

COURSE TEMPLATE

1.	Department / Centre proposing the course	School of Biological Sciences
2.	Course Title (<i>< 45 characters</i>)	INTRODUCTORY BIOLOGY FOR ENGINEERS
3.	L-T-P structure	3 - 0 - 2
4.	Credits	3 . 0
5.	Course number	SBL100
6.	Status (<i>category for program</i>)	Core 100 level course in biological sciences in the new UG curriculum

7.	Pre-requisites (<i>course no./title</i>)	NIL
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	None
8.2	Overlap with any UG/PG course of other Dept./Centre	None
8.3	Supercedes any existing course	None

9.	Not allowed for (<i>indicate program names</i>)	-N. A.-
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10.	Frequency of offering	☐ Every sem ☐ 1 st sem ☐ 2 nd sem ☒ Either sem
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11.	Faculty who will teach the course A. Mittal, J. Gomes, B. Jayaram, B. Kundu, A. Chugh, C. S. Dey, M. Banerjee, T. K. Chaudhuri, V. Perumal, S. E. Hasnain	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): To introduce students to modern biology with an emphasis on evolution of biology as a multi-disciplinary field, to make them aware of application of engineering principles in biology, and engineering robust solutions inspired by biological examples.	
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Darwinian evolution & molecular perspective; Introduction to phylogeny - Classification systems in biology and relationships; Cellular assemblies – From single cell to multi-cellular organisms: Geometry, Structure and Energetics; Comparing natural vs. human-made machines; Infection, disease and evolution – synergy and antagonism; Immunology – An example of permutations and combinations in biology; Cancer biology – Control and regulation; Stem cells – Degeneracy in biological systems; Engineering designs inspired by biology – Micro- to Macro- scales.	
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	Laboratory: Biosafety; Buffers in biology - Measuring microlitres, Preparation of standard biological buffers, buffering capacity and pKa of buffers, response of cells and plant tissues in different buffering conditions; Observing cell surface and intracellular contents using light and fluorescence microscopy, measuring cellular motion using real-time video microscopy; Measuring and visualizing intracellular molecular components - Proteins and Genomic DNA.
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15. Lecture Outline *(with topics and number of lectures)*

Module no.	Topic	No. of hours
1	Darwinian evolution & molecular perspective	6
2	Phylogenetic trees, study of inter- and intra- species relationships	6
3	Cellular assemblies – From single cell to multi-cellular organisms: Geometrical and Structural constraints	4
4	Organismal physiology – Energy and energetic constraints	5
5	Infection, disease and evolution – synergistic effects vs. antagonism	3
6	Immunology – Self vs. Non-self, bacterial viruses, human immune system, permutations and combinations in biology	6
7	Cancer biology – Control systems in biology	3
8	Stem cell biology – Degeneracy in biology	3
9	Engineering designs inspired by examples in biology	3
10	Engineering aspects of some Nobel Prizes in Physiology and Medicine & Chemistry	3
11		
12		
COURSE TOTAL (14 times 'L')		42

16. Brief description of tutorial activities

-N. A. -

17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours
1	Biosafety laboratory practices - use of lab coats, gloves, safety goggles, eye wash, shower, chemical and biological waste disposal	2
2	Buffers in biology - Preparation of standard biological buffers, buffering capacity and measuring pKa of buffers, behavior of biomolecules, whole cells and plant tissues in different buffering conditions	8
3	Observing cell surface and intracellular contents using light and/or fluorescence microscopy	5
4	Measuring mechanical strength of cells (plant cells, protoplasts, chicken red blood cells) membranes using osmolarity - elasticity of biological membranes	5
5	Protein and DNA isolation from plant cells, visualization of proteins and DNA	8
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COURSE TOTAL (14 times 'P')		28

18. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

Miko, I. & LeJeune, L., eds. Essentials of Genetics. Cambridge, MA: NPG Education, 2009.
 O'Connor, C. M. & Adams, J. U. Essentials of Cell Biology. Cambridge, MA: NPG Education, 2010.
 Warson JD, Baker, TA, Bell SP, Gann A, Levin M, Losick R, MOlecular Biology of the Gene,

Pearson Education, 2004.

Reference Texts

Dawkins, R. The Greatest Show on Earth: The Evidence For Evolution, Bantam Press, Transworld Publishers, Random House Group, London, 2009.

Dawkins, R. The Blind Watchmaker, W. W. Norton & Co., NY, 1996.

Watson, J. D. The Double Helix: A Personal Account of the Discovery of the Structure of DNA (Copyright © 1968, 1996 by James D. Watson), Simon & Schuster Inc., first Touchstone Edition (2001).

19. Resources required for the course *(itemized & student access requirements, if any)*

19.1	Software	No
19.2	Hardware	Student owned computers/laptops
19.3	Teaching aides (videos, etc.)	Projector
19.4	Laboratory	Yes
19.5	Equipment	Yes- Standard biology laboratory equipment (e.g. micropipettes, glassware, weighing balances, magnetic stirrers, spectrophotometers, electrophoresis apparatuses for DNA and protein gels, Microscopes with camera etc.)
19.6	Classroom infrastructure	Yes
19.7	Site visits	No

20. Design content of the course *(Percent of student time with examples, if possible)*

20.1	Design-type problems	0
20.2	Open-ended problems	20% (comparison of organismal physiologies/structures and morphogenesis)
20.3	Project-type activity	0
20.4	Open-ended laboratory work	0
20.5	Others (please specify)	0

Date: February 13, 2013

(Signature of the Head of the Department)