

Minor Area in Biodesign

Preamble

One of the major unaddressed challenges in our country lies in providing nutrition and affordable healthcare to one and all. Affordability of health care is a serious problem for the vast majority of country's population. Technology and innovation can play an important role in addressing some of the major grand challenges being faced in healthcare sector and institutes/universities can be potential public spaces for such innovations and for development of necessary human resources.

One of the areas where institute has now significant human resources is in terms of faculty in the area of biodesign. Some of the areas of biodesign where faculty is active include: diagnostic tools/devices (including lab-on-chip and point-of-care diagnostic devices), medical implants (including tissue engineered constructs and implantable organic electronic devices), assistive & rehabilitation devices, health systems and informatics. Institute also has large pool of new generation of students who have shown vast interest in working in multi-disciplinary teams towards solutions for healthcare needs. This interest among students was also clearly evident during recent workshops organized for students in the area of medical device design. Over the years institute has established strong relations with many hospitals and medical institutes in the NCR region. In other words institute is ready to undertake and develop an ecosystem for biodesign education and innovation. The proposed minor area in Biodesign is a major step in building such an ecosystem facilitating students and faculty to take their innovative ideas in medical technology from classrooms/labs to society.

The objectives of the proposed minor area is to sensitize and excite students about role of medical technology in addressing national health needs and to provide opportunity to engage in design & innovation. It will also provide opportunity for students/faculty to engage in coming up with affordable solutions in the area of medical technology. Such courses will draw guest/adjunct faculty from AIIMS and other medical institutes of repute. The proposed endeavour will also facilitate students and faculty from different departments/centers/schools to join hands which is a prerequisite for projects in the area of medical technology. Some of these projects will have faculty mentors from AIIMS and other institutes of repute.

Courses

Following courses would be available for students to complete minimum 20 credits to qualify for minor area in Biodesign.

Name of the Course	Department Offering the Course	Faculty Who will Teach This Course	Relevance to Minor Area
Medical Device Design	Interdisciplinary Course (Course owned by Group)	All Faculty of Biodesign Group	Mandatory Course for Minor Area.
Medical Robotics	Mechanical Engineering	Jitendra Prasad Khatait	Cover design and development of robots for medical applications

Biomechanics	CBME	Dinesh Kalyanasundaram; Sitikantha Roy;	A fundamental course needed for design of many medical devices
Mechanics of Biological Cells	Applied Mechanics	Nivedita K Gohil, Dinesh Kalyanasundaram; Sitikantha Roy; Ravikrishnan Elangovan; Sasidhar Kondaraju.	Introduction and design of devices to study mechanical phenotype at cellular scale (prototype optical tweezer, microfluidic setup etc). Design and analysis of mechanics based disease diagnostic tools (optomechanical, mechanical, electromechanical) at cellular scale (for e.g cancer metastasis can be quantified by measuring the rheological properties of the malignant cells.)
Mechanics of Soft Materials or Tissue Mechanics	Applied Mechanics	Sitikantha Roy; Anamika Prasad, Naresh Datla, Devendra Kumar Dubey	A fundamental course needed for design of many medical devices.
Mechanical Behaviour of Biomaterials	Applied Mechanics	Anamika Prasad; Sitikantha Roy; Naresh Verma Datla;	This is a foundation course to learn constitutive behavior of polymeric, tissue like material, tissue device interaction, stability and placement.
Thermo-fluid analysis in biosystems	Mechanical Engineering	Amit Gupta; Supreet Singh Bahga; Shubhra Datta; Sasidhar Kondaraju	A fundamental course needed for design of microfluidic devices including lab-on-chip devices
**Medical Textiles	Textile	Sourabh Ghosh	Polymers and textile based techniques for medical applications
**Biomaterials	CBME	Harpal Singh, Neetu Singh	Processing and characterization of biomaterials for medical applications.
**Tissue Engineering	CBME	Neetu Singh, Sourabh Ghosh	Tissue regeneration, healing and fabrication of scaffolds for Medical Applications.
**Biosensor Technology	CBME	Sandeep Jha	Measurement principles, and biotechnological components of biosensors for sensing of biocomponents.

Point of Care Medical Diagnostic Devices	CBME	Sandeep Jha	Principles of diagnostics and fabrication of personalized diagnostic tools. Useful for design of POC diagnostic devices.
Biofabrication	CBME	Dinesh Kalyanasundaram	Fabrication of tissues, organs and also expose them to fabrication of related biomedical devices (in the 'm' to 'nm' scale).
Medical Device Design for Orthopaedic Applications	CBME	Dinesh Kalyanasundaram	Advanced course on biomechanics with a focus to develop devices for orthopaedic applications.
Medical Imaging	CBME	Anup Singh, Amit Mehndiratta	Fundamentals of medical imaging (MRI, CT scan, PET etc)
Special Topics in Biodesign	Interdisciplinary Course (Course owned by Group)	All Faculty of Biodesign Group	Special topics relevant to design of medical devices.
Minor Biodesign Project	Interdisciplinary Course (Course owned by Group)	All Faculty of Biodesign Group	A project course to take medical devices from proof-of-concept prototype to functional prototype
Molecular Biotechnology and In Vitro Diagnostics	Chemical	Shalini Gupta; Ravikrishnan Elangovan	This course aims to provide a deeper understanding in central basic diagnostic technologies, principles & applications as they are found in modern state-of-art diagnostic systems. A successfully completed course should enable the student to extract the latest findings from the scientific literature relating to the various fields of analytical biotechnology and design a functional diagnostic platform for a particular disease.
Flexible Electronics	Electrical	Madhusudan Singh	A course needed for an understanding of challenges involved in the integration of electronic and optoelectronic instrumentation on flexible/conformal/biologically relevant substrates.
Product Interface Design	IDDC	Jyoti Kumar	A course which students can opt to design user interfaces, of medical devices. It will cover HMI and HCI aspects too.

**Introduction to Basic Medical Sciences for Engineers	CBME	Nivedita K Gohil	This course gives a basic introduction on the medical sciences to engineers.
**Industrial Biomedical Technology	CBME	Veena Koul	This course explains the procedures on how the devices are taken from lab to the market and details on sterilization requirements, biocompatibility, good manufacturing practices (GMP) etc.

** Indicates existing courses

Faculty

Following faculty members across the institute have agreed to actively participate in the proposed minor area of Biodesign. Prof Veena Koul, Head CBME will be overall coordinator of this group.

S. No	Name	Affiliation	Specialization
1	Supreet Singh Bahga	Mechanical Engineering	Microscale heat, mass, and fluid transport phenomena, electrokinetics, low-cost diagnostics
2	Naresh Bhatnagar	Mechanical Engineering	Processing of Plastics & Composites; Biomaterials; Design of Implants & Medical Devices
3	Nomesh B Bolia	Mechanical	Operations research; Healthcare Informatics
4	Naresh Verma Datla	Mechanical	Designing surgical devices; Mechanics of tissue-device interactions
5	Subhra Datta	Mechanical	Fluid Dynamics, Mass Transfer and Bio-artificial organs
6	Saakshi Dhanekar	CARE	Nano-sensors, Microfluidics, Porous Silicon fabrication and applications for chemical and bio-detection
7	Devendra Kumar Dubey	Mechanical Engineering	Computational Materials Science, Biomaterials, Bio & Nano mechanics, Biomedical Implants
8	Ravikrishnan Elangovan	DBEB	Biophysics, fluorescence imaging, in vitro diagnostics
9	Sourabh Ghosh	Textile	Silk-based biomaterials, Tissue engineering, Medical Textiles
10	Amit Gupta	Mechanical Engineering	Thermofluids
11	Shalini Gupta	Chemical	Colloids and interfaces for bioapplications
12	Sandeep K Jha	CBME	lab-on-a-chip, biosensors

13	Dinesh Kalyanasundaram	CBME	DNA based diagnostics, Orthopaedics, laser machining
14	Jitendra Prasad Khatait	Mechanical	Mechatronics, Medical device design
15	Sasidhar Kondaraju	Mechanical Engineering	Droplet and Cell sorting, Blood rheology, Fluid Mechanics, Interfacial science
16	Veena Koul	CBME	Biomaterials, Medical Devices, Clinical Diagnostics, Drug Delivery
17	Jyoti Kumar	IDDC	User Centered Design and Testing
18	Anamika Prasad	Applied Mechanics	Cardiovascular Biomechanics
19	P.V.M. Rao	Mechanical	Product Design & Manufacturing; Design of Medical and Assistive Devices
20	Sitikantha Roy	Applied Mechanics	Soft materials, Mechanobiology, Computational solid and fluid mechanics, mechanics based diagnostic tools
21	Madhusudan Singh	Electrical	Flexible optoelectronics, low cost fabrication methods, solar cells.
22	Neetu Singh	CBME	Smart Functional Nanomaterials and Tissue engineering
23	Anup Singh	CBME	Medical Imaging, Image Processing and mathematics
24	Nivedita K Gohil	CBME	Vascular mechanics, mechano-biology of cancer cells
25	Sneh Anand	CBME	Biomedical Instrumentation and rehabilitation
26	Harpal Singh	CBME	Nanomedicine, biomaterials and medical diagnostics
27	Amit Mehndriatta	CBME	Medical Physiology, medical imaging, mobile health, time series analysis

(Prof Veena Koul)

Group Coordinator for Minor Area in Biodesign

COURSE TEMPLATE

1.	Department/Centre proposing the course	Interdisciplinary Biodesign Group	
2.	Course Title	MEDICAL DEVICE DESIGN	
3.	L-T-P structure	2-0-4	
4.	Credits	2 Credits and 2 Design Units	
5.	Course number	XXX 7XX	
6.	Status	Elective Course for UG/PG Students	

7.	Pre-requisites (course no./title)	50 Credits Completion for UG Students	
----	---	---------------------------------------	--

8.	Status vis-à-vis other courses (give course number/title)		
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	N/A	

9.	Not allowed for (indicate program names)		
----	--	--	--

10.	Frequency of offering	☐ Every sem ☐ 1 st sem ☐ 2 nd sem ☒ Either sem	
-----	------------------------------	---	--

11.	Faculty who will teach the course Interested faculty in the biodesign programme		
-----	---	--	--

12.	Will the course require any visiting faculty?	No.	
-----	--	-----	--

13.	Course objective (about 50 words): Course would introduce medical technology and process of medical device design as a first course to UG/PG interested students. At the end of course, students should have learnt the process of medical device design through lectures and have gained some experience by addressing a small healthcare need by coming up with a work-alike prototype of a device by working in teams. Course will also expose students to opportunities in medtech and possible career options through case studies and guest lectures.		
-----	---	--	--

14.	Course contents (about 100 words) (Include laboratory/design activities): The course contents will include lectures and hands-on experience covering: 1) introduction to medical needs, identification of need by immersion, through physicians and policy makers. 2) state fundamentals of the need being addressed, market analysis, stakeholder analysis. 3) technology or system based solution to address the need by ideation and brainstorming and prototyping. 4) evaluation of alternate solutions by applying filters including regulatory considerations, markets, IP, business and impact. 5) demonstration of solution proposed through prototyping and testing.		
-----	--	--	--

15. Lecture Outline *(with topics and number of lectures)*

Module no.	Topic	No. of hours
1	Introduction to medical device design course and its significance in the current scenario	2
2	Basic human physiology, communicable and non-communicable diseases	2
3	Different approaches to medical device design	2
4	Considerations in medical device design	4
5	Case studies of medical device design	4
6	Identification of need, immersion, disease burden, disease state fundamentals, and the need for validation	4
7	Development of concepts, ideation & brainstorming, evaluation of concepts, risk/benefit analysis	3
8	Usability analysis & methods of prototyping	2
9	User feedback, stakeholder analysis & characterization	2
10	IP and regulatory requirements	2
11	Conclusions	1
12		
COURSE TOTAL (14 times 'L')		28

16. Brief description of tutorial activities

Not Applicable

17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours
1	Study of few commercial medical devices	8
2	Immersion in hospitals & primary healthcare centers	8
3	Process of need identification	8
4	Development and evaluation of concepts, Risk/benefit analysis	8
5	Prototyping	8
6	Feedback from stakeholders	8
7	Concept refinement	4
8	Final Presentations	4
9		
10		
COURSE TOTAL (14 times 'P')		56

18. Suggested texts and reference materials

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

1. Biodesign - The process of innovating medical technologies by Paul G. Yock, Stefanos Zenios, Joshua Makower and Todd J. Brinton
2. Medical device design: Innovation from concept to market by Peter J Ogradnik
3. The design and manufacture of medical devices by J Paulo Devim

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

19.1	Software	yes
19.2	Hardware	yes
19.3	Teaching aides (videos, etc.)	yes
19.4	Laboratory	ideation, brainstorming & prototyping facilities
19.5	Equipment	Some successful medical devices
19.6	Classroom infrastructure	None in particular
19.7	Site visits	yes

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

20.1	Design-type problems	65%
20.2	Open-ended problems	80%
20.3	Project-type activity	90%
20.4	Open-ended laboratory work	10%
20.5	Others (please specify)	

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Interdisciplinary Biodesign Group	
2.	Course Title (<i>< 45 characters</i>)	MINOR BIODESIGN PROJECT	
3.	L-T-P structure	0-0-8	
4.	Credits	4	
5.	Course number	XXX 7XX	
6.	Status (<i>category for program</i>)	Elective Course for UG/PG Students	

7.	Pre-requisites (<i>course no./title</i>)	50 Credits Completion for UG Students	
-----------	--	---------------------------------------	--

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	N/A	

9.	Not allowed for (<i>indicate program names</i>)		
-----------	---	--	--

10.	Frequency of offering	☐ Every sem ☐ 1 st sem ☐ 2 nd sem ☒ Either sem	
------------	------------------------------	---	--

11.	Faculty who will teach the course Interested faculty in the biodesign programme		
12.	Will the course require any visiting faculty?	No	

13.	Course objective (<i>about 50 words</i>): Course will provide opportunity to build functional propototypes of Medical Devices from concepts.		
------------	--	--	--

14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): The course will cover activities pertaining to design-build-test-modify iterations in order to build functional prototypes of medical devices.		
------------	--	--	--

15. Lecture Outline *(with topics and number of lectures)*

Module no.	Topic	No. of hours
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
COURSE TOTAL (14 times 'L')		

16. Brief description of tutorial activities

Not Applicable

17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours
1	Activities covering design-build-test-modify iterations to build functional prototypes of medical devices (such as scaffolds, implants, imaging or imaging processing tools etc).	88
2	Interim evaluation of projects after submission of interim report	4
3	final evaluation of projects after submission of final report	4
4		
5		
6		
7		
8		
9		
10		
COURSE TOTAL (14 times 'P')		96

18. Suggested texts and reference materials

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

--

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

19.1	Software	yes
19.2	Hardware	yes
19.3	Teaching aides (videos, etc.)	yes
19.4	Laboratory	ideation, brainstorming & prototyping facilities
19.5	Equipment	Some successful medical devices
19.6	Classroom infrastructure	None in particular

19.7	Site visits	yes
------	-------------	-----

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

20.1	Design-type problems	65%
20.2	Open-ended problems	80%
20.3	Project-type activity	90%
20.4	Open-ended laboratory work	10%
20.5	Others (please specify)	

Date: 8th October 2014

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Interdisciplinary Biodesign Group	
2.	Course Title (<i>< 45 characters</i>)	SPECIAL TOPICS IN BIODESIGN	
3.	L-T-P structure	3-0-0	
4.	Credits	3	
5.	Course number	XXX 7XX	
6.	Status (<i>category for program</i>)	Elective Course for UG/PG Students	

7.	Pre-requisites (<i>course no./title</i>)	50 Credits Completion for UG Students	
----	--	---------------------------------------	--

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	N/A	

9.	Not allowed for (<i>indicate program names</i>)		
----	---	--	--

10.	Frequency of offering	☐ Every sem ☐ 1 st sem ☐ 2 nd sem ☒ Either sem	
-----	------------------------------	---	--

11.	Faculty who will teach the course Interested faculty in the biodesign programme		
-----	---	--	--

12.	Will the course require any visiting faculty?	No	
-----	--	----	--

13.	Course objective (<i>about 50 words</i>): The course will cover new and existing developments in the broad spectrum of medical device design		
-----	--	--	--

14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): The course contents will be flexible covering state of the art design, research and innovation issues pertaining to biodesign. of importance in this area.		
-----	---	--	--

15. Lecture Outline *(with topics and number of lectures)*

Module no.	Topic	No. of hours
1	Topics covering new and existing developments in the broad spectrum of medical device design.	42
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
COURSE TOTAL (14 times 'L')		42

16. Brief description of tutorial activities

Not Applicable

17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours
1	Not Applicable	
2		
3		
4		
5		
6		
7		
8		
9		
10		
COURSE TOTAL (14 times 'P')		

18. Suggested texts and reference materials

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

The books will be pre-suggested by the faculty member floating the course

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

19.1	Software	yes
19.2	Hardware	yes
19.3	Teaching aides (videos, etc.)	yes
19.4	Laboratory	ideation, brainstorming & prototyping facilities
19.5	Equipment	Some successful medical devices
19.6	Classroom infrastructure	None in particular
19.7	Site visits	yes

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

20.1	Design-type problems	65%
20.2	Open-ended problems	80%
20.3	Project-type activity	90%
20.4	Open-ended laboratory work	10%
20.5	Others (please specify)	

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	APPLIED MECHANICS
2.	Course Title (<i>< 45 characters</i>)	MECHANICS OF SOFT MATERIAL
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	AML 778
6.	Status (<i>category for program</i>)	"PE" for MTech (Engg. Mechanics), "OC" for MTech (Design) & UG and MTech, MS from other departments.

7.	Pre-requisites (<i>course no./title</i>)	N/A
-----------	--	-----

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	N/A
8.2	Overlap with any UG/PG course of other Dept./Centre	N/A
8.3	Supercedes any existing course	N/A

9.	Not allowed for (<i>indicate program names</i>)	N/A
-----------	---	-----

10.	Frequency of offering	☐ Every sem ☐ 1 st sem ☐ 2 nd sem ☒ Either sem
------------	------------------------------	---

11.	Faculty who will teach the course Dr. Sitikantha Roy, Dr. Anamika Prasad	
12.	Will the course require any visiting faculty?	May be.

13.	Course objective (<i>about 50 words</i>): The course is appropriate for students wishing to learn mechanics of soft material at continuum scale. The emphasis for application will be on soft tissues, smart polymers etc but the student will develop general skills for continuum stress and strain analysis.	
------------	---	--

14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Mathematical Preliminaries: Scalars, vectors, tensor field. Gradient, transformation etc. Thermodynamics, Kinematics of Deformation & Motion, Stress-strain principles, Fundamental balance Laws and Equations, Nonlinear Elasticity, Anisotropic elasticity, Linear viscoelasticity, Chemo-mechanical coupling, Electromechanical coupling, Material growth.	
------------	---	--

15. Lecture Outline *(with topics and number of lectures)*

Module no.	Topic	No. of hours
1	Introduction: Course structure, policies etc	1
2	Essential Mathematics: Scalars, vectors, Tensors, Symbolic and Indicical notation, Matrices & Determinants, Tensor Transformations, Eigenvalues and Eigenvectors, Tensor fields & tensor calculus, Integral theorems of Gauss and Stokes.	3
3	Stress Principles: Body/surface forces and density, Cauchy stress principles, The stress tensor, force and Moment Equilibrium, Stress Tensor Symmetry, Stress Transformation Laws, Principle Stresses & Directions, Maximum & Minimum Stresses, Mohs's Circle for Stress, Plane Stress, Deviator and Spherical Stress.	6
4	Particles and Configurations, Deformation and Motion, Material and Spatial Coordinates, Lagrangian & Eulerian Descriptions, Displacement Fields, Material Derivatives, Deformation Gradients, Finite Strain Tensors, Infinitesimal Deformation Theory, Stretch Ratios, Rotation & Stretch Tensors, Velocity Gradient, Rate of Deformation, Vorticity, Material Derivatives of Line Elements, Areas and Volumes.	6
5	Balance Laws, Field and Constitutive Equations, Material Derivatives of Line, Surface, and Volume Integrals, Conservation of Mass and Continuity Equation, Linear Momentum Principle and Equations of Motion, Piola-Kirchhoff Stress Tensors, Lagrangian Equations of Motion, Angular Momentum Principle, Conservation of Energy, Entropy, Material Restrictions due to 2 nd law, Invariance, Constitutive Equation restrictions due to invariance, Constitutive Equations.	6
6	Nonlinear Elasticity: Molecular Approach to Rubber, Strain Energy Theory, Specific Forms of Strain Energy, Neo-Hookean, Arruda-Boyce Material models.	6
7	Linear Viscoelastic Constitutive Equations, One-Dimensional Theory/Models, Creep and Relaxation, Superposition principles, Heredity Integrals, Harmonic Loadings, Complex Modulus and Compliance, Three-Dimensional Problems, Correspondence Principle.	6
8	Chemo-mechanical Coupling, Electro-mechanical coupling, stimuli responsive smart polymer, gels etc.	6
9	Special topics: Poroelasticity, Instability in soft material, growth model.	2
10		
11		
12		
COURSE TOTAL (14 times 'L')		42

16. Brief description of tutorial activities

--

17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours
1		
2		
3		
4		
5		

6		
7		
8		
9		
10		
COURSE TOTAL (14 times 'P')		

18. Suggested texts and reference materials

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

1. Biomechanics: Mechanical Properties of Living Tissues, 2nd Edition, by Y. C. Fung (1993)
2. Gerhard A Holzapfel, "Non-linear solid Mechancis".
3. L. R. G. Treloar, "The Physics of Rubber Elasticity".
4. Gerhard A. Holzapfel, Ray W. Ogden, "Mechanics of Biological Tissue".
5. Yoshihito Osada & Alexei R. Khokhlov (Editors), "Polymer Gels and Networks".
6. Maria Rosa Aguilar & Juilo San Roman (Editors), "Smart Polymers and their applications"

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

19.1	Software	MATLAB, MATHEMATICA
19.2	Hardware	
19.3	Teaching aides (videos, etc.)	TABLET PROJECTOR.
19.4	Laboratory	
19.5	Equipment	
19.6	Classroom infrastructure	
19.7	Site visits	

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

20.1	Design-type problems	
20.2	Open-ended problems	
20.3	Project-type activity	
20.4	Open-ended laboratory work	
20.5	Others (please specify)	

Date: 11/9/2012

(Signature of the Head of the Department)