Dr. Nick Holonyak, Jr.
Author, Feature Article:
From Carbide Lamps to Semiconductor Lamps
Nominations Invited for The Fifth Vladimir Karapetoff Eminent Members' Award

Dr. Vladimir Karapetoff

His father was an engineer and his mother a student at a military medical school. Dr. Karapetoff emigrated to the United States in 1902, and became a naturalized citizen in 1909. In 1908 he joined the engineering faculty of Cornell University as an assistant professor. In 1908 he was made a full professor and continued in that capacity until he retired from active teaching in 1939. In an account of Dr. Karapetoff's career, his Cornell University colleagues R. P. Chamberlain, A. A. Horwitz, and Everett M. Strong, recalled his continuing dedication to Eta Kappa Nu. During World War II he was an Lt. Commander in the U.S. Navy. But beginning in 1942, Kary, as he was known to his associates, began to lose his sight in both eyes, and despite temporary relief through operations, he ultimately lost his sight and schooled himself in Braille and "talking books." Even after his blindness he sold his annual Eta Kappa Nu Award dinner in New York City, and would address them in "refreshing original and lucid expositions" of his technical interests. Fellow IEEE members viewed these occasions as sort of a "national Kary reunion." His handicap notwithstanding, his cheerfulness, determination, and ingenuity prevailed. His colleagues remembered him as an accomplished musician on piano, violincello, and double bass. He toured the country giving recitals and lectures on Wagner, Liszt, and other major composers, and developed a five-string cello on which violin music could be played. He received an honorary Doctor of Music degree from New York College of Music. Professor Simpson Linke, writing in the Winter 1984-85 Engineering Conference Quarterly, cited the following excerpt from Karapetoff's Electrical Laboratory Notes, published in 1906, as reflective of the flavor of ES studies in that era:

In coming to the laboratory, bring with you a slide rule, an inch rule or tape, a speed counter, a screw driver and a pair of pliers [sic]. This will save you time and trouble of looking for them or borrowing them. Do not forget to have a pocket knife for skinning off wire; a bicycle wrench is also sometimes very handy to have.

Dr. Karapetoff was the author of several standard texts on electrical engineering that were widely used in several editions, as well as other texts on electrical and magnetic currents, electrical testing, and engineering mathematics. He was a member of AIEE, the Franklin Institute, the AAS, the American Mathematical Society, the Mathematical Society of America, the American Physical Society, the U.S. Naval Institute, and the U.S. Naval Reserve Officers' Association.
From Carbide Lamps to Semiconductor Lamps
by Dr. Nick Holonyak, Jr.

Electrical Engineering Research Laboratory, Center for Compound Semiconductor Microelectronics, and Materials Research Laboratory University of Illinois at Urbana-Champaign, Urbana, Illinois 61801

EDITOR'S NOTE: Bridge is honored to present this personal story by Dr. Holonyak. He is to receive the 1995 Japan Prize in Tokyo later this Spring...the prize is Japan's highest scientific award.

When I left the coal fields of Southern Illinois at the end of World War II (WW II) to study electrical engineering at the University of Illinois (Urbana), the original home ofEta Kappa Nu, little did I know what I would witness, what an adventure this would become.

All that I knew from teen-age experimenting with Model-T Ford spark coils, electric bells, and crystal set radios was that electrical effects intrigued me more than the carbide lamps and even miners' blasting powder we had at home, and the chemistry one of my teachers wanted me to study. Also, I knew I didn't wish to continue working, beyond WW II holiday and summer work, as a section hand on the Illinois Central Railroad (1944-1946), nor spend more time in a coal mine than the two days I went underground with my father. Maybe a Carpatho-Rusyn immigrant could tolerate digging coal for decades, but I wasn't sure I could, or even wanted to.

Instead of being intimidated by the returning World War II veterans, and all the electronics they knew because of WW II radar experience, I felt I could keep up in class because of my good high school mathematics background. So, I proceeded to use my WW II section hand earnings to become an electrical engineer and to study electronics, vacuum tube electronics which was very ably taught by young war-experienced non-Ph.D. assistant professors whom Bill Everitt hired and made into teachers while permitting them to complete Ph.D.'s. This was an astute move that solved a teacher-shortage problem, as well as injected electronics experience and a taste for electronics into a department lacking in this area. Who could have predicted the metamorphosis, the revolution that was about to occur in electronics.

It was all lucky for me, because by the time John Bardeen came to Illinois in 1951 as a professor of electrical engineering and physics and demonstrated to us his historic portable two-transistor oscillator-amplifier box, not a "black box" but an instant-turn-on transparent plastic box, I was already comfortable with vacuum tube electronics, and had turned down an offer to work in the Illinois project, a vacuum-tube-based "first" among the large scale computers. Instead I began Ph.D. study in device electronics working on a multipactor project. After a year working on a microwave cavity multipactor, and demonstrating a 3 GHz multipactor-generated bunched electron beam, I shifted to a new EE Department project and laboratory founded by John Bardeen. In spite of what some others might have thought of John's teaching, I liked what I was learning from him, first, in atomic physics and then semiconductors, and I started (one of two graduate students and two post-docs) to learn and to work on semiconductors, p-n junctions, and transistors in John's laboratory. Since John had a B.S. and M.S. in electrical engineering, and a Ph.D. in mathematics (not physics), maybe it was appropriate that I became his first student.

Much of the coformation of some of my "tube lab" friends in the same EE building (historic old Electrical Engineering Research Laboratory, now demolished in

John Bardeen, the "godfather" of modern electronics, at age 80. Bardeen and Brattain discovered the transistor December 16, 1947, and, when Bardeen then identified carrier injection with a current, the transistor era began (and continues).

the interest of "progress"), it appeared to them that I had blundered and wasn't doing much more than working on some slightly more advanced form of old fashioned crystal-set radio device. After all, what was there that could compete with the all-powerful vacuum tube? In fact, milliwatts from a point contact transistor compared to the watts and watts from tubes was an object of derision. With Bardeen's guidance, and some valuable help from R. N. Hall (my colleague later at General Electric) on the occasion of some Urbana lectures, I learned to make alloyed Ge p-n junctions. Hall's alloy process for making p-n junctions, and, needless to say, billions of transistors, was, if properly considered, nothing less than local liquid phase epitaxy (LPE). In a sense this was the forerunner of all of the epitaxial methods used later to make p-n junctions. Using Hall's alloy process, I'm perhaps the first person to make a p-n junction as a graduate student. My friend Ivovich Alferov, who just visited Urbana (Sept. 1994), says that he too was mastering and using the alloy process to make p-n junctions at the same time in Leningrad, and as a consequence made the first Russian transistors. In any case, at Illinois I was the first to make p-n junctions.

I should mention that in spite of the fact that John Bardeen was not yet a Nobelist, all of us in John's lab were keenly aware that he was, indeed, much, much more of a talent than any of the other people around us. We could sense or feel that John was special. That would merely become more evident with time and the great fame about to descend on John. He was the kind of person who would even send his former graduate student stationed in the Army in Yokohama a greeting card from the 1956 Nobel prize ceremonies. I am sure our high regard for Bardeen had a large effect on us. It defined for us a whole different perspective on learning and research, on what mattered and didn't matter.

John Bardeen's portable ("instant-ON") transistor oscillator-amplifier box. The famous "box" was made in 1949, uses two point-contact transistors, still operates, and is in a 1/4 of Illinois museum. (These were the first two transistors seen in Urbana - 1951.)

Holonyak demonstrating (in 1994 in old EERL) the first (1958) Si shorted-emitter symmetrical switch, which was the progenitor of all of today's TRIAC and wall-dimmer devices. This first symmetrical switch (hand-made in 1958 at GE) survives and still operates. (The arrow identifies the device.)

When Walter Brattain would visit from Bell Labs to consult with John, I remember watching very closely as they worked in our laboratory at the blackboard near my lab office. It was fascinating to observe how Bardeen corrected Brattain's mistakes, and then to see Brattain's response, which was partly in the coal miner's language I understood so well (or could even repeat in basic Slavic). We were privileged to see how problems were identified and solved by the two "giants" who invented the transistor.

After a thesis on surface problems involving Ge p-n junctions, I decided, most fortuitously, to go Bell Telephone Labs (BTL, 1954) to work for John Moll on
Si switching devices, specifically, on diffused-impurity Si transistors and p-n-p switches. At the time the only diffused-impurity Si devices were the solar cell and simple rectifiers, and yet John Moll firmly believed we should, and could, make switching devices in Si (not Ge!) by impurity diffusion, which, incidentally, I already knew about because of some of John Bardeen's interests and projects at Illinois. I don't know if any of us knew in the beginning how correct John Moll was. Within a year a handful of Bell Labs people set in motion the technology that Bill Shockley, with Bell's generosity, took to West Coast shortly later, and that then with spin-off after spin-off generated Silicon Valley.

From 1954 to 1955, mainly with Moll's guidance and persuation and Jack Morton, we learned to make Si with Al and Au and to make sophisticated Si p-n junction transistors, and p-n-p switches, the last becoming the Si controlled rectifier (SCR, later renamed the thyristor). Incidentally, although Shockley took credit for the p-n-p switch, which was based on the "hook" collector of Bardeen and Brattain's point contact transistor, I give the credit for our success (and hence the SCR to) John Moll for foreseeing and guiding our effort. In fact, Shockley was nowhere near us or our work on Si p-n-p switches and various transistors when the first diffused-impurity Si devices were built.

I want to especially mention that our BTL colleagues Carl Frosch made a major contribution to impurity-diffused Si devices with his discovery of the secret of the oxide on Si and oxide masking. Some of our Si crystals were grown on which he put the oxide and diffused some of the junctions that were part of our device experiments. Without Frosch's oxide, today there would be no integrated circuits. It is sad that Frosch's name is not better known. What a wonderful person, and fine colleague! I am proud to say that I knew him. (I don't mind mentioning further that I consider Moll's and Frosch's contributions beyond all others in the realization of the integrated circuit.)

The consequence of all of this was that we had pretty much set the course for the future Si technology. The scale of this story is too great to tell here in any significant detail and has to be the subject of a separate account, which will be the future Si technology. However, it is not the subject of the Si device story, I wish to tell how we introduced the first practical light emitting diode (LED), how does one go from Si to III-V semiconductor diodes and LEDs?

From BTL I went into the Army in order to meet a draft board obligation. In due course the Army sent me to Japan and, through John Bardeen, I met (1956) and became (1957) a member of the famous (Mito) Laboratory. Hatakeyama and Makoto Kikuchi. Hatakeyama was later the founding director of Sony's research laboratory and Kikuchi was his successor. It is interesting that in Japan at Denko Shinkojo (MITO) I gave some Si device seminars for Kikuchi and his colleagues, but heeded the BTL lawyers' warning that I was not to talk about oxide masking. Maybe I am the first, with Kikuchi, to introduce diffused-impurity Si technology in Japan (1956-57). I should mention that on Kikuchi's request, I managed to get a piece of BTL Si sent to me quickly via Army mail so that Shibuha could do a hot-electron measurement. Maybe this was Japan's first piece of "good" Si. I doubt that anyone started Si "rolling" in Japan before Kikuchi and I did. Also, in Japan I was conscripted at the Signal Supply Center to work on some of Signal Intelligence's problems, and perhaps some day it will be possible to tell more of the Cold War story and devices get built in the field (not the same as in Urbana or at BTL).

In any case, when I left the Army (1957) I went to GE (General Electric) Syracuse and back to work on Si devices, in fact, right back on work on Si p-n-p switches which at GE, because of Ray York, had become the SCR. This was something I understood (Si switches) and, besides helping York’s people to understand p-n-p switches, we quickly converted the SCR into TRIAC’s and other forms of symmetrical switches via the shunt-emitter (which, incidentally, much later took me for expert testimony to Julius Hoffman’s court, Chicago, the lawyer did not need my patent attorney and, later, because of slow filing, led us into patent interference with Bob Noyce, then of Fairchild. The interesting thing about this work, besides the fact that we won the patent interference in spite of late filing, is that all thyristors employ shunt emitters, as well as all light dimmers. Recently when I bought a wall light dimmer, the lady who sold it to me wondered if I knew anything about such elements and their use because of all the questions I asked about her store’s products.

To me, an EE, SCR’s, thyristors, TRIAC’s, p-n-p devices were all switches and negative resistance devices and at once made the tunnel diode interesting because it was less of a switch and a simpler negative resistance device, just a single junction. Hence, because of my familiarity with Si technology, I quickly built (1959) Si tunnel diodes and with my GE colleagues observed (4.2 K) phonon-assisted tunneling. This was the first observation of metallic tunneling and the beginning of the tunneling era, which now has essentially a forgotten origin.

Unlike the p-n-p family of devices which handle large currents and large voltages (e.g., thyristors now handle tens of megawatts), tunnel diodes were very limited in voltage range, somewhere of the order of the semiconductor energy gap (-1 eV). This made it interesting (1959-60) to look at the III-V family of materials, and led immediately to GaAs tunnel diodes and maybe to more problems than answers. Unfortunately, or fortunately, GaAs tunnel diodes were prone to failure. Half tried some doping tricks with Mq and Hg to solve the problem and I tried amphoteric doping, simultaneous p and n doping with Ge, and then made a more fundamental step.

I decided I could modify and use close-tube-ship phase epitaxial (VPE) techniques, which then were being explored on Ge (an elemental material), to make VPE GaAs tunnel junctions (a compound material). My colleagues at GE who grew our crystals considered me crazy for thinking I could do this, and then do it. They attributed this to the fact that I was an EE and would have known better and not attempted it had I been a chemist. I learned not only how to make p-n junctions in GaAs via VPE, but also how, in general, to grow III-V semiconductor via VPE. Also I could make heterojunctions, as well as the usual homojunctions, and described the work in some detail in widely circulated Air Force reports and, of course, in disclosures to our patent attorney. In addition, I showed my work to two visitors, F. V. Williams and R. Ruheman (Monsanto); Ruheman, with his chemist’s background, promptly wrote a disclosure on what then became perhaps the most famous patent in the field of vapor phase epitaxial growth of III-V crystals. In any case, in the interest of still higher voltage tunnel diodes than possible with GaAs, I used VPE methods (1960) to synthesize higher bandgap (red-spectrum) GaAs, InP, and also made GaAs, InP p-n junctions. Near the end of 1960 I filed US patents for GaAs, InP, and GaAs, InP p-n junctions (E > 1.2 eV), as well as
GaAs$_x$P$_y$-GaAs$_y$P$_z$ (x-y-z) heterojunctions.

By the time of the 1962 IEEE Device Research Conference (DRC), I had two years of experience in the synthesis and VPE growth of GaAs$_x$P$_y$ and in making red-spectrum p-n junctions in a so-called direct-gap semiconductor, a material like GaAs but not restricted to infrared (IR) wavelengths. At this point tunnel diodes were not as interesting to me as what I had gotten into. VPE III-V crystal growth and various new device possibilities, including light emitters. When Rediker’s group (Lincoln Laboratory, MIT) reported, at the 1962 DRC (July), success in transmitting signals with the IR output of GaAs p-n junctions, several of us speculated that a laser could be built with a p-n junction, now proven to be a powerful IR light source, and this, indeed, occurred before year’s end.

I thought I could realize a red-spectrum GaAs$_x$P$_y$ p-n junction laser ahead of everybody because of the convenience of working in the visible spectrum, but by thinking in terms of putting a p-n junction in an external-cavity laser resonator, I was behind my Schenectady colleague Bob Hall who was clever enough to use the GaAs crystal itself as the cavity resonator and could use a snorkel-scope to see what he was doing. After I gave up clearing attempts on large-grain polycrystalline material and devised a simple polishing scheme to make a Fabry-Perot cavity, I quickly realized a GaAs$_x$P$_y$ laser. It turned out that I was one of the first to make a semiconductor laser (the second with a Fabry-Perot cavity), and the first to make a laser on a “homemade” crystal, a red-spectrum III-V alloy. At a conference in Schenectady on November 28, 1962, Bob Hall and I presented our work to a large group of invited representatives from the Defense Department.

Hall talked about GaAs in the morning and I about GaAs$_x$P$_y$ in the afternoon. This presentation to a large group in the GE Schenectady auditorium turned out to be the first conference on semiconductor lasers.

As part of my talk, which was recorded on a Dictaphone belt and (as poor as it is) still exists, I described the operation of GaAs$_x$P$_y$ not just as a laser but also as a visible-spectrum light emitting diode (LED). In fact, at the Schenectady meeting I gave away some GaAs$_x$P$_y$ LEDs assembled in little pigtail glass diode packages, and volunteered somewhat later (Readers Digest, Feb, 1963) that the LED exceeded the laser in importance. General Electric quickly offered Hall’s IR lasers for sale, and at a more exorbitant price my red lasers and LED’s. The first practical LED was out in the world (1962), and it was a direct-gap III-V alloy. I left, and continue to feel, that it was important to build light emitters were the human eye sees, i.e., wider bandgap visible-spectrum p-n junctions.

The GaAs$_x$P$_y$ laser, indeed, gave an unambiguous start to the first practical LED, which in the figure below is the point (arrow, 1962) way over at the lower left. This figure, supplied by my former student and now colleague of many years, George Craford (Hewlett-Packard), shows how LEDs have evolved in performance over the years, in fact, decades. Science and engineering do not give instant answers. It takes time. If you are not a believer, you get nothing! In the interest of brevity I will not describe all the steps and plateaus in LED performance in this figure, except to say that the figure starts with a direct-gap III-V alloy semiconductor on the left, the prototype red-spectrum alloy GaAs$_x$P$_y$ (1962), and then at the far right (1989-95) climbs, because of the alloy In$_x$(AlGa)$_{1-x}$As grown lattice matched to GaAs, to well above the performance of conventional incandescents. In other words, III-V alloys have prevailed as LED’s, and still continue to improve. Also, concerning the figure, the lower left hand corner is where I started and the upper right hand corner, and beyond, is where my former students have taken LEDs.

It is worth mentioning that our Air Force supported work at GE from 1960 to 1962 and construction of a visible-spectrum GaAs$_x$P$_y$ laser proved that III-V alloys were not inherently highly disturbed and riddled with defects. This was a mistaken belief of many early workers, as well as some high-placed managers who had wrongly decreed that GaP was the ultimate LED material. GaAs$_x$P$_y$, and later its direct-gap relatives AlGaAs and InGaAsP (and now the latter modified by AlGa substitution into In$_y$(AlGa)$_{1-y}$As), and their capability for laser operation, were inherently more efficient sources of recombination radiation (photons) than indirect-gap (non-laser) materials such as GaP; hence, the alloys at the upper right in the figure. Furthermore, III-V alloys made possible the construction of single (SH) and double heterojunctions (DHs), i.e., a wider bandgap hole (p) and electron (n) emitter on either side of a narrower gain active region. This proves to be advantageous for reasons of carrier injection and also in allowing escape of photons from the active region (loss absorption), and is, of course, part of the design of the high brightness red-orange-yellow-green (BOYG) InGaAsP LED’s of the upper right hand corner of the figure.

For the high brightness BOYG InGaAsP LED’s at the upper right of the figure (and climbing up beyond the boundary of the figure), part of the basis for the
1992-93 Chapter Awards

by Alan Leffkow

The Outstanding Chapter-Activities Award program recognizes the characteristics of a successful chapter of Eta Kappa Nu. Members' election to Eta Kappa Nu demonstrates their academic ability. But members, working together in concert as a college chapter, demonstrate their humanitarian side with their activities of service to their fellow students, their department, their school, and the community at large. In return, the Chapter Award program provides recognition of college chapters for their programs of service to their students and community.

For the academic year 1992-93, seven college chapters received awards for having outstanding programs of activities. Awards are broken into three categories: Certificate of Merit, Certificate of Appreciation, and Certificate of Honorable Mention. The award plaques themselves have been made as rich as possible. The National and Honorable Mention winners receive metal plaques engraved in color. The Certificate winners receive their awards laminated in walnut.

Winning chapters seek in reports of distinction that do justice to their programs of activities, and many of these reports have been published in the pages of BRIDGE as examples to others. Desktop publishing and other professional services on campus have contributed to annual reports that look as good as the chapters portray. A winning report requires hard work, but then so does an outstanding program of activities. The Certificate of Merit Report of Zeta Pi is presented here as an encouraging example of a Winning Report.

ETA KAPPA NU
ZETA PI CHAPTER
1992-1993
ANNUAL REPORT
INTRODUCTION
Welcome to the Kappa Nu Zeta Xi Chapter at the State University of New York at Buffalo (SUNY-Buffalo). This paper represents some of the activities of our chapter as we continue to grow and strive for excellence.

The Buffalo chapter was founded in 1988 and has been active ever since. It has maintained a strong presence in the Western New York area, with over 200 members currently enrolled. The chapter has a long history of involvement in community service projects and has received numerous awards for its contributions.

The chapter is currently led by the Executive Committee, which includes the President, Vice President, Secretary, and Treasurer. The chapter also has a strong alumni network that provides mentorship and networking opportunities for current members.

ACKNOWLEDGEMENTS
Concept and Editing: Sonika Bahlani

FUNDRAISERS
I. LUNCHEON PERSON ON CAMPUS
This fundraiser was held for the American Diabetes Association. A service committee under the direction of Dr. John Smith and Dr. Jane Doe organized the event. The proceeds are used to support the American Diabetes Association's efforts to promote awareness and education.

II. STUDENT ASSOCIATION CARNIVAL/CIRCUS DRIVE
When the event came on the Eisenhower. This event was held for the annual carnival/circus drive. The proceeds are used to support the American Diabetes Association's efforts to promote awareness and education.

III. BUFFALO MISSION PROJECT/COUNCIL DRIVE
This event was held for the annual mission project/council drive. The proceeds are used to support the American Diabetes Association's efforts to promote awareness and education.

2012-2013 OFFICERS

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TECHNICAL ELECTIVE SURVEY
November 1962 & April 1963

I. GENERAL DESCRIPTION
Since 1962, when the idea for the SUNY-E HEC Technical Elective was first discussed, the interest in this elective has grown steadily. The S.U.N.Y. Board of Trustees and the student body have consistently supported the program. The elective has been offered in various departments, including Engineering, Economics, and Business Administration.

The technical elective is designed to provide students with the opportunity to explore a field of interest in greater depth. The program is open to all students, and students are encouraged to select an elective that aligns with their academic and professional goals.

The technical elective is offered in the fall and spring semesters. Students must register for the elective during the registration period. The program is provided by the college and is subject to availability.

REVIEW SESSIONS
September 1982 - May 1983

General Description
The Technical Elective Review Sessions were held to assess the progress and performance of students enrolled in the Technical Elective. The sessions were conducted by faculty members and were attended by students enrolled in the elective. The sessions were designed to provide students with an opportunity to discuss their progress, share insights, and receive feedback from faculty members.

Specific Information
The Technical Elective Review Sessions were conducted by the Department of Chemistry and the Department of Economics. The sessions were held in the Science 101 auditorium on the campus.

The sessions were attended by a significant number of students who expressed a strong interest in the Technical Elective. The students were encouraged to attend the sessions and to participate actively in the discussions.

The Technical Elective Review Sessions provided students with a valuable opportunity to reflect on their progress and to receive constructive feedback from faculty members. The sessions were well-attended and were considered to be an important component of the Technical Elective program.

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ECE Elective Booklet
Fall 1993
Eta Kappa Nu
Zeta Pi Chapter

ECE 401—Electronic Instrument Design
Dr. Wilbschall

ECE 419—Industrial Control Systems
Dr. M. Saladin

ECE 427—Plasma Physics I
Dr. Benson

ECE 442—Operating System Concepts
Dr. DeWatt

ECE 448—Microelectronic Device Fabrication
A.M. Kirman

Introduction:
Henceforth, the fall 1993 edition of the Eta Kappa Nu Techinal Elective Booklet. The purpose of this document is to allow students in the ECE Department to become familiar with some of the courses being offered this semester and to inform them of the requirements for graduation. The booklet is organized by college, department, and faculty. The college of ECE has the most courses, followed by the College of Engineering and Applied Sciences.

Student Feedback:

Student Feedback:

Student Feedback:

Student Feedback:

Student Feedback:

Student Feedback:

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Student Feedback:

Student Feedback:

Student Feedback:

Student Feedback:

Student Feedback:
### ECE 470—Digital Circuits Lab

**Dr. Schmitt**

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**Recommendations:**
- Great course but could improve in some areas.
- Students should review the course syllabus before attending lectures.

**Student Feedback**

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**Workload:**
- Professors choose style
  - 1.5 hour lecture
- 1.5 hour lab
- 3 assignments
- 3 midterms
- 1 final exam
- Homework: 10%

**ECE 475—Minicomputer Systems & Interfacing**

**Dr. Damjanovski**

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**Recommendations:**
- Good course but could improve in some areas.
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<tr>
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<tr>
<td>Project difficulty</td>
<td></td>
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<tr>
<td>Ability to get help</td>
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</tbody>
</table>

**Workload:**
- Professors choose style
  - 1 hour lecture
  - 3 assignments
  - 3 midterms
  - 1 final exam
  - Homework: 10%

### ECE 479—High Voltage Engineering

**Dr. Laghari**

<table>
<thead>
<tr>
<th>Test</th>
<th>None</th>
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<tbody>
<tr>
<td>Grade</td>
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</tr>
<tr>
<td>Laboratory Session</td>
<td>Yes</td>
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<tr>
<td>Computer Project</td>
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<tr>
<td>Homework Inclusive</td>
<td>No</td>
</tr>
<tr>
<td>Grade Scale</td>
<td>2 exams: 15% and 25%</td>
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<tr>
<td>Homework/Projects: 10% and 20%</td>
<td></td>
</tr>
</tbody>
</table>

**Recommendations:**
- Good course but could improve in some areas.
- Students should review the course syllabus before attending lectures.

**Student Feedback**

<table>
<thead>
<tr>
<th>Grade</th>
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**Workload:**
- Professors choose style
  - 1 hour lecture
  - 3 assignments
  - 3 midterms
  - 1 final exam
  - Homework: 10%

### ECE 480—Microprocessor Systems and Interfacing

**Dr. Zupancic**

<table>
<thead>
<tr>
<th>Test</th>
<th>None Required</th>
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<tbody>
<tr>
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<tr>
<td>Laboratory Session</td>
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<tr>
<td>Computer Project</td>
<td>No, 2 for programs</td>
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</tr>
<tr>
<td>Homework Inclusive</td>
<td>Yes, paper hardware design</td>
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<tr>
<td>Grade Scale</td>
<td>Midterm: 25%, Final: 30%, Labs: 35%</td>
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**Recommendations:**
- Good course but could improve in some areas.
- Students should review the course syllabus before attending lectures.

**Student Feedback**

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**Workload:**
- Professors choose style
  - 1 hour lecture
  - 3 assignments
  - 3 midterms
  - 1 final exam
  - Homework: 10%

### ECE 482—Power Engineering I

**Dr. Dukler**

<table>
<thead>
<tr>
<th>Test</th>
<th>&quot;Electric Power Transmission Systems&quot;</th>
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**Student Feedback**

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**Workload:**
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  - Homework: 10%

### ECE 483—Communications Systems I

**Dr. Capito**

<table>
<thead>
<tr>
<th>Test</th>
<th>Communications Systems, Bellak's (806)</th>
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<tr>
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**Workload:**
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  - 1 final exam
  - Homework: 10%

### ECE 485—Engineering Optics

**Dr. Malone**

<table>
<thead>
<tr>
<th>Test</th>
<th>Contemporary Optics for Engineers</th>
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**Workload:**
- Professors choose style
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  - 3 assignments
  - 3 midterms
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  - Homework: 10%

### ECE 495—Intro to VLSI Design

**Dr. Ramesh**

<table>
<thead>
<tr>
<th>Test</th>
<th>&quot;An Engineering Approach to Digital Design&quot;</th>
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**Workload:**
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CHAPTER ACTIVITIES
1992-93

Annual Report
Zeta Xi Chapter
University of Massachusetts at Dartmouth

A LETTER
FROM THE PRESIDENT
As the 1992-93 academic year comes to a close it is with great pride that I endorse this year as a very successful and motivating one. Through the dedication and efforts of our members and committed officers our chapter successfully completed several new activities and projects. Among them was an unprecedented celebration of an official initiation ceremony. This letter is a tribute to their perseverance and hard work towards bettering our chapter.

Sincerely,
Paul J. Pacheco
President

OFFICERS AND DATA
1992-1993
President.................Paul J. Pacheco
Vice President........David R. Fitzpatrick
Recording Secretary........Thomas R. Gomes
Treasurer.................Melanie Wong

Secretary...............Kimberly Duff
Bridge Correspondent

Faculty Advisor..........Dr. Robert H. Caverly

SOCIAL FUNCTIONS

INTRUCTORY MEETING
Everyone can understand how difficult it is to capture the attention of a group of busy engineering students. It seems the only way to break them away from their work is to offer them free food. It was no wonder that by sheer mention of the word "pizza" in the meeting announcement that we received a tremendous turnout at our introductory meeting. All HKM members and several faculty members were present to welcome the new inductees into the society. Inductees were informed about the society's pledge requirements and introduced to the other members of the society and attending faculty. By the end of the evening, the inductees were not only well informed about the university and HKM, but they were also well fed.

END OF THE YEAR BASH
Since pizza seemed to be a good catalyst for the stimulation of engineering social behavior we decided to use it again. This time it was called the END OF THE YEAR BASH—sponsored by both IEEE and HKM. This was a great opportunity for all to relax and enjoy themselves just before the tortures of finals. The party was well attended and proved to be a fun time for all.

INITIATION CEREMONY
In one of the most mysterious and mystical events of the year we held our initiation ceremony. Just to give you a taste of what happened picture seven robed figures silhouetted by candle light, inductees being led through the dark and damp bowels of the university into the initiation hall. It gives me shivers just thinking about it. This is the first time in over eight years that we have practiced this ancient ceremony. It was without a doubt a great experience for all who attended.

HKM BANQUET
The last social activity of the year was the HKM banquet. At the banquet certificates were awarded to the current officers as well as to the new members. Speaking at this year's banquet ceremony was Dr. Karen Payton. Dr. Payton grew up in southern California and received her B.S. in Electrical Engineering and Biomedical Engineering from Carnegie-Mellon University in Pennsylvania. She later went on to earn her M.S. and Ph.D. in Electrical Engineering from Johns Hopkins University doing her doctoral dissertation on "Vowel processing by a model of the auditory periphery." Dr. Payton held a three year postdoctoral fellowship at MIT in the research laboratory of electronics "Sensory Communications Group." Since 1989 she has held an Assistant Professorship at UMass Dartmouth and maintained a Visiting Scientist position at MIT. Her research interests now include speech intelligibility, speech perception, and signal processing.

Dr. Payton's speech contained her work in the interpretation of speech signals and the work done not only for the hearing impaired at MIT. We would like to take this opportunity to thank Dr. Payton again not only for speaking at our banquet, but also for her work with the hearing impaired.

FUND RAISERS
Top 10 T-shirt Sales
To foster engineering camaraderie at the university, HKM started the Top 10 Reasons Why I Am In Engineering T-shirt activity. This yearly activity is begun with posters being mounted throughout the engineering buildings that asked all to write down the main reason they became an engineering student. Well, after long hours of deliberation, over hundreds of entries we were able to narrow the list down to these Top 10 Reasons Why I Am In Engineering for 1993:

1. The reasons are left to the student as an exercise.
2. Commander Montgomery Scott is my hero.
3. My mind was in the right-half plane.
4. I'm in engineering.
5. Nothing else is tough enough.
6. The afternoon after the math.
7. I thrive on frustration.
8. I don't suffer enough as a child.
9. 'cause I have no clue.
10. It sounds impressive so people think you're really smart.

You should have read the ones that we had to throw out. WOW!!! Now seen spotted all over campus are engineers displaying with pride, the top 10 reasons that they are in engineering.

OUTSTANDING ACHIEVEMENT
Recognized for his outstanding scholastic achievement as an electrical engineering student and HKM member is Stephen P. Longworth. Among his honors this year was his acceptance to the graduate study program at MIT and scholastic achievement awards at the UMass Dartmouth Honors Convocation as well as graduating Magna Cum Laude with a B.S. in Electrical Engineering this June. We are all very proud to have Steven Longworth as a member of the Zeta Xi chapter of HKM at UMass Dartmouth.

FUTURE ACTIVITIES
The new officers for the 93-94 year have a mountain of work ahead of them. One of their tasks for this year will be to organize the first annual Freshman Engineering Contact Program (FECP). The job of the FECP is to help in the transition of incoming freshmen engineers by supplying them with an upperclass contact. These contacts will be helpful in course selection, professional guidance, orientation and even peer counseling. The initiation phase of this activity will take place at a beginning of the year mixer where the new students will have the opportunity to mingle with faculty, other freshmen engineers and other FECP contacts on a social level. We are sure the FECP will be instrumental in making the transition into the university an easier and more enjoyable experience.

"A YEAR IN REVIEW"
Summary Letter from the Adviser
DearEta Kappa Nu Members,
This has been quite a busy one for the Zeta Xi chapter at the University of Massachusetts Dart-

18

19
Annual Report
Epsilon Eta
Chapter
Rose-Hulman Institute of Technology

OFFICERS AND DATA
Number of Members: 36
Number of Meetings: 8

Officers for 1992-93
President: Jason A. Mix
Vice President: Brent Hoffman
Secretary: Jeff Swartz
Recording Secretary: Eugene Park
Corresponding Secretary: Theron Nelson
Bridge Correspondent: None
Faculty Advisor: Dr. Frank Acker

OFFICERS FOR 1993-94
President: Tim Walker
Vice President: Daniel Janko
Treasurer: Julian Waddy
Recording and Corresponding Secretary: Jay Moorman

REPORT OF MEETINGS
9-17-92 Meeting to discuss new ideas for the chapter’s activities for upcoming year, and to discuss the file system in the library.

Annual Report
Gamma Theta
Chapter
University of Missouri-Rolla

INTRODUCTION
The Gamma Theta Chapter represents Kappa Nu on the campus of the University of Missouri-Rolla (UMR). We seek to uphold the principles of integrity and professionalism intended by the founding members of HKN, to assist in the development of students in electrical and computer engineering, and to ensure our community will be involved with other successful EE chapters.

We hold regular meetings to discuss current projects and future opportunities. We participate in various technical and social events, such as the annual meeting at which new members are inducted.

Sincerely,
Robert H. Carverly, Ph.D.
Professor

Annual Report
Chi Chapter
Lehigh University

OFFICERS AND DATA
President: Beth Naussbaum
Vice President: James Larrabee
Secretary: Nick Jankel
Treasurer: Doug Frey
Faculty Advisor: Neil Cohen

No. of Members: 17
No. of Initiates: 6
No. of Meetings: 6

ACTIVITIES
Tutoring
New activity. We required all new and old members to assist in tutoring of the two new electrical engineering students. The programs were for 10 hours each with a new project every week.

2-10-93 ballots for new members
3-22-93 Executive meeting for initiation ceremony practice
4-23-93 Initiated 15 new HKN members and held a recognition dinner at Gerhardt’s Bistro with temporary E.E. faculty. We also held a meeting to decide the Outstanding Sophomore ECE Student and local HKN award.
5-24-93 Report on Outstanding Sophomore ECE Student to school.
8-27-93 judges held a science fair and chose best ‘Electrical Project’ for Kappa Nu award of $100.
5-18-94 Meeting to elect new officers and distribute ballots for new members.
5-21-94 New members for new officer.
5-21-94 Initiation ceremony for new members.
8-25-94 Formally transfer control of the Epsilon Eta chapter to the new officers.

Jason A. Mix
Former President
Timothy Walker
President

INITIATION
Our chapter’s pledging process begins each semester with a “smok-er,” a meeting to which all those prospective pledges who meet membership requirements are invited. Those who participate in this meeting are introduced to current members of HKN to find out something about the pledges. Those who volunteer to interview will verify that the pledges do meet the academic requirements and have the character becoming a member of HKN, and try to answer their questions about the organization.

All pledges are required to attend a workday, to assist the chapter in some service project. During Pledge Week the pledges are to dress up every day and wear a hat so that everyone will know that they are receiving this honor. The pledges sand, stant, and paint their plaques, leaving the back of the plaque coated with the names of the current student and faculty members of HKN. Each pledge is also supposed to sell two tickets to the initiation banquet. During the Spring semester a volleyball game was scheduled for members and pledges as part of the Pledge Week activities.

At the Pledge Week the pledges have to take three tests. In the first they are required to write out the KNK preamble from memory. Then they take a test over the chapter and national bylaws. Extra credit is given for any names of current members or pledges which they can remember. The third test is a grueling Circuit Analysis test, written by several of the members. This test is used to screen the HKN members who have already taken it and who are now watching the new pledges. Then after the tests, there is a pledge party for all members and pledge to relax and get to know each other.

The initiation banquets were held at Zeno’s Steak House on November 22 and April 17. The
pledged were taken through the formal process. When we enjoyed a great meal. Awards for best plaque and best pledge were given during the evening.

The Gamma Theta Chapter honored four outstanding UMR professors with membership in Eta Kappa Nu. The professors were nominated for membership according to the provisions in the national constitution, after it was discovered that they did not already belong to Eta Kappa Nu. We are honored to have them as fellow members of this honor society.

EE Tours—HKN ambassadors

The Gamma Theta Chapter had the opportunity of conducting tours of the Electrical Engineering building for prospective students and their families. Beginning on October 1992 continuing through the spring semester, members of HKN were requested to volunteer for leading these tours. Individuals individually given the title "HKN Ambassador." Each Ambassador gave a practice tour with either another student or another student before actually giving the tour to prospective students.

The tours were coordinated through the secretary of the electrical engineering department, and the registrar's office. Students coming to the visits were provided with a tour, a campus tour, a social aid office, etc., and sometimes be given a tour of the campus. Those who had expressed an interest in majoring in electrical would also be offered the opportunity of touring the EE department.

Other Activities

We also maintained a large stock of parts manuals, oscilloscopes and other equipment, several breadboards, wires, and tools, which are helpful for students trying to work on their own projects or quietly working on a problem. This spring semester we also were able to purchase a computer for the hobby club through the UMKC student council. Thanks to the efforts of our student council representative, the computer will soon be ready to be connected to the UMKC network, so that hobby club members can have access to the campus computing facility. Our chapter plans to share our HKN record on the computer.

During our initiation activities, pledges have to participate in various activities related to EE. Usually the project they end up doing is helping to organize and clean the club room. This year we opened a new computer lab, which we plan to use for the electrical engineering program at our university.

Help Sessions

In past semesters HKN has tried to provide help sessions for beginning Circuit Analysis students. Pledges have been required to sign up to run one of these sessions. We hope to continue this practice during the week. The practice has met with varying success at times, and usually suffers from lack of participation.

During the spring semester of 1993, the help session program was again expanded and included the subjects of Circuit Analysis and Electronic Engineering Majors. The Gamma Theta Chapter was given the opportunity to volunteer to lead these help sessions.

At the beginning of the semester there was great enthusiasm. This began to wane by the end of the semester, until most of the sessions were cancelled. However, the M.E. Circuit Analysis class was heavily attended up to and including finals week. The sessions were very appreciated by the students who attended, and most felt they learned the material better and were better prepared for exams.

Other Activities

The Gamma Theta Chapter was involved in other activities, and is preparing for other activities in the future. At the beginning of the Fall semester, we raised over $800 for a local charity. We also had a picnic with the local chapter ofIEEE. The picnic was open to EE professors, students, and their guests. It is a good way to start out the school year.

We attempted to sell doughnuts on Friday mornings during the fall semester, in an attempt to raise a little bit of money. This venture was met by several of the students and faculty bought some. But the demand was not high enough to make much of a profit, and the doughnut sales were finally discontinued.

We also purchased a variety of shirts and sweaters from a local store, with the Eta Kappa Nu logo imprinted on them in full color. There were several styles and colors available. Many of these were sold to the chapter members and pledges each semester. Some of the HKN Ambassadors who led the tours wore their HKN polo shirts on the days when they were scheduled to do the tour.

For the future, the chapter has voted to begin selling T-shirts to those who will be studying for the graduate program entrance exam.

HKN also sells T-shirts to students enrolling in the electronics lab, with the possibility of buying them back and reselling them. This would help the EE students reduce their education costs. It was also suggested that we keep a current address record of students who made use of the HKN resources.

Annual Report

Tau Chapter
University of Cincinnati
OFFICERS AND DATA

Winter 1993
Number of Members: 35
Number of New Initiates: 9
Number of Business Meetings: 6
President: Sean Hodge
Vice President: John Bellando
Treasurer: Kevin McGonagle
Recording Secretary: Jenny Tsai
Corresponding Secretary: Greg Brockman
Bridge Correspondent: None
Faculty Advisor: Dan Samp

PROGRAM AND ACTIVITIES

The Activity, Old, New, or C (Continued), and Man Hours are listed below, respectively:

Fall 1992
Fundraiser Old 10
Grad School Info Seminar Old 2
Grad School Info Seminar Old 2
Winter 1993
Initiation Ceremony & Banquet Old 8
Incoming Students (Open House) Old 12
Networks Tutoring Old 5
Grad School Info Seminar Old 2
Spring 1993
Fundraiser Old 10
ECE Lounge Cleaning Old 4
Initiation Ceremony & Banquet Old 8
Freshman Info Session New 2.5
Spring Picnic Old 5
Grad School Info Seminar Old 8
Junior Class Info. New 1
Networks Tutoring Old 5

Fall 1992
Number of Members: 26
Number of New Initiates: 9
Number of Business Meetings: 7
President: Sean Hodge
Vice President: John Bellando
Treasurer: Kevin McGonagle
Recording Secretary: Jenny Tsai
Corresponding Secretary: Greg Brockman
Bridge Correspondent: None
Faculty Advisor: Dan Samp
A Life Subscription to the BRIDGE is available at a modest cost of $60. Send a check with name and address to:

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P.O. Box 2107
Rolla, MO 65401

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Rolla, MO 65401

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