

**ANS6447 RUMINANT NUTRITION**  
(Section No. 6447)

**Academic Term:** FALL 2024 – 4 credits

**Class Periods:** Tuesdays and Thursdays, Periods 10 and 11 (17:10 to 19:05 h)

**Location:** Lectures and exams in person with some lecture online. Lectures are in room 102 (building 459), unless you are in a remote Research Center. All exams on campus. Zoom Meeting ID: 649-065-6162 (<https://ufl.zoom.us/j/6490656162>)

**Course Coordinator:**

José Eduardo P. Santos, Department of Animal Sciences, L.E. “Red” Larson Building, Room 204A

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**Instructor:**

José Eduardo P. Santos, Department of Animal Sciences, L.E. “Red” Larson Building, Room 204A

Contact: Email: [Jepsantos@ufl.edu](mailto:Jepsantos@ufl.edu); Tel: 352/294-6998

**Teaching Assistant: TBD**

**Office Hours:** Contact me anytime via e-mail ([jepsantos@ufl.edu](mailto:jepsantos@ufl.edu)) and we will schedule an appointment as needed.

**Course Content/Description**

An advanced course in ruminant nutrition designed to familiarize students with the anatomy and physiology of the ruminant digestive system as well as the digestion and metabolism of dietary nutrients for the purposes of growth, pregnancy, and lactation of ruminant animals, mainly bovine. Knowledge and application of information covered in lecture and in assigned readings will be evaluated during exams. Class-time discussion will be encouraged and rewarded. Students will use current software to formulate and evaluate ruminant diets. Commercial feed additives will be assigned to students who will evaluate and report their efficacy based upon the scientific literature.

**Goals of This Course** (Learning Objectives)

Upon completion of this course, students will have 1) a fundamental understanding and an in depth knowledge of ruminant nutrition and nutritional management of cattle, 2) developed critical thinking skills on experimental design and research techniques in ruminant nutrition, 3) an understanding of how dietary ingredients and nutrients are digested, absorbed, and metabolized in ruminants, 4) an understanding of the role of forestomach microbial fermentation and its implications to the provision of nutrients to the host animal, and 5) an understanding of the nutritional implications on animal health, growth, production, and reproduction. Completion of these goals will enable students to formulate viable hypotheses, plan/conduct experiments, and properly interpret results in ruminant nutrition. Diet formulation for ruminants is an expected outcome of the course.

### **Pre-Requisite**

ANS 5446 Animal Nutrition or approval of the instructor (s). Please, be aware that this is an advanced course. It is expected that all enrolled students have a minimum background in nutrition and biochemistry.

### **Course Format**

- Two two-period lectures per week.
- Many topics have an associated scientific article to read prior to lecture.
- Students will select 1 commercially marketed feed additive to study from the scientific and commercial literature to summarize in a Power Point presentation.

### **Schedule and Critical Dates**

Lectures on Tuesday and Thursdays, periods 10 and 11 (17:10 to 19:05). Weekly topics and critical dates are presented in table on the last page of the syllabus.

### **Membership**

Students are strongly encouraged to join American Dairy Science Association ([www.adsa.org](http://www.adsa.org)) and/or American Society of Animal Science ([www.asas.org](http://www.asas.org)). Cost is \$10/year for graduate students.

### **Suggested Text and Readings**

No textbook is required; however, the following books will be used as reference for some lectures:

**The Ruminant Animal – Digestive Physiology and Nutrition.** 1988. D.C. Church (Ed.), Prentice Hall, Englewood Cliffs, NJ.

**Nutritional Ecology of the Ruminant.** 1994. 2<sup>nd</sup> Edition. P.J. Van Soest, Cornell University Press, Ithaca, NY.

**Rumen Microbiology and Its Role in Ruminant Nutrition.** 2002. J.B. Russell. Cornell University. Ithaca, NY.

**Nutrient Requirements of Beef Cattle.** 2016. 8<sup>th</sup> Rev. Ed. National Research Council. National Academy Press. Washington, DC.

**Nutrient Requirements of Dairy Cattle.** 2021. 8<sup>th</sup> Rev. Ed., National Academy of Science, Engineering, and Medicine, NASEM Dairy. National Academy Press. Washington, DC.

**The Veterinary Clinics of North America – Food Animal Practice:** Metabolic Disorders of Ruminants. Vol 16, number 2, July 2000. W.B. Saunders, Philadelphia.

**Selected scientific articles** will be required reading throughout the semester. The manuscripts will be provided concurrent with class notes. Examples include the following:

Allen and Bradford. 2012. Control of food intake by metabolism of fuels: a comparison across species. Proc. Nutr. Society 71:401-409.

Titgemeyer, E.C. 1997. Design and interpretation of nutrient digestion studies. J. Anim. Sci. 75:2235-2247.

Doreau, M. and A. Ferlay. 1994. Digestion and utilization of fatty acids by ruminants. Anim. Feed. Sci. Technol. 45:379-396.

For each lecture, there will be 1 or 2 key review articles that you are required to study in detail. This material might be in exams or exercises.

### **Instructional Methods**

This course will be taught by José E.P. Santos. A TA for the course, whenever available, will assist with the lectures. Lectures will be the basis of instruction. Each lecture will have at least 1 or 2 scientific review articles that are required reading.

Students are expected to study the assigned papers either before or after each class to encourage discussion during lectures. **Assigned reading materials are part of the teaching materials and will be used to formulate exam questions.**

### **Grading**

For information on current UF policies for assigning grade points, see <https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/>.

#### **Exams and points**

	Percentage of final grade	Due Date/Date of Exam
1 <sup>st</sup> Exam	25%	01 October 2024
2 <sup>nd</sup> Exam	25%	31 October 2024
Ration formulation exercise	10%	02 December 2024
Feed additive presentation	10%	03 December 2024
Final cumulative exam	30%	10 December 2024
Class participation	5% extra	Entire semester
Total	100%	

#### **Grading scale (% total points)**

A = 93-100	A- = 88-92.9	B+ = 83-87.9	B = 78-82.9	B- = 73-77.9	C+ = 68-72.9
C = 63-67.9	C- = 58-62.9	D+ = 53-57.9	D = 48-52.9	D- = 43-47.9	E < 43

### **Exams**

There will be 3 exams worth 100 points each. The first 2 exams will represent each 25% of the final grade and the final exam, comprehensive, will represent 30% of the final grade. The material covered in the exam will be detailed prior to each exam. Exams will be in-presence in Animal Sciences room 102 (unless we have to change) from 17:10 to 19:05 h. Bring pen, pencil and calculator. Cell phones or computers not allowed.

**Feed additive presentation**

See topics to be selected at the end of this syllabus. Details about the oral presentation will be discussed in class. Number of presentations will depend on the number of students registered so we have enough time for the presentations and discussions. The format of the presentation is the same as that used during a scientific meeting, a specific time allotted for presentation and the remaining time allotted for discussion. Do not go over the time allotted for presentation.

**Ration formulation exercise**

We will have a lecture to show the mechanics of how to use a ration formulation software. See schedule of classes. A ration formulation exercise will be prepared, and the deadline is depicted in the schedule of lectures.

**Recording of Lectures**

Students on campus are expected to attend the lectures in person, unless a justifiable issue occur (illness, travel, etc.), or unless we have an online lecture. Please discuss with the instructor ahead of time if you need to be absent in a lecture or if you need to attend it virtually. All lectures will be recorded in Zoom and students will have the opportunity to review them. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

**Attendance and Make-Up Work**

Attendance will not be taken. You are expected to attend the lectures. Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>.

**Software Use:**

All faculty, staff, and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

**Online Course Evaluation Process**

Student assessment of instruction is an important part of efforts to improve teaching and learning. At the end of the semester, students are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals.

Guidance on how to give feedback in a professional and respectful manner is available at: <https://gatorevals.ua.ufl.edu/students/>. Students will be notified when the evaluation period opens and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluer.com/ufl/>. Summaries of course evaluation results are available to students at:

<https://gatorevals.ua.ufl.edu/public-results/>.

**Academic Honesty**

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: *"We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity."* You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: *"On my honor, I have neither given nor received unauthorized aid in doing this assignment."*

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g., assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: <http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code>.

### **Services for Students with Disabilities**

The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation 0001 Reid Hall, 352-392-8565, <https://disability.ufl.edu/>

### **Campus Helping Resources**

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, [www.counseling.ufl.edu](http://www.counseling.ufl.edu)

Counseling Services  
Groups and Workshops  
Outreach and Consultation  
Self-Help Library  
Wellness Coaching

- U Matter We Care, [www.umatter.ufl.edu/](http://www.umatter.ufl.edu/)
- Career Connections Center, First Floor JWRU, 392-1601, <https://career.ufl.edu/>.

### Student Complaints:

- Residential Course: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>.
- Online Course: <http://www.distance.ufl.edu/student-complaint-process>

### **Additional information**

Class notes and reading materials will be forwarded to students before each lecture. Students are expected to attend the lectures and participate during discussions. Participation is encouraged and will be evaluated and awarded up to 5 pts in your final grade.

Students are expected to study the reading assignments to be able to actively engage in discussions. We will have a break half-way through each lecture. Please, do not use cell phones, email, or internet during lectures. You can do that during the break or after class. Please, do not hesitate to contact the instructor if you are having problems during the course.

### **Feed additive assignment topics**

Group	Active compound	Commercial product
1. Acidogenic products	Cl or S product	Bio-Chlor, SoyChlor, Animate
2. Beta-adrenergic receptor agonists	Zilpaterol or Ractopamine	Zilmax, Optaflexx
3. Dietary immune-stimulant	Not described	Omnigen-AF
4. Ionophores	Monensin or Lasalocid	Rumensin, Bovatec
5. Methane inhibitor	3-Nitrooxypropanol	Bovaer
6. Nutrient – Vitamin	Biotin	Rovimix biotin
7. Nutrient – Vitamin	Beta-carotene	Rovimix beta carotene
8. Nutrient - Rumen-protected choline	Choline chloride	Reashure, Jefe Choline
9. Nutrient – Protected amino acids	Lysine	Ajipro-L, AminoShure L
10. Nutrient – Protected amino acids	Methionine	Smartamine, Mepron
11. Nutrient – Protected amino acids	Methionine analog	Meta-Smart, Alimet
12. Nutrient – Encapsulated NPN	N	Optigen or Nitroshure
13. Nutrient – Rumen-protected niacin	Niacin	Niashure
14. Nutrient – Fermentation based product	Protein	Fermenten
15. Nutrient - Organic trace minerals	Zn, Cu, Mn, Co	Bioplex, Availa
16. Nutrient – hydroxychloride minerals	Cu, Zn, Mn	IntelliBond
17. Nutrient - Selenized yeast	Se	Sellplex, Alkosel
18. Mycotoxin adsorbents	Silicate-based products	Mycofix, Novasil, etc
19. Mycotoxin adsorbents	Yeast-based products	Mycosorb A, Bio-Moss
20. Yeast culture or live yeast product	Saccharomyces cerevisiae	Diamond V, Levucell
21. Mineral binders	sodium aluminum silicates or Zeolite A	CalBal, X-Zelit, etc

## Course content<sup>†</sup>

Week	Day	Date	Lecture	Topic	Instructor*
1	Thursday	22-Aug-24	1	Introduction to course. Importance of the Ruminant Animal	JS
2	Tuesday	27-Aug-24	2	Anatomy of the digestive tract, motility, rumination and salivation	JS
2	Thursday	29-Aug-24	3	Development of pre-stomach and calf nutrition	JS
3	Tuesday	3-Sep-24	4	Rumen microbes and rumen fermentation	DV
3	Thursday	5-Sep-24	5	SCFA absorption, control of rumen fluid pH and osmolarity	JS
4	Tuesday	10-Sep-24	6	Kinetics of digestion in the rumen	DV
4	Thursday	12-Sep-24	7	N requirements of rumen microbes and microbial efficiency	JS
5	Tuesday	17-Sep-24	8	Control of feed intake in ruminants	JS
5	Thursday	19-Sep-24	9	Control of feed intake in ruminants	JS
6	Tuesday	24-Sep-24	10	Energetics	JS
6	Thursday	26-Sep-24	11	Energetics	JS
7	Tuesday	1-Oct-24		<b>FIRST EXAM</b>	
7	Thursday	3-Oct-24	12	Structural carbohydrate digestion	JS
8	Tuesday	8-Oct-24	13	Nonstructural carbohydrate digestion	JS
8	Thursday	10-Oct-24	14	Protein digestion in the forestomach and synergism between protein and CHO	JS
9	Tuesday	15-Oct-24	15	Amino acid absorption and post-absorptive metabolism	JS
9	Thursday	17-Oct-24	16	Lipid metabolism in the rumen	JS
10	Tuesday	22-Oct-24	17	Digestion, absorption, and metabolism of lipids	JS
10	Thursday	24-Oct-24	18	Post-absorptive metabolism of energy compounds	JS
11	Tuesday	29-Oct-24	19	Impacts of nutrition on milk composition	JS
11	Thursday	31-Oct-24		<b>SECOND EXAM</b>	
12	Tuesday	5-Nov-24	20	Disorders of the intermediary metabolism (ketosis and hepatic lipidosis)	JS
12	Thursday	7-Nov-24	21	Disorders of mineral metabolism (Ca, P and Mg)	JS
13	Tuesday	12-Nov-24	22	Disorders of carbohydrate digestion (acidosis, bloat, PEM, DA)	DV
13	Thursday	14-Nov-24	23	Function, absorption and metabolism of trace minerals	DV
14	Tuesday	19-Nov-24	24	Function, absorption, and metabolism of fat-soluble vitamins	JS
14	Thursday	21-Nov-24	25	Ration Formulation Software Laboratory <sup>§</sup>	JS
15	Tuesday	26-Nov-24	25	<b>Holiday - No class (Thanksgiving week)</b>	XXXX
15	Thursday	28-Nov-24	26	<b>Holiday - No class (Thanksgiving week)</b>	XXXX
16	Tuesday	3-Dec-24	27	Feed additive assignment presentations by students	JS
16	Thursday	5-Dec-24		<b>READING DAY - NO CLASS</b>	XXXX
17	Tuesday	10-Dec-24		<b>FINAL COMPREHENSIVE EXAM (on campus everyone)</b>	XXXX

<sup>†</sup> We will follow the proposed dates and content; however, we might have to accommodate a few changes because of other events such as the ANS symposium, etc.

\*Instructors: JS = José Santos; DV = Diwakar Vyas.

<sup>§</sup> Exercise due on 02 December 2024.