Research: Past and Present

Plasma research at Texas Tech University started in 1966. The initial work was concerned with harmonic ion cyclotron resonances in small mirror machines and tokamaks, laser heating of magnetized plasmas, and pellet injection in hot dense plasmas. Later the emphasis was on theoretical wave propagation and turbulence studies along with applications of plasma technology to pulsed power devices, plasma synthesis of thin films, and electric space propulsion engines.

Pulsed power research at Texas Tech University began in the early 1970s with studies in high beta, controlled thermonuclear fusion. These initial investigations at Texas Tech, along with other developments in the field, established the need for a better understanding of the physical phenomena of pulsed power technology. High power switching, fast insulator breakdown, compact power supply and power system design, materials studies, and high power microwaves are major priority research areas and have, today, become the main emphasis of the Texas Tech University Pulsed Power Research Program. The program is interdisciplinary and involves faculty members from Electrical and Computer Engineering, Mechanical Engineering, and Physics.

The area of pulsed power research involves storing, shaping, transmitting, and measuring high voltage, high current pulses of electrical energy. This is of importance to many application areas, such as laser drivers, high power microwave generators, particle accelerators, nuclear fusion, nuclear weapons effects and lightning simulations, industrial manufacturing technology, and electromagnetic mass drivers. The voltages and currents involved may be in the MV and MA range and time scales may be as short as the sub-nanosecond regime. This calls for extremely difficult and challenging materials, shielding, and measuring techniques. High power (> 100 MW) microwave source development is an important area for military applications. Power Electronics involves high efficiency power supply designs, rotating machines, and special, high power solid state circuit designs.

Course Overview

The course is designed for Electrical Engineers, Mechanical Engineers, Physicists, and any other professionals who are involved in the work of pulsed power and power electronics (P3E). In this course, you will be introduced to the basics of pulsed power technology.

This course will be presented in a lecture format by the faculty members of the Center for Pulsed Power & Power Electronics at Texas Tech University.

Course Topics Include:

- Introduction to Pulsed Power
- Basic Circuits
- Electromagnetic Field Theory
- High Voltage Breakdown and Physics
- Charging Power Supplies
- Electromagnetic Field Simulations
- Solid State Switching
- High Power Vacuum and Gas Switches
- Pulse Generation
- Voltage Multipliers
- Diagnostics
- Grounding, Shielding, and Safety
- Computer Simulations
- Compact and Explosive Pulsed Power
- Applications

Each topic will be covered in a 1 to 3 hour lecture format.
**Location**
The Electrical and Computer Engineering Building on the Texas Tech University campus, Lubbock, Texas.

**Fee**
The fee for the course is $1800. The fee includes short course notes, an electronic copy of the presentations, lunches, break refreshments, and a barbecue dinner.

**Registration**
To register online and pay via credit card visit: [www.p3e.ttu.edu/shortcourse2015](http://www.p3e.ttu.edu/shortcourse2015)

**Deadline for registration is December 6, 2014. This course will be canceled if there are insufficient registrants by this date.**

**Cancellations / Refunds**
A full refund of your registration fee, less a $75 processing charge, will be granted for refund requests received by December 6, 2014. Thereafter, only partial refunds can be granted, less $900 processing charge.

**Continuing Education Units**
2.3 CEUs will be awarded for participation in the entire short course. No partial credit can be given.

**Lodging**
A block of suites, with a special rate, have been reserved at two hotels located near the Texas Tech campus. The rate can be obtained by reserving your room through the link on the short course website.

<table>
<thead>
<tr>
<th>Hotel</th>
<th>Address</th>
<th>Phone</th>
<th>Website</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Overton Hotel</td>
<td>2322 Mac Davis Lane</td>
<td>888.776.7001</td>
<td><a href="http://www.overtonhotel.com">www.overtonhotel.com</a></td>
<td>$109.00 / night</td>
</tr>
<tr>
<td>Staybridge Suites</td>
<td>2515 19th Street</td>
<td>877.238.8889</td>
<td><a href="http://www.staybridgesuites.com">www.staybridgesuites.com</a></td>
<td>$109.99 / night</td>
</tr>
</tbody>
</table>

Also, each hotel has a limited number of rooms at a government rate of $85, with proper ID.

**More Information**
call: 806.834.2870  email: p3e@ttu.edu
806.834.6061

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### Short Course Schedule

#### Tuesday, January 6th, 2015
- 8:00 a.m. - 8:30 a.m. Registration/Check In
- 8:30 a.m. - 9:00 a.m. Introduction
- 9:00 a.m. - 12:00 p.m. Basic Circuits, Field Theory
- 12:00 p.m. - 1:00 p.m. Lunch
- 1:00 p.m. - 5:00 p.m. High Voltage Breakdown, Physics Issues, Energy Storage

#### Wednesday, January 7th, 2015
- 8:00 a.m. - 12:00 p.m. High Power Switching, Physics Issues, Energy Storage
- 12:00 p.m. - 1:00 p.m. Lunch
- 1:00 p.m. - 5:00 p.m. Pulse Generators, Voltage Multipliers, Grounding and Shielding
- 6:00 p.m. - 9:00 p.m. BBQ Dinner

#### Thursday, January 8th, 2015
- 8:00 a.m. - 12:00 p.m. Diagnostics, Computer Simulations, Explosive Pulsed Power
- 12:00 p.m. - 1:00 p.m. Lunch
- 1:00 p.m. - 5:00 p.m. Applications, Laboratory Tour

Short course rates at the hotels are good for Thursday night as well for attendees who plan to leave on Friday, January 9th.

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### Course Faculty

**Dr. Stephen Bayne**
Associate Professor at Texas Tech University. Research specialties include Power Electronics, Power Semiconductor Devices, Renewable Energy, Pulsed Power.

**Dr. James Dickens**

**Dr. Mike Giesselmann**
Professor and ECE Department Chair at Texas Tech University. Research specialties include Gas Discharges, Electrical and Optical Diagnostics, H.V. Measuring Techniques, High Power Switching, Power Electronics.

**Dr. M. “Kris” Kristiansen**

**Dr. John Mankowski**
Associate Professor at Texas Tech University. Research specialties include Pulsed Power Technology, Electric Space Propulsion, Liquid and Gas Discharge Physics, Railgun Technology, Explosive Pulsed Power, and High Power Microwave Generation.

**Dr. Andreas Neuber**
AT&T Professor of Electrical and Computer Engineering at Texas Tech University and Co-Director of the Center for Pulsed Power & Power Electronics. Research specialties include Dielectric Surface Flashover, HV Electric Breakdown, Gaseous Electronics, High Power Microwaves, Pulsed Power Technology, Non-intrusive high speed plasma diagnostic (OSE, LIF, CARS, Raman), Microdischarges.

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**Pictures:**
Front cover: SiC PCSS Driven NITL
Back cover spine: PTFE coated silver exploding wire
Back cover bottom: In Situ Vircator plasma cleaning