you optimize your audio settings at meetings>manage my settings>Audio Setup Wizard.

3. It is also possible to us a separate phone conference call (charge or toll-free). Normally this would be done only if more than two locations are involved. Again, the instructor/host needs to arrange this.

NOTE: As currently configured, all attendees in the meeting room are considered PRESENTERS, which means they can share material, including the whiteboard. The levels of attendees are:

HOST: can schedule meetings, share material, interact with audio/video, change settings

PRESENTER can share material, interact with audio/video
PARTICIPANT can only view material, and can interact with audio/video.

C. Exam Proctoring

Online students will need to arrange for their exams to be proctored at an approved site. There may be a fee for such services.

12. COURSE SCHEDULE DYNAMICS OF TURBOMACHINERY

TOPICAL OUTLINE (by week) ME 515 Rotordynamics of Turbomachinery

WEEK TOPIC

1 Introduction
- Unique Characteristics of Rotating Equipment
- Examples of Rotor Systems
- Design Issues, Constraints, Prediction and Problem-Solving
- Computational Design Tools
- Course Content
- Instructor Background

2 SDOF Vibration Fundamentals -- Free Response and Resonance
- Undamped System
- Differential Equation
- Lagrange's Equation
- S-operator and Roots
- Damped system Roots and S-plane
- Underdamped, Critically damped, Overdamped
- Transient response and Log decrement
- ANSYS Models (APDL and Workbench)
- Equivalent SDOF System (Effective stiffness/Effective Mass)
- Negative damping and Instability

3 SDOF Vibration Fundamentals -- Damped Response
- Harmonic Response to Constant Force, Unbalance, Base Motion
- Sharpness of Resonance
- Q-factor and estimation of damping
- ANSYS Models for response (APDL and Workbench)
- Vibration Measurement and Analysis

4 Simple Rotor Systems
- Resonant amplitude
- Balancing Concepts
- Historical Perspectives (mid-1800's to mid-1900's)
- Bearings and Seals
- Jeffcott Rotor applications
- Rigid shaft and flexible Support
- Flexible shaft and Rigid Support
- 2D Motion, Orbits, circular and Elliptical
- ANSYS elements for Rotor Analysis
- COMBIN214 Bearing Element
- Instability with negative damping
- Overhung Rotor and Gyroscopic Effects

5 MultiDOF Systems – 2DOF

- Differential Equations
- Coefficient Matrix/Determinant/Roots
- Eigenvalues/Eigenvectors
- Mode shapes
- General eigenproblem
- Harmonic response
- ANSYS
- Uncoupling System/diagonalized
- Normalized Mode Shapes
- Orthogonality of Mode Shapes
- Solution algorithms
- Damping
- Vibration Absorber/ ANSYS Model
- Vertical Pump examples (Rouch, Childs CS2)
- Boring Bar Active Vibration Absorber

6 Finite Element Methods

- Statics and stiffness Matrix
- Matrix assembly
- Energy Methods
- Damping Matrix

Mid-term Exam

7 Continuous Systems

- Modeling with Differential Equation
- Modeling with Finite Element
- Differential Equation for Vibration of Bar/Torsional System/Vibrating string
- Solution by Separation of Variables
- Differential Equation for Vibration of Beams in Bending
- Example closed-form Solutions
- Boundary Conditions
- ANSYS
- Thomson Table and ANSYS Comparison

8 Finite Element Approaches for Vibration of Continuous Systems

- Lumped Mass and Consistent Mass
- Axial vibration of Bar Element
- Bending Vibration of Beam
- ANSYS BEAM3, BEAM188, PIPE16
- Symmetry

9 Finite Element Approaches for Rotor Dynamics

- Components
  - Lumped Mass/Inertia/MASS21

Rigid Disks
Shaft Elements/PIPE16
COMBIN214 Bearing Element
Coriolis/SYNCHRO/OMEGA/Unbalance
Simple Rigid Rotor – Undamped and damped
Nelson-McVaugh Rotor in ANSYS (APDL and Workbench)
Bearings
Fixed arc
Pivoted pad/Pad assembly
Parameters and speed-dependent
Seal dynamics
Squeeze film damper
Foundation modeling

10 Specialized Displays for Rotor Dynamics
Critical Speed Map
Mode Shapes-Undamped and damped
Synchronous Response/Bode/amplitude and Phase
Whirl direction in damped critical, harmonic response
Unbalance Limits
Waterfall Plot
Cross-coupling
Examples from Childs (Kaybob, Ekofisk)
Cross-coupling
Transient Dynamics, explicit/Implicit
Rigid Rotor Example

11 Modeling of rotor Systems
Required number of shaft elements/discretization
Disks and Interference fits
Case studies – Childs 1,2,3,5,6

12 Presentations of Student Projects

13 Final exam