 <b>FLORIDA ATLANTIC UNIVERSITY</b>	<b>NEW COURSE PROPOSAL</b> <b>Graduate Programs</b>	UGPC Approval _____ UFS Approval _____ SCNS Submittal _____ Confirmed _____ Banner Posted _____ Catalog _____
	<b>Department</b> Computer & Elec. Eng. and Computer Sci  <b>College</b> College of Engineering and Computer Science <i>(To obtain a course number, contact erudolph@fau.edu)</i>	

<b>Prefix</b> EEE  <b>Number</b> 5425	<i>(L = Lab Course; C = Combined Lecture/Lab; add if appropriate)</i> <b>Lab Code</b>	<b>Course Title</b> Nanobiotechnology
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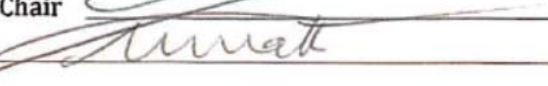
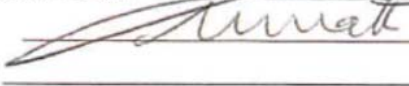
<b>Credits</b> <i>(Review Provost Memorandum)</i> 3	<b>Grading</b> <i>(Select One Option)</i>  <b>Regular</b> <input checked="" type="radio"/>  <b>Sat/UnSat</b> <input type="radio"/>	<b>Course Description</b> <i>(Syllabus must be attached; see Guidelines)</i>  This course covers the sensing and characterization of biological entities with novel nanoscale devices and nano-object mediated modalities. It also covers the fundamentals of nanotechnology in biological and biomedical research.
<b>Effective Date</b> <i>(TERM &amp; YEAR)</i> Fall 2017		

<b>Prerequisites</b> Graduate level standing in engineering and/or physical/biological sciences	<b>Corequisites</b> N/A	<b>Registration Controls</b> <i>(Major, College, Level)</i> Graduates, Seniors (College of Engineering or College of Science)
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*Prerequisites, Corequisites and Registration Controls are enforced for all sections of course*

<b>Minimum qualifications needed to teach course:</b> Member of the FAU graduate faculty and has a terminal degree in the subject area (or a closely related field.)	<b>List textbook information in syllabus or here</b>  No text book is required.
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<b>Faculty Contact/Email/Phone</b>  Waseem Asghar wasghar@fau.edu	<b>List/Attach comments from departments affected by new course</b>  College of Eng. and Comp. Sci, Department of Ocean and Mechanical Eng. College of Science, Department of Biological Sciences
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<b>Approved by</b> Department Chair <u></u> College Curriculum Chair <u></u> College Dean <u></u> UGPC Chair _____ Graduate College Dean _____ UFS President _____ Provost _____	<b>Date</b> <u>02/03/17</u> <u>2/6/17</u> <u>2/6/17</u> _____ _____ _____
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Email this form and syllabus to [UGPC@fau.edu](mailto:UGPC@fau.edu) one week before the UGPC meeting.

**Department of Computer & Electrical Engineering  
and Computer Science  
Florida Atlantic University  
Course Syllabus**

<b>1. Course title/number, number of credit hours</b>		
Nanobiotechnology EEE 5425		# of credit hours = 3
<b>2. Course prerequisites, corequisites, and where the course fits in the program of study</b>		
Prerequisites: Graduate level standing in engineering and/or physical/biological sciences		
<b>3. Course logistics</b>		
Term: Fall 2017 Location: TBD		
<b>4. Instructor contact information</b>		
<i>Instructor's name</i>	Waseem Asghar, PhD	
<i>Office address</i>	Bldg. EE 96/ Room 435	
<i>Office Hours</i>	TBD	
<i>Contact telephone number</i>	561-297-2800	
<i>Email address</i>	<a href="mailto:wasghar@fau.edu">wasghar@fau.edu</a>	
<b>5. TA contact information</b>		
<i>TA's name</i>	TBD	
<i>Office address</i>		
<i>Office Hours</i>		
<i>Contact telephone number</i>		
<i>Email address</i>		
<b>6. Course description</b>		
<p>This course covers the sensing and characterization of biological entities with novel nanoscale devices and nano-object mediated modalities. It also covers the fundamentals of nanotechnology in biological and biomedical research. The sensing and characterization of biological entities, processes and events, with novel nanoscale devices and nano-object mediated modalities, will have immediate and far reaching impacts. The course work is approached from an engineering perspective offering insights on the details of nanoscale fabrication processes as well as cell biology. The basics of biology and chemistry, with focus on how to engineer the behavior of molecules at the nanoscale, are also introduced and analyzed. Concepts and processes related to BioMEMS and microfluidics will also be explained.</p>		
<b>7. Course objectives/student learning outcomes/program outcomes</b>		
<i>Course objectives</i>	To introduce the students to the concepts of nanobiotechnology and its applications in biological and biomedical engineering, pharmaceuticals, diagnostics, and public health. Students will also learn material properties of natural and synthetic materials and their applications in biomedical engineering.	
<b>8. Course evaluation method</b>		
5 Homework assignments (4% each):	20%	For key paper review, each student has to find a key paper in nanobiotechnology which has first
Key paper review:	20%	

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Group research proposal:	20%	<p>reported some fundamentally novel mechanism, method, or technique which laid the foundation of significant work later on. Student has to make a presentation on this paper and present in class.</p> <p>For group research proposal, students will be divided into groups of 2-3 students. Each group will propose an interesting topic related to latest key advances in the field of Silicon Integrated Circuit Fabrication. Each group will present and defend their proposal topic in class.</p>
Midterm exam:	20%	
Final exam:	20%	

**9. Course grading scale**

Grading Scale:

90 and above: "A", 87-89: "A-", 83-86: "B+", 80-82: "B", 77-79: "B-", 73-76: "C+", 70-72: "C", 67-69: "C-", 63-66: "D+", 60-62: "D", 51-59: "D-", 50 and below: "F."

**10. Policy on makeup tests, late work, and incompletes**

Students are strongly suggested to inform the instructor in advance in the case of emergency (if possible). Makeup exams are given only if there is solid evidence of a medical or otherwise serious emergency that prevents the student of participating in the exam.

Students must turn in homework, assignment and projects on time. Students will lose 25% (after 1 day) and 50% of marks (after 2 days) if they turn in late. Submissions are not accepted after 2<sup>nd</sup> day of due date.

**11. Special course requirements**

NA

**12. Classroom etiquette policy**

University policy requires that in order to enhance and maintain a productive atmosphere for education, personal communication devices, such as cellular phones and laptops, are to be disabled in class sessions.

**13. Disability policy statement**

In compliance with the Americans with Disabilities Act Amendments Act (ADAAA), students who require reasonable accommodations due to a disability to properly execute coursework must register with Student Accessibility Services (SAS)—in Boca Raton, SU 133 (561-297-3880); in Davie, LA 131 (954-236-1222); or in Jupiter, SR 111F (561-799-8585)—and follow all SAS procedures.

**14. Honor code policy**

Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and place high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. See University Regulation 4.001 at

**Department of Computer & Electrical Engineering  
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[www.fau.edu/regulations/chapter4/4.001\\_Code\\_of\\_Academic\\_Integrity.pdf](http://www.fau.edu/regulations/chapter4/4.001_Code_of_Academic_Integrity.pdf)

**15. Required texts/reading**

No textbook is required

**16. Supplementary/recommended readings**

Books:

Mauro Ferrari Ph.D., Abraham P. Lee, L. James Lee: *BioMEMS and Biomedical Nanotechnology*, ISBN: 978-0-387-25563-7 (Print) 978-0-387-25842-3 (Online), 2006

Iqbal, Samir M., Bashir, Rashid (Eds.): *Nanopores Sensing and Fundamental Biological Interactions*, ISBN 978-1-4419-8252-0, 2011

Research Articles:

M. Sher, R. Zhuang, V. U. Demirci, W. Asghar, "Paper-based analytical devices for clinical diagnosis: recent advances in the fabrication techniques and sensing mechanisms," *Expert Review of Molecular Diagnostics*, Accepted, DOI: 10.1080/14737159.2017.1285228 (2017)

W. Asghar, H. Shafiee, V. Velasco, V. R. Sah, S. Guo, R. El Assal, F. Inci, A. Rajagopalan, M. Jahangir, R. M. Anchan, G. L. Mutter, M. Ozkan, C. S. Ozkan, and U. Demirci "Toxicology Study of Single-walled Carbon Nanotubes and Reduced Graphene Oxide in Human Sperm," *Scientific Reports*, vol 6, article 30270 (2016)

K. Rappa, HF Rodriguez, GC Hakkarainen, RM. Anchan, GL. Mutter, W. Asghar, "Sperm processing for advanced reproductive technologies: Where are we today?", *Biotechnology Advances*, doi:10.1016/j.biotechadv.2016.01.007 (2016)

M. Safavieh, C. Coarsey, N. Esiobu, A. Memic, J. Mahesh, H. Shafiee, W. Asghar, "Advances in Candida Detection Platforms for Clinical and Point-of-Care Applications", *Critical Reviews in Biotechnology*, DOI:10.3109/07388551.2016.1167667 (2016)

W. Asghar, M. Yuksekkaya, H. Shafiee, M. Zhang, M. Ozen, F. Inci, M. Kocaculak, U. Demirci, "Engineering long shelf life multi-layer biologically active surfaces on microfluidic devices for point of care applications", *Scientific Reports*, 6: 21163 (2016)

M. Safavieh, M.K. Kanakasabapathy, F. Tarlan, M. Ahmed, M. Zourob, W. Asghar#, and H. Shafiee#, "Emerging Loop-mediated Isothermal Amplification-based Microchip and Microdevice Technologies for Nucleic Acid Detection", *ACS Biomaterials Science and Engineering*", vol. 2, no. 3, 2016

W. Asghar\*#, R. EL Assal\*, H. Shafiee, S. Pitteri, R. Paulmurugan, and U. Demirci#, "Engineering cancer microenvironments for in vitro 3-D tumor models", *Materials Today*, vol 18, no. 10, (2015)

H. Shafiee, W. Asghar, F. Inci, M. Yuksekkaya, M. Jahangir, M. H. Zhang, N.G. Durmus, U.A. Gurkan, D. R. Kuritzkes, and U. Demirci, "Paper and flexible substrates as materials for biosensing platforms to detect multiple biotargets," *Scientific Reports*, 5, (2015)

W. Asghar, V. Velasco, J.L. Kingslye, M.S. Shoukat, H. Shafiee, R.M. Anchan, G.L. Mutter, E. Tuzel, and U. Demirci, "Selection of functional human sperm with higher DNA integrity and fewer reactive oxygen species," *Advanced HealthCare Materials*, vol 3. no. 10 (2014)

**Department of Computer & Electrical Engineering  
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**17. Course topical outline, including dates for exams/quizzes, papers, completion of reading**

Weekly Schedule	Topics
Week 01	<p>Introduction to Nanobiotechnology, historical prospective, solid-state fabrication, Moore's law and its implication in bioengineering.</p> <p>Basic semiconductor materials, Crystal structure, Miller indices, Crystalline materials.</p>
Week 02	<p>Standard fabrication processes and modules, oxidation (wet and dry), oxide properties, Photolithography</p> <p>Projection Lithography, Pitch limit and diffraction, Light sources</p>
Week 03	<p>Doping, Diffusion, Ion Implantation, dry etching, wet etching, Isotropic and anisotropic etching.</p> <p>Deep reactive ion etching, LPCVD, PECVD, PVD</p> <p><b>HW-1</b></p>
Week 04	<p>Trade-offs in lithography, next generation lithography.</p> <p>X-Ray lithography, XPS, Auger electron spectroscopy, EUV lithography, Proximal X-ray lithography</p>
Week 05	<p>E-beam lithography, Focused ion beam lithography, Projection e-beam and ion beam lithography</p> <p>Scanning probe lithography, atomic force lithography</p> <p><b>Key paper review nomination</b></p>
Week 06	<p>Dip pen lithography, AFM lithography by local probe oxidation, STM lithography</p> <p>Soft lithography, contact printing, PDMS properties</p> <p><b>HW-2</b></p>
Week 07	<p>Micro transfer molding, replica molding, PDMS issues, CD based fluidics</p> <p>Nanoimprint lithography, step and flash lithography</p>
Week 08	<p>Biomolecules, cells and organelles, chemical structure of phospholipids</p> <p>Functional groups, structure of nucleic acids, genes, electronics properties of nucleic acids, aptamers</p> <p><b>HW-3</b></p>
Week 09	<p>DNA structure and fundamentals, human genome project</p> <p><b>Midterm Exam</b></p>

**Department of Computer & Electrical Engineering  
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Week 10	<b>Presentations for Key Paper Reviews</b>
Week 11	DNA microarrays, Integration of bionano, need to biosensing, electronic properties of biomaterials  Molecular sensing, DNA hybridization, Annealing, Polymerase chain reaction (PCR), DNA replication and amplification.  <b>HW-4</b>
Week 12	Real-time PCR, SYBR staining, Taqman, Scorpion, RT-PCR, PCR on-chip, microfluidics  Next generation sequencing, ion torrent technology, Solid-state and biological nanopores for DNA analysis
Week 13	<b>Group Research Proposal Presentations</b>
Week 14	Gene translation and expression (mRNA, tRNA, rRNA)  Types and structure of protein, types of amino acids, surface functionalization with protein and DNA/RNA probes  <b>HW-5</b>
Week 15	Nanowires, synthesis, nanowire biosensors  Quantum dot confinement, carbon nanotubes and graphene, synthesis and their applications in biomedical engineering
	<b>Final Exam</b>

2/1/2017

Re: Request of approval - new course in Nanobiotechnology.

**Re: Request of approval - new course in Nanobiotechnology.**

Tsung-Chow Su

Sent: Tuesday, January 31, 2017 2:41 PM

To: Waseem Asghar

Cc: Mihaela Cardei; Zvi Roth; Nurgun Erdol

Dear Professor Asghar,

Thanks for sending me syllabus of new course you proposed.

This appears to be an excellent course and I look forward it being offered.

Best

Joe

Sent from my iPhone

On Jan 31, 2017, at 2:33 PM, Waseem Asghar <[wasghar@fau.edu](mailto:wasghar@fau.edu)> wrote:

Dear Dr. Su,

The Department of Computer & Electrical Engineering and Computer Science (CEECS) is proposing a new course: EEE 5425 - Nano Biotechnology. Please see the attached syllabus for this course.

I heard that you have taught a course on "nanotechnology" before, just wondering if you can look at the attached syllabus and send me an email in the support of this course (if you like it) which may be helpful during the course approval process. I will be happy to hear if you have any suggestions.

Thanks  
Waseem

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Regards,  
Waseem Asghar, Ph.D.,  
Assistant Professor,  
Department of Computer & Electrical Engineering and Computer Science,  
Department of Biological Sciences (Joint Appointment),  
Florida Atlantic University,  
777 Glades Road, EE 96/Rm 435, Boca Raton, FL 33431  
Ph: 561.297.3728  
Fax: 561.297.2800  
<http://faculty.eng.fau.edu/asghar/>

<SACS FORM-Nanobiotechnology (EEE 5425)-Waseem.docx>

2/1/2017

RE: Request of approval - new course in Nanobiotechnology.

**RE: Request of approval - new course in Nanobiotechnology.**

Michelle Cavallo

**Sent:** Wednesday, February 01, 2017 10:35 AM

**To:** Waseem Asghar

**Cc:** Mihaela Cardei; Zvi Roth; Nurgun Erdol; Rodney Murphey

Dear Dr. Asghar,

Our apologies for the delay. On behalf of Dr. Rod Murphey, I am writing to confirm that the Department of Biological Sciences supports this proposal.

All the best,

Michelle

Michelle Cavallo  
Administrative Assistant & Graduate Coordinator  
Department of Biological Sciences  
Florida Atlantic University  
777 Glades Road  
Boca Raton, FL 33431  
PH: 561-297-0384

**From:** Waseem Asghar [mailto:wasghar@fau.edu]

**Sent:** Tuesday, January 31, 2017 2:46 PM

**To:** Michelle Cavallo <MCAVALLO@fau.edu>

**Cc:** Mihaela Cardei <mcardei@fau.edu>; Zvi Roth <rothz@fau.edu>; Nurgun Erdol <erdol@fau.edu>; Rodney Murphey <RMURPHEY@fau.edu>

**Subject:** Re: Request of approval - new course in Nanobiotechnology.

Hi Michelle,

Just wondering if you get a chance to talk to Dr. Murphey about the new course proposal (see below email for further details). Thank you

--

Regards,

Waseem Asghar, Ph.D.,

Assistant Professor,

Department of Computer & Electrical Engineering and Computer Science,

Department of Biological Sciences (Joint Appointment),

Florida Atlantic University,

777 Glades Road, EE 96/Rm 435, Boca Raton, FL 33431

Ph: 561.297.3728

Fax: 561.297.2800

<http://faculty.eng.fau.edu/asghar/>

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**From:** Waseem Asghar

**Sent:** Friday, January 27, 2017 11:28 AM

**To:** Michelle Cavallo

**Subject:** Fwd: Request of approval - new course in Nanobiotechnology.



2/1/2017

RE: Request of approval - new course in Nanobiotechnology.

Hi Michelle,

I just talked to you over phone. Please see the below email. Thank you for your help

Regards,

Waseem

Assistant Professor,

CEECS, College of Eng and Comp Sci

FAU, Boca Raton, FL 33431

Sent from my iPhone, excuse for brevity

Begin forwarded message:

**From:** Waseem Asghar <[wasghar@fau.edu](mailto:wasghar@fau.edu)>  
**Date:** January 26, 2017 at 12:32:56 PM EST  
**To:** Rodney Murphey <[RMURPHEY@fau.edu](mailto:RMURPHEY@fau.edu)>  
**Cc:** Nurgun Erdol <[erdol@fau.edu](mailto:erdol@fau.edu)>, Mihaela Cardei <[mcardei@fau.edu](mailto:mcardei@fau.edu)>  
**Subject:** RE: Request of approval - new course in Nanobiotechnology.

Dear Dr. Murphey,

The Department of Computer & Electrical Engineering and Computer Science (CEECS) is proposing a new course: EEE 5425 - Nano Biotechnology. Please see the attached syllabus for this course.

We need your approval that Department of Biological Sciences has no objection to this new course proposal. Can you please review the syllabus and email me your decision on approval? Thank you for your time.

Thanks

Waseem

--

Regards,

Waseem Asghar, Ph.D.,

Assistant Professor,

Department of Computer & Electrical Engineering and Computer Science,

Department of Biological Sciences (Joint Appointment),

Florida Atlantic University,

777 Glades Road, EE 96/Rm 435, Boca Raton, FL 33431

Ph: 561.297.3728

Fax: 561.297.2800

<http://faculty.eng.fau.edu/asghar/>

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**From:** Waseem Asghar  
**Sent:** Thursday, December 15, 2016 3:37 PM  
**To:** Rodney Murphey  
**Cc:** Mihaela Cardei; Nurgun Erdol  
**Subject:** Request of approval - new course in Nanobiotechnology.

Dear Dr. Murphey,

The Department of Computer & Electrical Engineering and Computer Science (CEECS) is proposing a new course: EEE 5425 - Nano Biotechnology. Please see the attached syllabus for this course.

We need your approval that Department of Biological Sciences has no objection to this new course proposal. Can you please review the syllabus and email me your decision on approval? Thank you and Happy Holidays.

--

2/1/2017

RE: Request of approval - new course in Nanobiotechnology.

Regards,  
Waseem Asghar, Ph.D.,  
Assistant Professor,  
Department of Computer & Electrical Engineering and Computer Science,  
Department of Biological Sciences (Joint Appointment),  
Florida Atlantic University,  
777 Glades Road, EE 96/Rm 435, Boca Raton, FL 33431  
Ph: 561.297.3728  
Fax: 561.297.2800  
<http://faculty.eng.fau.edu/asghar/>