



**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani**  
**Pilani Campus**  
**AUGS/ AGSR Division**

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**SECOND SEMESTER 2020-21**  
**COURSE HANDOUT**

**Date: 15.01.2021**

In addition to part I (General Handout for all courses appended to the Time table) this portion gives further specific details regarding the course.

**Course No** : **BIO F315**

**Course Title** : **APPLIED NUTRITION AND NUTRACEUTICALS**

**Instructor-in-Charge** : **Dr. Sudeshna Mukherjee** ([sudeshna@pilani.bits-pilani.ac.in](mailto:sudeshna@pilani.bits-pilani.ac.in))

**Instructor(s)** : **Prof. P. R. Deepa** ([deepa@pilani.bits-pilani.ac.in](mailto:deepa@pilani.bits-pilani.ac.in))

**1. Course Description:**

This course will provide a broad framework for understanding the significance of food and nutrition to human health and well-being. Beginning with basic concepts in nutritional biochemistry & microbiology, this course will expand into applied nutrition themes — malnutrition – under-nutrition versus over-nutrition, nutrigenomics, clinical nutrition, functional foods & nutraceuticals, food safety and security. The course will also include themes such as industrial development of functional and genotype-specific foods and beverages (example, infant-food formulations), fortified foods, phytochemicals, nutritional databases & personalized nutritional plan, using suitable case-studies.

**2. Scope and Objective of the Course:**

This course is designed to provide insight in the basic concepts as well recent advances in the area of nutrition related to human health. At the end of the course, students will be able to: a. Inter-relate concepts learned in Biology/Chemistry/Pharmacy courses and will appreciate their integration in human nutrition and in disease therapy. They can understand how some nutrients ‘promote’ health or ‘affect’ health (nutritional toxicology), through their molecular/gene interactions. Appreciate mechanism of action of functional foods, nutraceuticals and dietary supplements. Explore how certain diseases (cardiovascular diseases, diabetes, cancers, obesity, inborn errors of metabolism) can be managed by nutritional approach. Appreciate the growing strategic collaborations/alliances between food and pharma companies — immense potential in research and product development/innovations in food biotechnology and nutraceuticals. Realize the immense role that India can play in the growing nutraceutical/functional foods industry, given the knowledge that is available in traditional systems of medicine.



### 3. Text Books:

- i). Textbook of Biochemistry & Human Biology, Third Edition, 2002 (Ed: GP Talwar & LM Srivastava), Prentice Hall India.
- ii). Harper's Illustrated Biochemistry 31<sup>st</sup> Edition, 2018, McGraw Hill [Authors: Robert Murray, et al.]
- iii). Introduction to Human Nutrition, Second Edition, 2009 [ Edited on behalf of The Nutrition Society by Michael J Gibney, Susan A Lanham-New, Aedin Cassidy, Hester H Vorster], Wiley Blackwell Publication.

### 4. Reference Books:

- i) Clinical Nutrition. 2nd edition, Marinos Elia, Olle Ljungqvist, Rebecca J Stratton and Susan A Lanham-New, 2013.
- ii) Relevant review articles/ research articles will be discussed in class to enhance coverage of select topics.

### 5. Course Plan:

Module No.	Lecture Session	Reference	Learning outcomes	Module No.
I	L# 1-2: Introduction – Broad spectrum view of applied nutrition	Definitions – Food, nutrient, balanced diet, food pyramid, malnutrition (under/over nutrition). Food, Nutrients and Energy Metabolism. Chirality of biomolecules – pharma applications. Age-dependent nutritional needs Special nutritional needs (maternal nutrition, high altitude nutrition). Applications – Food biotechnology, Nutraceuticals, Clinical Nutrition, Nutritional deficiencies/toxicity and Public Health.	Chap 33-35, 37-39, TB1; Chap 43, TB2, Chap 3, TB3; Chap 1 RB-1.	Overview of fundamental aspects of nutrition and its applications in health, medicine, food industry and public health policy.
II	L# 3-5: Food Microbiology	Microorganisms in food spoilage, food borne diseases, food fermentation, food safety.	Chap 14, TB3	Understanding different roles of microbes related to food preservation and safety.
III	L# 6-13: Nutritional Biochemistry in Health and Disease	Macromolecules – Integration of topics related to carbohydrate/lipid and energy metabolism, protein and amino acids - Enzyme & Hormonal Regulation – Potential Clinical/Pharmacologic Targets (in metabolic syndrome, diabetes, cancer, cardiovascular disease).  Micronutrients - Deficiency and Toxicity conditions.	Chap 40-45, TB1; Chap 13, 16, 17, 44, 45, 58 (Biochemical Case Histories) TB2	Relating the key biochemical metabolisms to nutrition with emphasis on antioxidant nutrients.



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		Oxidative stress and the cell and molecular roles of dietary antioxidants and pro-oxidants with implications in certain diseases. Free radicals production, lipid peroxidation, protein oxidation, cellular and DNA damage will be discussed with examples (cardiovascular disease, cancer, diabetes). Emphasis on dietary antioxidants - vitamins E and C, carotenoids, polyphenols, selenium, iron, zinc and copper in antioxidant defense mechanisms.		
IV	L# 14-19: Clinical Nutrition	<ul style="list-style-type: none"> <li>Role of nutrition in the prevention and management of several major chronic clinical conditions and Metabolic Syndrome: Obesity, Liver diseases, Cancers, Cardiovascular diseases (CVDs), Diabetes, Renal Diseases</li> <li>Nutritional Management of <i>Inborn errors of metabolism</i>.</li> </ul>	Chap 32, 39 TB1	To understand how diseases are managed through dietary interventions.
V	L# 20-23: Nutritional toxicology	Allergenic and toxic constituents in diet - food supplement toxicity – food additives toxicity - environmental contaminants, pesticides and other chemical residues - mutagenesis, carcinogenesis; including case studies / regulations	Chap 14, TB3	To understand several types of chemical toxins exposure that human beings encounter through food.
VI	L# 24-26: Nutrigenomics and nutrition databases	Understanding nutrient-gene interactions, with case studies in cancers and cardiovascular diseases. Development of nutrition databases / personalized nutrition plans; case studies.	Chap 4, TB3	Understanding the molecular role of specific nutrients in diseases, and to kindle interest in the growing field of personalized nutrition.
VII	L# 27-29: Nutraceuticals	Phytochemicals, functional foods, Plant and animal sources - Milk and Dairy products – Prebiotics and Probiotics.	Chap 37 TB1	To appreciate the medicinal value of natural and formulated foods.
VIII	L# 30: Course Summary	Pointers for R&D and industry applications, and public health policy.	Chap 7, 12, 14, 15 TB3.	Recapitulating the course contents and their immense scope in food industry, nutrition research/innovations and developing community health framework.



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**6. Evaluation Scheme:**

Component	Duration	Weightage (%)	Date & Time	Nature of component (Close Book/ Open Book)
Mid-Semester Test	90 Min.	30	<TEST_1>	CB/OB
Comprehensive Examination	3 h	35	<TEST_C>	CB/OB
Quiz/ Assignment/ Case-study/ Mini-Project	Will be announced in class	35	Quiz & in-class assignment may be conducted surprise or announced. For other components, specific schedule will be announced in class for submission / presentation.	CB/OB

**7. Notices:** Notices will be displayed on Nalanda / Google Classroom.

**8. Make-up Policy:** Make up may be granted only to genuine cases such as hospitalization. No make up for quiz under any circumstances.

**9. Note (if any):**

(i) Regular attendance and active participation in class will be monitored and recorded. Absenting from classes without prior permission, lack of punctuality in reporting to class, non-submission of evaluative reports/assignments as per the scheduled time-line, can all impact Grades during evaluation.

(ii) Mini-projects will be allotted only to the students present in the class during the project topic allotment and discussion session. In-absentia students will not be considered for mini-project seminar/report evaluations.

**Instructor-in-charge**  
**Course No. BIO F315**