



University of Puerto Rico
Mayagüez Campus
College of Agricultural Sciences
Department of Agricultural and Biosystems Engineering
Agricultural and Environmental Systems



OFFICIAL SYLLABUS

1. General Information:

Alpha-numeric codification:	SAGA 4009
Course Title:	Mechanical Power in Agriculture
Number of Credits:	3 credits
Contact Period:	Two hours conference and a laboratory period of three hours per week.

2. Course Description:

English: Sources, measurement, transmission and economic application of mechanical power on the farm; principles of construction and operation of various types of farm power units, with particular emphasis on internal combustion engines. Classification, selection, operation and maintenance of agricultural farm power units.

Spanish: Fuentes, medición, transmisión y aplicación económica a las operaciones agrícolas. Principios de construcción y funcionamiento de varios tipos de motores con particular consideración de los de combustión interna. Clasificación, selección, manejo y mantenimiento de los equipos agrícolas motorizados.

3. Prerequisites/Corequisites:

Prerequisites: FISI 3171 or FISI 3151 or FISI 3091

Corequisites:

4. Course Objectives:

At the end of the course the students will be able to:

- know and understand terminology, design features, principles of operation, and maintenance of engines and tractors, and
- evaluate performance of tractors and engines to make decisions such as which tractor to buy and how to get the most out of it.

5. Instructional Strategies:

- conference discussion computation laboratory
 seminar with formal presentation seminar without formal presentation workshop
 art workshop practice trip thesis special problems
 tutoring research others, please specify:

6. Minimum or Required Resources Available:

The course will take place in a traditional classroom. I will be using a computer projector during the presentation of the theory. Examples of computations will be performed on the Blackboard. Laboratory exercises will be carried out in the facilities of the Department of Biosystems and agricultural engineering, on grounds the Coliseo Rafael and the Finca Alzamora.

The student must have access to the Internet to access the Moodle Institucional (<https://online.upr.edu/>) account. Biosystems and agricultural engineering department computers can be used during business hours when not in use. It is expected that student would frequently visit Moodle Institucional account to keep up to date with the material and assignments. Not having access to the Internet, is the responsibility of student. Contact Professor so he can provide the material and assignments in digital way.

It is required that students bring a conventional scientific calculator (will not accept cell phones or other electronic devices) to the classroom, laboratories and tests. It is recommended to purchase a USB flash drive to store lectures, assignments and labs.

7. Course time frame and thematic outline:

Conference Outline		Contact Hours
a.	Introduction	1
b.	Basic thermodynamics of engines	1
c.	Cylinder volumes and engine cycles	1
d.	Engine components	2
	Quiz 1 (Chapter 2 and 3)	
e.	Engine cycles and timing	1
f.	Power and efficiencies	2
g.	Engine performance and efficiency	1
h.	Dynamometers and tractor testing	1
	Quiz 2 (Chapter 4 and 5)	
i.	Revision	1
j.	First mid-term examination*	1
k.	Fuels & Combustion	1

l.	Fuel Properties	1
m.	Octane and Cetane ratings	1
n.	Lubrication and lubricants	1
	Quiz 3 (Chapter 6 and 13)	
o.	Diesel engines	1
p.	Diesel fuel injection systems	1
q.	Turbochargers & Intercoolers	1
r.	Turbochargers and engine families	1
	Quiz 4 (Chapter 10 and 11)	
s.	Traction & tires	1
t.	Revision	1
u.	Second mid-term examination*	1
v.	Traction & stability	1
w.	Traction & safety	1
	Quiz 5 (Chapter 16)	
x.	Power trains	1
y.	Transmissions	2
z.	Differentials and Final drives	1
aa.	PTO drives/Review for final examination	1
Total hours:		30

Laboratory Outline		Contact Hours
a.	Introduction	3
b.	Unit Analysis	3
c.	Excel Applications	3
d.	Disassembly and assembly of engine model	3
e.	Review Exam I	3
f.	Exam I	3
g.	Identification and measurement of engine parts	3
h.	Engine governors	3
i.	Tractor serviceability and maintenance	3
j.	Review Exam II	3
k.	Exam II	3
l.	Lubrication	3

m. PTO and drawbar power measurements	3
n. Technical presentation	3
o. Review Final Exam	3
Total hours:	45

8. Grading System:

Quantifiable (letters) Not Quantifiable

Standard curve: 90 to 100 A; 80 < 90 B; 70 < 80 C; 60 < 70 D; < 60 F

9. Evaluation Strategies:

	Quantity	Percent
<input checked="" type="checkbox"/> Exams	2 @ 50%	50
<input checked="" type="checkbox"/> Final Exam		25
<input checked="" type="checkbox"/> Short Quizzes		10
<input type="checkbox"/> Homework		
<input checked="" type="checkbox"/> Laboratory		15
<input type="checkbox"/> Oral Reports		
<input type="checkbox"/> Written Reports		
<input type="checkbox"/> Monographies		
<input type="checkbox"/> Portfolio		
<input type="checkbox"/> Projects		
<input type="checkbox"/> Journals		
<input type="checkbox"/> Other, specify:		
	TOTAL:	100%

10. Bibliography

ASABE Standards: Standards, Engineering Practices and Data. American Society of Agricultural and Biological Engineers. (S671. A325 2007-2010)

Bell, B. 2008. Farm Machinery, 5th Ed. Rev. Old Pond. Ipwich, U.K. (S675. B35 2008)

Borgman, D.E. 2008. Tractors: How to improve, maintain, and improve the performance of your tractor. Fundamentals of Machine Operation. Deere & Co., Moline, IL. (TL233.6. J64 B67 2008).

Goering, C.E., M.L. Stone, D.W. Smith and P.K. Turnquist. 2003 Off-Road Vehicle Engineering Principles. AKNOWETH Publication 801M 0103. St. Joseph, MI. (TL 235.6. G64 2003)

Hall, M. 2009. Engines: A service, testing, and maintenance guide for engine systems in off road vehicles, trucks, and buses. Fundamentals of Service. Deere & Co., Moline, IL. (ISBN: 0866913548)

Hathaway, I. 1991. Machinery Maintenance. Fundamentals of Machine Operation. Deere & Co., Moline, IL. (TL233.2. B83 1991)

Ortíz Cañavate, J. 2005. Tractores: Técnica y Seguridad. Ediciones Mundi-Prensa. Madrid, España. (TL233 .O78 2005)

Kuhar, J.E. 2006. Hydraulics: the fundamentals of service and theory of operation for hydraulic systems in off road vehicles, trucks, and buses. Fundamentals of Service Series. John Deere Publishing, Moline, IL. (TC160. H93 2006)

11. According to Law 51:

Law 51: The Comprehensive Educational Services Act for People with disabilities states that after identifying with the instructor and the institution, the student with disabilities will receive reasonable accommodation in their courses and evaluations. For more information contact the Department of Counseling and Psychological services at the Office of the Dean of Students (Office DE 21) or call 787-265-3864 or 787-832-4040 x 3772, 2040 and 3864.

12. Academic Integrity:

The University of Puerto Rico promotes the highest standards of academic and scientific integrity. Article 6.2 of the UPR Students General Bylaws (Board of Trustees Certification 13, 2009-2010) states that academic dishonesty includes, but is not limited to: fraudulent actions; obtaining grades or academic degrees by false or fraudulent simulations; copying the whole or part of the academic work of another person; plagiarizing totally or partially the work of another person; copying all or part of another person answers to the questions of an oral or written exam by taking or getting someone else to take the exam on his/her behalf; as well as enabling and facilitating another person to perform the aforementioned behavior. Any of these behaviors will be subject to disciplinary action in accordance with the disciplinary procedure laid down in the UPR Students General Bylaws.—.

13. Policy Against Discrimination Based on Sex, Sexual Orientation, and Gender Identity:

The University of Puerto Rico prohibits discrimination based on sex, sexual orientation, and gender identity in any of its forms, including that of sexual harassment. According to the Institutional Policy Against Sexual Harassment at the University of Puerto Rico, Certification Num. 130, 2014-2015 from the Board of Governors, any student subjected to acts constituting sexual harassment, may turn to the Office of the Student Ombudsperson, the Office of the Dean of Students, and/or the Coordinator of the Office of Compliance with Title IX for an orientation and/or formal complaint.

14. Sexual Harassment: Certification 130-2014-2015 states:

Sexual harassment in the workplace and in the study environment is an illegal and discriminatory act and is against the best interests of the University of Puerto Rico. All persons who understand they have been subject to acts of sexual harassment at the University of Puerto Rico may file a complaint and request that the institution investigate, where necessary, and assume the corresponding action by the university authorities. If the complainant is a student, he or she must refer his or her complaint to the Office of the Student Ombudsperson or that of the Dean of Students.

15. Certification 06-43 of the Academic Senate states, "The academic guidelines for offering online courses," defines:

Traditional face-to-face courses are those that have less than 25% of the course's regular contact hours via the Internet. Therefore, a three-credit course will be considered "face to face" if, of the 45 hours of regular contact, 11 or less are taught via the Internet. According to certification 16-43 of the Academic Senate, a course may include up to 25% of its total contact hours via the Internet. The objective of this is so that all professors have this alternative in the case of any unscheduled eventuality.