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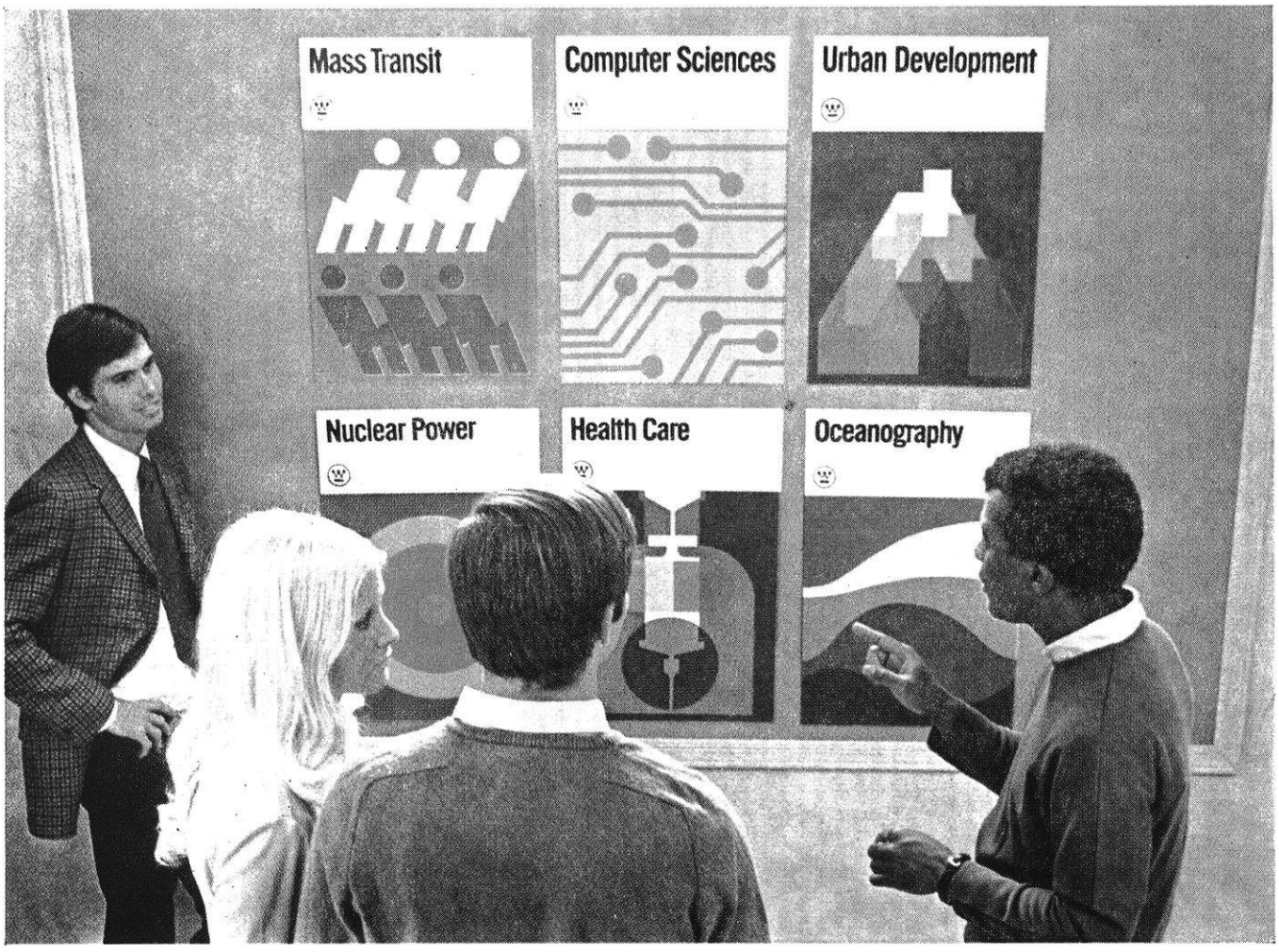
VOL. 75, NO. 3

35 CENTS DECEMBER, 1970

wisconsin engineer

If you want to engineer a better world...



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CONTENTS:

wisconsin engineer

MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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Editorial —

Let's Get It Together

Recently Dean Leidel suggested in Freshmen Lectures that engineering students, with their overwhelming presence, help secure the new Union South for engineers and the like so that he could feel comfortable in a Student Union once more. The implication, once again, is that long hair, beards, bells, beads, and attendent philosophies plus engineers do not good company make. We apologize for making an example of Dean Leidel's sentiments because they are by no means his alone; just more recent and vocal. Perhaps we should thank him for pointing out to freshmen engineers what we're all suffering here at Madison — two campuses with an abiding gulf between them.

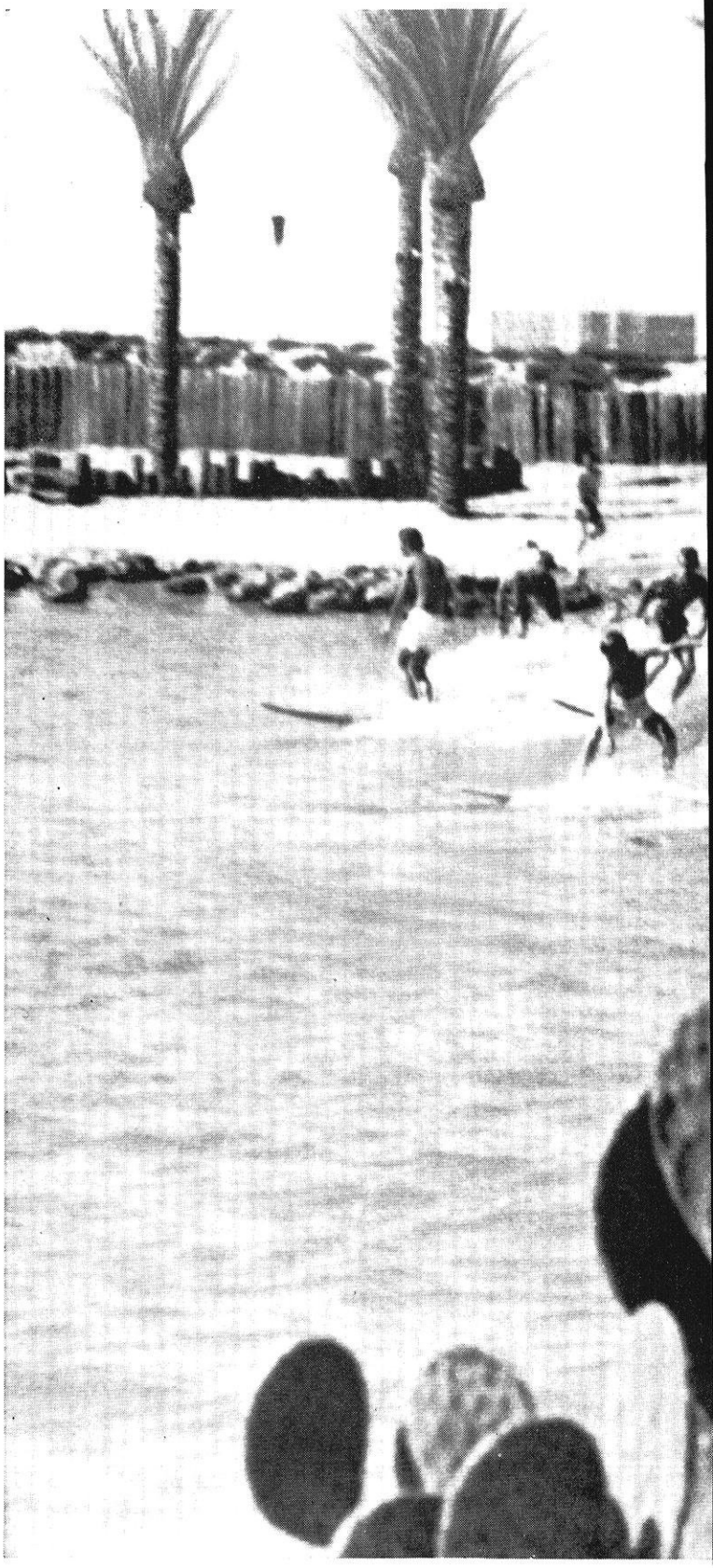
The obvious error (forgive worn-out logic) is the attempt to stereotype engineers. There are many many students who submerge themselves in engineering disciplines during the week and still suffer the perplexing embarrassment at a weekend bash across town of having someone say, "Are you really an engineer?" But it is more than this. The attempt to make engineers and other professionals the vanguard of the status quo is all too prevalent. Words like professionalism, professional judgement, engineering ethics, etc. are constant reminders to us in class of a particularly volatile state of being which often evaporates from our senses like pipe smoke in old panelled reading rooms.

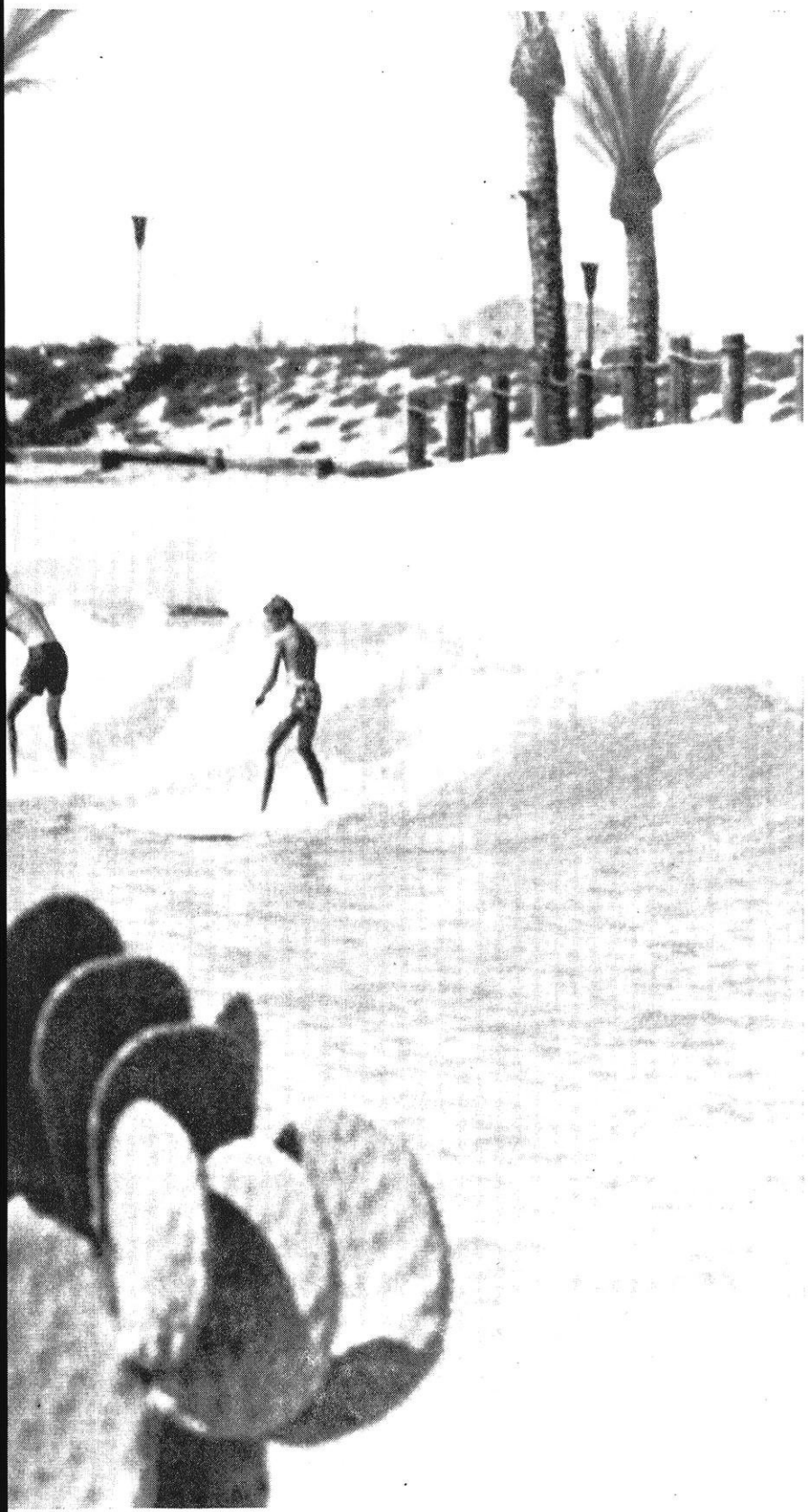
Now, somehow, the new Union South holds great promise for those who would continue the polarization. But it seems to us that this structure, like anything fresh and new, should be a means of getting it all together. No one can deny, or hide from, the bifurcation of life styles or the explosion of values that has shaken traditions especially on University campuses. No one can shield for very much longer the intense scrutiny being given the sciences and applied sciences. Engineers, as designers and builders, far from being an elite that some perhaps do wish, have a responsibility, even an ethical commitment if you will, to try and bridge the growing discontinuities in social-economic thought with a little help from everybody. It can't be done with possessive thinking about a piece of real estate on Randall Ave. To do anything but welcome all life styles and a melting-pot of values in the Union South, and participate, would be to dedicate it as an eventual tomb of the status quo.

—berner

[***]

They're "shooting the curl" in Phoenix.





Surfing has come at last to the Arizona desert.

The ersatz ocean is called Big Surf*. At 4 million gallons, it's believed to be the biggest "pool" ever built: 400 feet long by 300 feet wide, and nine feet at its deepest point.

And it makes its own waves.

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Water Pollution in Wisconsin

— A HISTORICAL REVIEW —

By ROYDEN TULL
Zoology Graduate Student
University of Wisconsin

That a great number of waters are polluted is a fact that cannot be argued against very effectively. In the 1970 Wisconsin River Basin Survey, even the inept monitoring of the Wisconsin River showed over fifty percent of the river is below minimum standards. In the 1968 Fox River Basin Survey, there were no tolerant organisms at all from Memasha to Green Bay except for two different species consisting of one each at a single Appleton sampling station.

The absence of any intolerant organisms in the Fox River shows that it is very polluted, and its bottom and flow characteristic would support a healthy population of intolerant organisms were the river not polluted.

If the high degree of pollution of these two rivers and other waters of the state, was inevitable because of the technological limitation imposed on past populations, the investigation of the history of Wisconsin's water would be a waste of time, and one now could simply say, "Now we have the tools to clean up our waters let's do it." However, Wisconsin's present and past water pollution is not and for a large part of the twentieth century has not been a function of technology, either separate or in conjunction with cost considerations.

The considerations are economic, political, outside uncontrollable events (i.e. WW II), Public indifference and ignorance coupled with an attitude that favors short term advantages with long term disadvantages over advantages spread out over a longer period of time with fewer attendant disadvantages. This attitude is characterized as instant gratification by psychologists, and is **sine qua non** of immaturity in individuals.

1800-1850
THE DEVELOPMENT OF METHODS

If it were not for the devastating effects of typhoid, cholera, and other water born diseases, our waters would be in worse shape than they are. It was the impetus provided by these diseases that first lead to the development and use of water treatment facilities. In England in 1802, the use of chemicals in breaking up and deodorizing sewage was discovered. In 1826, it was found that sand filtration by the East Chelsea Water Company in London could render even the highly polluted Thames River 99% free of unwholesome material. In 1840 Ozone was found to be a successful purifier of sediment free water and in 1846 the basis of present day sewage treatment was developed. Just after this in 1849, it was found that to be effective a chemical precipitator had to be used in combination with filtration, settling and agitation of the sewage, along with frequent removal of the sludge. Dr. John Snow and an engineer John York proved empirically that cholera could be contracted through drinking water containing the excreta of cholera victims. Dr. William Rudd proved the same thing for typhoid in 1856. During this period, by the efforts of Edwin Chadwick, a General Board of Health was established in England in 1848. Chadwick, like our own State Board of Health established later in the century, had to work through local voluntary formed Boards of Health. These he found detestable because "unpaid dilettante service is cheap service" and he thought that people elected or appointed for short terms could not know their jobs or stand firmly against local pressure.

1850 to 1925
NO CONSTRUCTIVE WORK

By 1875 the tools and knowledge were available to handle the water pollution of the population. Studies had been completed which showed that heavy pollution destroyed the capacity of a river to restore itself. It was known that pollution control required:

1. Subsidence of the waste in a series of settling tanks.
2. Filtration through a series of gravel beds, perforated planks, wire screens, gause, charcoal, sand, or ashes.
3. The addition of lime and carbolic acid to the effluent.

The fact that water pollution was a problem is bornout by an analysis of 19th century law which shows an abundance of water pollution laws, but they are all aimed at delegating control to local authorities and to the instigation of civic action by private citizens. In considering this, it's easy to see why that sort of law was ineffective. During this time, the emphasis was on expansion and growth, resources seemed unlimited. If a local official responsible for water pollution control was not already connected to the industries he was supposed to regulate, they would be one of his more vociferous constituents. So the combination of attitudes and local pressures would tend to render

local control totally worthless. Lawyers being what they are, civil action was as expensive then as it is now and few citizens had the money to pay it.

From 1875 to 1925 concerned officials mostly in the State Board of Health and concerned citizens were met with indifference and with hostility, abeit political ignorance played a part also. In 1874 the Fisheries Commission made up of active politicians looking for a "practical" solution introduced carp into the state waters as a solution to pollution. They thought that carp would act as a living vacuum cleaner and clean up the sewage in the state's waters.

The American Medical Association relative to its present reputation as a conservative body was quite radical in 1876 when it stated that one "who will only pollute a stream of water . . . be held 'guilty of a crime against society' and be adequately punished." In that year the Wisconsin State Board of Health was established, its first permanent president said, "The people need facts: facts fortified and made cogent by figures; facts demonstrated from persistent and ever acting causes, and gathered from many localities. They need to be taught . . . what the external cause of typhoid fever is . . ." Seventy years later with decades of defeat and experience the retiring State Health Officer said, "The old theory of educating the public to a reasonable conformity for their own protection has proven a failure, and if results are to be obtained positive and constructive procedure by statutory provisions are basically fundamental essentials." Although the S.B.H. did not have all of the dubious assets of the Communications media including Madison Avenue, it is clear that education of the populace should best be considered as secondary to administrative and legal action by environmentally concerned officials.

The Wisconsin State Board of Health's Committee on water and water supply did its first sampling of streams and underground water in 1877. They sampled the Wisconsin, Black, Yellow, Wolf, and Fox Rivers. After an analysis of the data was completed, they concluded that most of the water supplies in the state were polluted. As a result of this report, the WSBH was compelled by political pressure to drop the sampling and dissolve its committee. This action showed that the state's opinion makers would not tolerate "radical" reports from a state agency. In 1878 there was a malaria problem on the Crawfish River and the WSBH made its first river valley survey. There was a mill dam there but the board could not prove that the dams impoundment was providing the necessary breeding area for mosquitoes. Appropo of present day tactics the local farmers took matters in their own hands and one night the mill mysteriously caught on fire and burned. The frightened miller left the area, the dam was destroyed, and the malaria cleared up.

Mechanical filters using chemical coagulants in addition to sand and gravel, were patented in 1884. This general period marked a time when the essence of modern sewage treatment was known and written for popular consumption in plain language and was available to any city officer. In another development during that time the use of iron pipes as opposed to lead pipes and hollowed elm wood pipes was known to be advantageous. The lead pipes were known to be poisonous and the wood pipes were prone to breakage, contamination from leaks, and irregular flow, while the iron pipes had none of the disadvantages. Thus by the last of the 19th century when typhoid and cholera were ever present dangers the reliable safe means for both obtaining water and getting rid of waste were known and avoidable. Yet iron pipes were not being used because the "common sense" of the times dictated that things worked well enough as they were and if there was not a direct profit attached a thing was not worth doing. This attitude is still prevalent today, even among our regulatory agencies wherein the economic consideration or profit motive as it's related to industry is paramount in decision making about our natural resources.As might be expected city fathers and industrialists had similiar attitudes about pollution. The very idea of spending capital on something which did not produce when it could be spent on something which did was an anethema to the industrialist. Early in the development of Wisconsin this attitude was justified but by the early 1900's methods were available and business was well established and the attitude that the industrialist "could see no responsibility on his part to control pollution at the source," was the only thing preventing a comprehensive pollution control program.

By 1900 in the U.S. only 40% of the population was serviced by public water supply and only 6.3% were supplied with filtered water. To meet this challenge and the attendant rise in typhoid fever in Wisconsin, the Wisconsin legislature in 1905 gave limited jurisdiction over the proposed water supply and sewage systems to cities and villages. However, this not being an overwhelming need, the legislature failed to appropriate any funds for this new responsibility. Also in 1905 E.A. Birge a professor of Zoology from the University of Wisconsin showed the relationship between fish survival, oxygen content, and the amount of decomposible material. This discovery had no effect on Wisconsin's policy makers. In 1908 Wisconsin set up the Wisconsin Natural Resources Policy Committee and through its existence the Wisconsin's Conservation Committee was formed. In response to the obvious delineation of the limits of Wisconsin's natural resources the legislature declared in 1911

(Continued on Page 16)

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1971

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UNION SOUTH

The poster-covered construction fences are down, cement walkways have been poured, and one of the University of Wisconsin's newest buildings – Memorial Union South – has literally begun to take shape.

Slated to partially open in February, the $3.5 million structure will be the University's second full-service Union, complementing the Langdon St. Union constructed in 1929.

Located on the southern end of campus at the corner of Randall and Johnson Sts., Union South will feature several dining areas, bowling lanes, conference rooms, a banquet and lecture hall, guest rooms, an arts and crafts workshop, games area, and music and study lounges.

"It's really beginning to move along now," said Union South Resident Manager Merrill Sischo, who has spent innumerable hours in the planning of the building since appointment to the position in July, 1969.

All along, construction of the three story light brick structure has been plagued with the usual delays caused by strikes, delivery of equipment and materials, and of course, bad weather. So when the Union South opens in February, it will be the culmination of many years of talking, planning and hard work for the students and staff at the Union.

Discussion of a second Union began in 1950, when it was decided that additional services were needed on the south end of campus. Students have been actively involved in the new union's plans all along, and now play a major role in "promotion" of the building by traveling to various campus departments, dormitories and organizations to make Union South's presence known.

In May, UW senior Jim Wessing, of Lomira, was selected as the first Vice-President of the Union, in charge of Union South, serving over an eight member student program board. The students, along with committee members recruited this fall, have already begun sponsoring programs to acquaint the campus with the new Union.

Each weekend the students hold a folksinging coffeehouse in the Rust-Schreiner co-op dormitories a block from the Union South site. Recently they sponsored a much-publicized police-student rap session in the Memorial Union Rathskellar, to promote contact between the two groups. They have also held two rock concerts at Camp Randall, just across the street from the new Union.

The UW is the first campus in the nation to have two full-service Unions. Many universities have two buildings, but usually the second is little more than a food service branch.

With recreational facilities, four dining areas, meeting space, a workshop and an emphasis on student-planned programming, Union South expects to offer the same types of services as the Langdon St. Union has over the years.

"Our biggest problem will be to make the community aware that we have two unions, but one organization. We will have to establish a separate identity for Union South, yet maintain the concept of the Union as a unified idea, as two buildings working towards the same goal," commented Sischo.

For example, the two buildings will complement in many ways, but offering different services that are built around the same purpose. With Lake Mendota at its doorstep, the Memorial Union rates high as an outdoor recretaional facility with its Hoofer activities in sailing and canoeing. Union South will have an extensive indoor recreational program – with bowling lanes, billiards tables, table tennis and a strong tournaments program in bridge and chess.

The program emphasis will be different, too, as Wessing points out: "I think we're going to be planning a lot of noon and midday programs, such as films, speakers and forums, rather than all evening programs."

Wessing and students from the Union South Program Board put a great deal of emphasis on "community consciousness." That is, working to discover what the needs are of students, faculty and staff working and living in the area. They hope that their programs will reflect the desires of their expected clientel.

Randi Christensen, the students' Program Director, has been working to help develop present and future programs since June.

"Our biggest asset right now, is that we don't have a building to program in – we've been forced to seek out places in the community to hold our programs. By planning films, coffeehouses and forums in dormitories and classrooms, we go to the people and discover what they want in a program, rather than expecting them to come to us," she pointed out.

Miss Christensen hopes that this practice will continue even after the building opens.

Sischo hopes that by February 1, they will be able to open up the recreational facilities in the basement, and then open the first floor dining and lounge and meeting area by March 1. The 102,000 square foot building consists of three stories and a basement and is built around a central skylit well.

Union South and the Memorial Union will continue to be governed by the same student-faculty-staff board, the Union Council. The Union is a membership organization, and as such, is open to Union members and their guests. Students are automatically members since part of the University fee includes Union membership. Others may join by paying the same yearly fee. The Union is, however, open to the public for specific events. One membership will cover both Unions. [***]

International Opportunities for Student Engineers

by Jeffrey W. Crick EE4

Are you getting bored with all those engineering classes and problem sets? Was last summer a real drag? Or is it that your research project is all bogged down? Maybe you just want to get away from the same old place and see something different. If any of these are true the Engineering Foreign Programs may be just what you are looking for.

For the freshman engineer the Wisconsin-Monterrey Junior Year abroad exchange program would be worth looking in to. The upperclass engineer who cannot find a decent summer job should find out about the IAESTE program. There is also a graduate study program in Germany and a proposed set-up in France. Each program has certain requirements concerning language, grade point and economics. Each one also affords an opportunity for foreign travel and study and a chance to get to know a different culture and people. For the ambitious student it is an opportunity that should not be passed up.

THE GRADUATE STUDENT PROGRAM

The aspiring grad student, who has completed a year of grad school in engineering and has mastered the German language, can spend a year of his study in Stuttgart, Germany at one of the University of Stuttgart's related institutes for Chemical or Nuclear Engineering. This is a highly individual program and must be arranged personally; however, much of the red tape has already been cut by previous student participants. A program is now in the making with the Ecole Centrale des Arts et Manufactures in Paris, France. Any interested grad student or "would be grad student" should contact Professor Merton Barry, Engineering Foreign Programs, 439 Engineering Research Building, University of Wisconsin.

THE WISCONSIN-MONTEREY PROGRAM

The Wisconsin-Monterrey program is a Junior Year abroad exchange program designed uniquely for engineers. The technical requirements of engineering limit the possibilities for transferring credits between schools, but because of their high standards the College of Engineering and El Instituto both transfer all credits readily making this program an uncommon opportunity. Students during their junior year go to Monterrey, Mexico to study at El Instituto Tecnologico y de Estudios Superiores de Monterrey which is known as one of the best technical schools throughout Latin America.

The program was initiated in 1961 under a grant by the Carnegie Corporation. That first year seven students took part. Several other schools have since formed similar programs at the Tecnologico including Case Western Reserve University, Stanford University, Colorado State University, and Cornell University. Many of the past participants who have graduated are now working in positions where they directly use the experience they gained in the Spanish language and culture through their year abroad.

Each year the number of participants varies depending only on the number of young engineers interested. Wisconsin has sent between one in 1966 and eleven in 1969. Up to now there has never been any reason to limit the number of participants because interest is some what limited. The total number of Americans students at the Tec from all the schools involved has varied between seven and eighteen.

The program begins in July with a specialized, intensified summer school course in Spanish at the Tec. It entails a general review of the Spanish language along with pronunciation practice and cultural aspects such as guitar lessons. The regular summer school is attended by many other Americans so that the atmosphere is not much different from an American school.

The academic year brings a change when all the other American summer students leave and the Mexican students return from their homes. Classes are taught completely in Spanish and the participating students find themselves sitting alongside either Mexicans or Latin Americans. Classes themselves are not too difficult once the Spanish language is mastered.

During the year the most rewarding experiences are gained through the opportunity to travel throughout all of Mexico. Cities like Acapulco, Mexico City, Guanajuato, and Guadalajara are simply fascinating. The Gulf of Mexico, Pacific Ocean, and Caribbean Sea are exciting for swimming, skin diving, and deep sea fishing. Meeting people and getting to know Mexican culture are probably the most worthwhile experiences each participant has. For those who have never travelled it is an opportunity to learn; for those who already know the advantage of travelling, it is merely a great chance to do so.

(Continued on Page 18)

CALCULUS*

* What You Should Be Able to Do When You Finish the Sequence

By WILLIAM D. BAASEL
Professor of Chemical Engineering, Ohio University

Algebra

The student should be able to:

1. Solve a second order algebraic equation in two unknowns using the quadratic formula.
2. Solve a cubic or quartic equation in two unknowns graphically.
3. Determine the value of a third order.
4. Solve three equations in three unknowns without the use of a textbook.
5. Plot any algebraic equation in two unknowns.
6. Plot an algebraic equation having three unknowns by assuming one of the unknowns is a constant and obtaining a series of curves for different values of the constant.
7. Take a tabulated set of x,y values, plot these values on a graph, and obtain from the graph and the values proper, a good graphical fit by drawing a line and also a reasonable equation, i.e. involving polynominals or exponentials.
8. Determine the maximum or minimum for an algebraic equation.
9. Recognize a maximum or minimum on a graph and determine where it is.

Limits & Series

The student should be able to:

1. Expand the logarithmic function into a series.
2. Expand the sine into a simple series.
3. Expand the cosine into a simple series.
4. Expand the exponential, ae^{bx}, into a simple series.
5. Define the term limit.
6. Define a convergant and divergant series.
7. Give three examples of a convergant and a divergant series.
8. Find the sum of a finite or infinite power series.
9. Determine whether a simple series is convergant or divergant: such as: $1 + X + X^2 + X^3 + X^4 + \ldots$
10. Determine in a series such as the above for what values of X the series diverges and for what values of X the series converges.
11. Define the Taylor Series expansion of a function and, be able to expand simple functions in a Taylor expansion.
12. Define the Fourier expansion of a function, and be able to perform this expansion for simple functions.
13. Define a power series.
14. Give three functions that can be expanded in power series and he should be able to perform such an expansion for simple functions.
15. Give a numetical answer for the following:

$$\lim_{h \to \infty} \left(\frac{1+1}{h}\right)^{1/h} \quad \text{and} \quad \lim_{h \to 0} (1+h)^{1/h}$$

Differentiation

The student should be able to:

1. Differentiate the following simple functions without a table, a log bx, ax^{bn}, asine bx, a cosine bx, ae^{bx}.
2. Determine the first and second derivatives from a graph or table of the function.
3. Distinguish continous and discontinuous functions.
4. Recognize the usual notations used in calculus such as: X, x', $\partial a / \partial y$, dx/dy.
5. Differentiate a product, a sum and, a quotient.
6. Differentiate a complicated function using tables.
7. Recognize where in a discontinuous function the derivative does exist.
8. Use L' Hospital's rule.
9. Solve problems involving simple physical principles using calculus.

Integration

The student should be able to:

1. Integrate simple functions i.e. a log bx, ax^b, ae^{bx}, a sine bx, acosine bx.
2. Determine the area under a graph and recognize that this is the integral of the function.
3. Determine the integral under a plain surface by some physical means.
4. Integrate a complicated function using a table of integrals.
5. Integrate a discontinuous function.
6. State why definite integral tables exist for certain functions.
7. Solve problems requiring the use of definite integral tables.
8. Recognize the common integral functions which cannot be presented in an open form.
9. Evaluate the constant of integration given enough values of pairs of the dependent and independent variables.
10. Recognize the notations of integral calculus.
11. Integrate the product, sume or quotient of functions which are given in Dwight's table of integrals.
12. Solve problems involving simple physical principles using integral calculus.
13. Obtain the volumes enclosed by surfaces of revolution using the concepts of multiple integrals and multiple derivatives.
14. Graphically and numberically integrate a function of one independent variable.

Vectors

The student should be able to:

1. Define a vector.
2. Add and subtract vectors.
3. Define and find the dot product of two vectors.
4. Define and find the scalar product of two vectors and the cross products of two vectors.

(Continued on Page 19)

Venture: Seven minutes to save a life.

The problem: lifesaving clinical tests of blood, urine and spinal fluid may take technicians hours to perform using traditional methods.

The possible solution: design a virtually complete chemical laboratory in a desk-sized cabinet that will perform a variety of clinical tests automatically, accurately, quickly.

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Separate packs—made of a chemically inert, optically clear plastic—are designed for a variety of tests. And each pack is supplied with a binary code to instruct the analyzer. Packs for certain tests also contain individual disposable chromatographic columns to isolate specific constituents or molecular weight fractions on the sample.

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A built-in solid-state computer monitors the operation, calculates the concentration value for each test and prints out a report sheet for each sample. The instrument is capable of handling 30 different tests, the chemistry procedures for ten of which have already been developed. The first test result is ready in about seven minutes. And in continuous operation, successive test results are obtained every 35 to 70 seconds, depending on the type of test.

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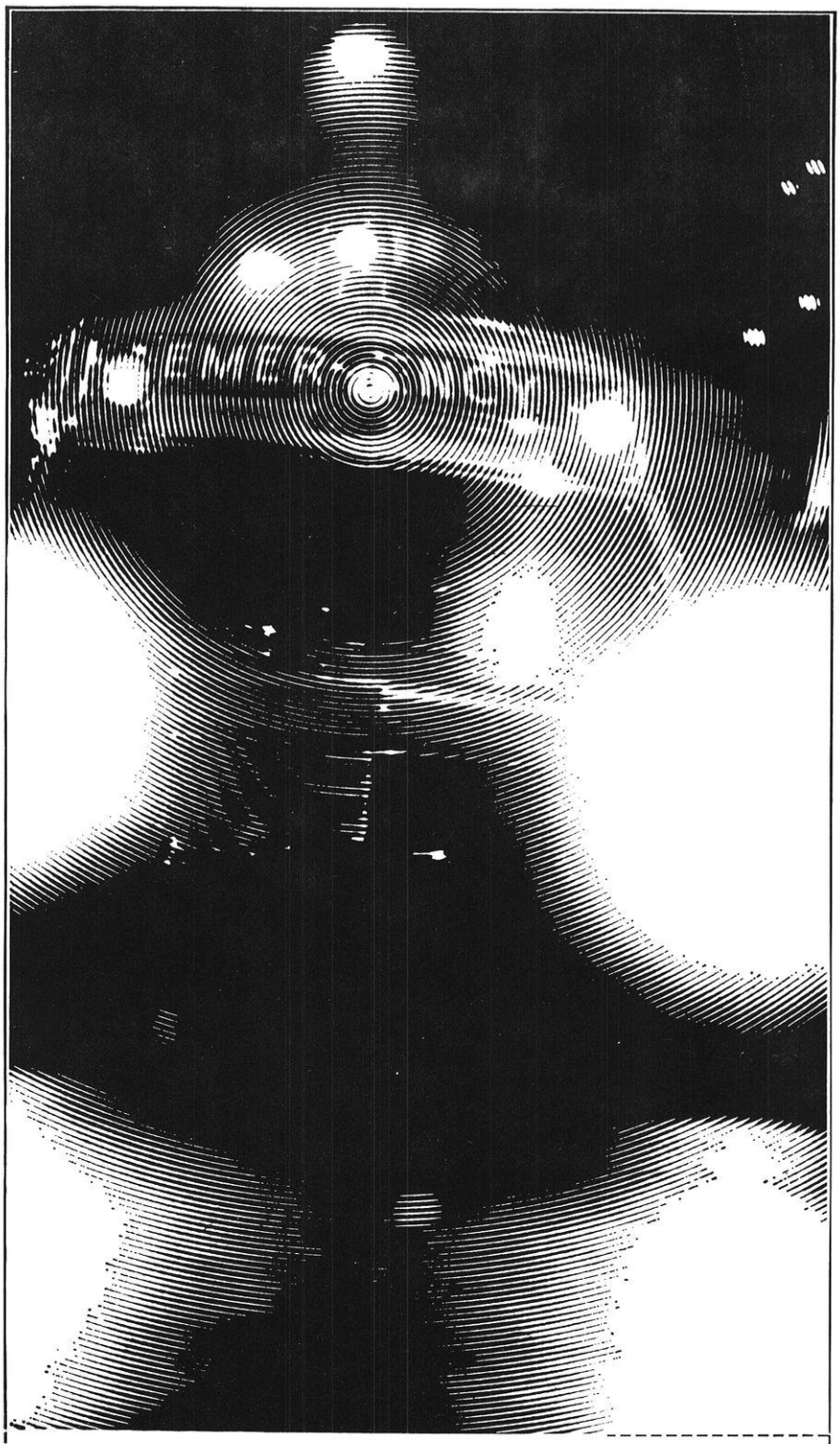

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POLLUTION – (from Page 9)

that the public policy of Wisconsin was to prohibit "any person, firms, or cooperation, unreasonably to waste or maliciously to injure, destroy or impair any natural resources within the state." In the 1920s the legislature made further responses to Wisconsin's dwindling resources by ordering the new Conservation Commission to cooperate with the SBH on water pollution. However since there were considerable policy differences, conflict quickly grew. The Conservation Commission looked at the matter in a relatively simple but action oriented manner. That is, pollution is caused by dumping waste in the surface waters and that pollution is illegal. Therefore polluters should be compelled to stop dumping wastes. The SBH took a more comprehensive, but perhaps, less effective view feeling that studies should be made to determine causes, kinds and operations of water pollution, and the ways of controlling it through prohibitions and treatment, and into the economic situation of the polluters. To resolve this conflict the State Committee on Water Pollution (SWCP) made up of representatives from the Conservation Commission, the S.B.H., and the Railroad Commission (later renamed the Public Service Commission), the State Sanitary Engineer and the State Chief Engineer was formed.

The State Committee or water pollution was formed none too soon for some of the state rivers were as polluted then as they are now. The Fox River for instance received in waste 31% of its minimum yearly mean flow and most of this was industrial which has three times the effect of domestic sewages. One should multiply 31% by 3 to get an idea of the true effect on the river at that time. In 1926 state investigators found that only "the most resistant organisms could survive in the Wisconsin River and not even these could live in the Fox." Even then the S.C.W.P. thought it impossible to restore these rivers to anything resembling good health.

"No constructive work was carried on" this was the pronouncement of the S.B.H. on its own activities in 1927 after fifty years of existence. It was true, however it wasn't because the board didn't try to serve the people of the state. The general public's apathy and ignorance manifested itself in the form of the state's legislature which made little appropriations, provided small moral support, and generally looked on the WSBH with indifference.

1926 to 1958 – A LOT OF ACTION BUT NO SOLUTION TO POLLUTION

During the 1920's the paper mills had no controls at all and everything went directly into the river. The price of wood was cheap so there was no sense in saving. The average sulfite mill using 110 tons per day (TPD) of wood released 20,000 tons per year (TPY) of suspended solids from unused fiber alone and 75,262 TPY of BOD based on the average of 700 lbs. BOD/ton production for sulfite mills.

The industry made some signs of recognizing its responsibility for in the Milwaukee Journal on May 21, 1926, Joseph H. Slater, Northwestern Divisions President of the American Pulp and Paper Association was quoted as saying with apparent sincerity "Heretofore the manufacturers have failed to recognize the imperative need for preserving the purity of streams . . . .But something must be done, for the public is now thoroughly aroused over the situation and will not be satisfied with idle promises. There is a cause for complaint . . . .and the mill companies owe it to the people to preserve what is left of their lawful heritage." The mills were under state pressure to clean up, and while under such pressure they began to learn that their methods were extremely wasteful and were indeed uneconomical. However they did not agree with the SCWP that 90% of the fibers would be recovered. 90% recovery of fibers are easily obtained in todays paper industry. This example serves to point out that even industry can benefit from public intervention in private business. In 1931 the SCWP had found that wood waste had increased 100% between 1930 and 1954 and the SCWP justified it by saying that Wisconsin has less pollution of water than any other state at that time and that the state had managed to hold constant the effect of such waters on water despite the increase in production.

The treatment of domestic sewage was aided by the Depression as Wisconsin was all ready to go and then the Federal Make Work Programs came through. This coupled with a sharp change in Federal attitude around 1933 put Wisconsin ahead of many other states and nations by 1939 when the treatment program reached 87% of the population.

World War II interrupted water pollution control as it interrupted all aspects of normal life. Even if one wanted to one could hardly ask a war time industry to regulate its water pollution. At the end of the war all control programs had dissipated and industry wasn't in any mood to regulate itself. The Industry argued in Washington that pollution control was a local matter. It argued at the local level that nonregulation of pollution in other states would provide unfair competition. Probably this was the beginning of the now hackneyed "We'll move" threat.

The state regulatory agencies took a conciliatory attitude towards industry perhaps better described as administrative persuasion. The result

was that they got nowhere. Except to inflame some citizen conservation groups such as the Izaak Walton League who in partnership with the Southern Wisconsin Lakelands Association attacked the SCWP and the pulp and paper industry in the 1949 Legislature. The citizens were trying to reform the SCWP. The pulp and paper industry, the canning factories, and the dairy industries lined up against them with the legislature in the middle. The official sentiment seemed to be in favor of the industries. State Senator Taylor G. Brown, chairman of the Senate's Conservation Subcommittee said, "Paper mills and other industries are giving employment and the tendency already is for some of the paper mills to move out of the state. We've got to be fair about this pollution thing." But the citizens' groups were fierce and the result was the SCWP got a larger budget.

The SCWP never moved against the polluting paper industry and a look at the state regulatory agencies in relation to the dairy industry is a study in black humor. In 1926 the state sanitary engineer warned the dairy industry there would be a crack down, and in 1927 he repeated his warning. In 1940 the SCWP said there would be no more problem with dairy waste because of the new uses for it. In 1951 the SCWP said it expected compliance from every dairy plant in the state. In 1955 Ted Wieniewski said before the assembly finance committee that even the smallest processor must observe the law. Assemblyman Peters of Calumet County in the heart of the dairy industry said, "It is an awful problem for some of these small dairy factories." Mr. Wieniewski agreed, "Yes, it is." At the recent 1970 hearings of the Wisconsin River Basin Survey, Carl Blaibaum said it was much easier for even the smallest dairies to get rid of their waste than the paper mills because there is so little of it.

In the 1950's the control of water pollution in Wisconsin fell to three agencies, the Public Service Commission, the State Board of Health, and the Conservation Commission. The Public Service Commission was ordered by statute to "protect life, health and property," but considered the protection of property its most serious undertaking. The State Board of Health's major concern was "life and health" and it operated under the theory of persuasion rather than compulsion. Although it seemed apparent that even those cities that could afford it weren't going to make improvements, if they could get away with it and their Constituents supported them. Mr. Lawrence Motl the Conservation Commission representative to the SCWP summed up both his department's attitude and the committee's attitude in 1958 when he said, "We on the committee see our work as serving the best interests of the most people. **This means we can't stop water pollution completely.** It would hurt the state too much economically. We have to try to balance things out and we can't satisfy everybody. That's what these people won't understand who say we could stop polluting tomorrow. Whatever our legal power or technical ability economics won't let us do such a thing. "It must be remembered that there are different types of economics, and Mr. Motl was speaking only of one type. This attitude does not seem too conducive to cleaning up the state's waters and the committee was faced with a growing waste treatment problem. In the same year, the director of the SCWP said, "We are increasing wastes treated but the total wastes to be treated grows all the time. By 1980, at present rates of improvement and waste expansion, we will cut the amount of untreated waste to .8 million pounds or an improvement since 1940 of 14% . . . This is not enough. We have got to increase our margins of improvement or we will really lose." The director was referring only to domestic wastes not industrial which have three times the detrimental effects to streams as domestic sewage. Mr. Motl said in reference to the Wisconsin River that by 1958 even though treatment had improved considerably pollution **increased** because rates of pollution had gone up as fast as treatment.

Thus for the past few decades the laws, technology and money has been available to clean up Wisconsin's rivers. A lot of things have intervened, temporary economic set backs, major events such as WW II, and the attitudes of the people of Wisconsin. Of these, attitudes are clearly the one over riding determining factor in the present State of Wisconsin's waters. It seems that attitudes are now changing as the irreversible deterioration of our waters is becoming obvious even to state officials who are economically minded. For those that are so minded now is the time to act, to ride the crest of public attitudes such that effective programs are instituted to bring about the restoration of all Wisconsin waters by 1978.

In 1958 the environmental reporter of the *Milwaukee Journal* was told by the top research people for the paper industry to "keep fighting!" We must be compelled to control wastes or in forty years we'll drown in our own filth. Don't listen to our squawks. The best in the industry won't fight you. Some paper mills have worked at waste control; some have made money out of it. But most want to sit on the sidelines saying "That process doesn't suit our needs" and meaning "We won't spend the money." [***]

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Most of the facts and ideas contained in this history I owe to Earl Finbar Murphy's book *Water Purity: A Study in Control of Natural Resources.* Published in 1961 by the University of Wisconsin Press.

OPPORTUNITIES – (from Page 13)

In order to be eligible for the program the student must be a U.S. citizen, studying in the College of Engineering at the University of Wisconsin or other participating schools and maintain a 3.00 (B) grade point. Since all classes during the academic year are taught in Spanish, two semesters of oral emphasis Spanish, usually taken during the sophomore year at Wisconsin, are also requirements. The only other prerequisites are a desire to take advantage of the great opportunity this program presents and a yearning to personally experience living in another culture much different from our own.

I was a participant during the 1969-1970 school year and know firsthand the advantages the program offers. I would personally recommend to any interested engineer the experiences gained through a year in Mexico. For further information contact Mrs. Bonnie Kienitz, Coordinator, Wisconsin-Monterrey Tec Program, 437 Engineering Research Building, University of Wisconsin.

IAESTE

If you were to look in the SATURDAY REVIEW'S classified section under Employment Opportunities, you would see an ad for "Career Vacations Abroad" advertising summer jobs overseas for college students in engineering, architecture, agriculture, and the sciences. The International Association for the Exchange of Students for Technical Experience (IAESTE) is a non-profit, non-governmental, non-political organization whose aims are "to provide student at institutions of higher learning with technical experience abroad relative to their studies" and "to promote international understanding and goodwill amongst the students of all nations."

The association was founded in 1948 by ten European countries in an attempt to provide students the opportunity to spend their summer vacations working in foreign industries. Member countries have now increased to 43, 19 of which are located outside Europe. Over three thousand companies are represented and students number near 8,000. Countries involved cover all corners of the world including such places as Argentina, Czechoslovakia, Finland, Iceland, India, Korea, Malta, South Africa, Switzerland, Yugoslavia, and many more.

In each country offers are taken from individual companies to employ students for a training period during the summer months. These companies pay students sufficiently to cover their cost of living during actual training periods. Offers are exchanged between countries on a reciprocal basis during the Annual Conference in January. Qualified student applicants are then chosen to fill the offers received by each country.

IAESTE exchange participation is open to bona fide students following courses at universities, institutes of technology, and similar institutes of higher learning. The main aim is for student exchange during the summer months; however, some long term offers between three and twelve months can be set up. Offers are also arranged during other times of the year such as winter months with southern hemisphere countries. There is no actual restriction on areas of study but most often offers are received for students of engineering and technology and the majority of applicants are students in these fields.

Any student interested in this type of experience will find a simple procedure for applying. Eligibility is basic: 1) current enrollment in good standing in a 4-year college or university; 2) major study in any field of engineering, agriculture, the sciences or architecture; and 3) completion of at least sophomore year, but not yet finishing a Doctorate by the time of training. Each applicant must also have an "academic" endorsement attesting to his eligibility. An application form along with an application fee of $50 must be sent in. Should no appropriate opening be found the applicant receives a $25 refund, however, should he withdraw for any reason the entire fee is forfeited. This application should be completed and mailed by December 15. This deadline is very soon or may already have passed. Nevertheless in many instances job offers are received in excess of applicants so that late applications can be placed. Therefore, should the deadline already have passed, do not give up, a possibility still exists.

The work experience itself may be in a research laboratory, design office, production department, or field station depending on the background and interest of each trainee. It could be in any one of 42 countries and knowledge of a foreign language is only required in eight of them.

An interested student must not be mislead. This is not a "get rich quick" program. Generally he will spend $400-$600, possibly more depending on the location, paying for his international transportation, free-time travel, and personal expenses. On the job pay will generally only cover his cost of living, but varies from country to country.

IAESTE offers "career vacations" to students from all member countries. In the word of Bob Sprinkle the Executive Director of IAESTE/US: "With the ever increasing international outlook of American business and industry the IAESTE trainee is often one step ahead of his fellow job seeking graduates." If you would like to get that one step ahead, seriously think about the IAESTE opportunity. It could be just what you have been looking for. For further information contact Professor Merton Barry, Foreign Engineering Programs, 439 Engineering Research Building, University of Wisconsin.

[***]

5. Define the divergence of a vector, the gradient of a vector and the curl of a vector.
6. Define the Laplacian operator of a vector.
7. Define a line integral of a vector and should be able to find such an integral for some simple examples chosen particularly from thermodynamics.
8. Define a unit vector.
9. Determine the unit vectos for simple systems.
10. State why the concept of a unit vector is necessary.
11. Differentiate a unit vector in cylindrical coordinates.

Matrices

The student should be able to:

1. Add matrices of any order.
2. Determine when two matrices can be multiplied together.
3. Multiply matrices together.
4. Determine for simple matrices a) the inverse matrix, b) the transpose of the matrix, c) the adjoint of the matrix.
5. Define what a matrix is.
6. Define a row matrix.
7. Define a column matrix.
8. Define the identity matrix and list its unique properties.
9. Identify a symmetric matrix.
10. Define the difference between a matrix and a determinant.

Partial Derivatives

The student should be able to:

1. Define a partial derivative.
2. State physically how the partial derivative differs from the full derivative.
3. Graph the partial derivative of any complex function.
4. Solve simple problems by using the chain rule for partial differentiation.

Miscellaneous

The student should be able to:

1. Define a periodic function and be able to give three examples of this.
2. Define a multi-valued function and give three examples of this.
3. Recognize which roots are extraneous in solving a multi-valued physical problem.
4. Define a hyperbolic sine and a hyperbolic cosine.
5. Define the sine and cosine in terms of exponentials.
6. Draw a sine and cosine in terms of exponentials.
7. Determine the logarithm to the base of ten of any number using tables.
8. Determine the logarithm to the base of e of any number using tables.
9. Define an imaginary number.
10. Tell why it is necessary to develop the concept of an imaginary number.
11. Express complex numbers in terms of polar coordinants.
12. Express complex exponentials in terms of trigometric functions when tables are provided.
13. Define the word function.
14. List the various independent and dependent variables if he is given a physical problem.
15. Recognize and explain the notation Y = f (x,y,x) and give three physical formulas which are of this form.
16. Find the n^{th} difference of a function.

[***]

Mister Boodle

(Sung to the tune of Yankee Doodle)

Mister Boodle came to town
Without invitation
Walked into the Pentagon
And walked out with the nation.
Mister Boodle Beedle-Bum
Mister Boodle Beedle-Bum
Mister Boodle Beedle-Bum
Hanky-Panky Boodle!

Mister Boodle sings all day
You can hear him whistle
He made Uncle Sam okay
A brand new anti-missile.
Mister Boodle Beedle-Bum

Mister Boodle told the Brass
"Boys when they retire you
I won't let a minute pass
I'll be right there to hire you.
Mister Boodle Beedle-Bum

Mister Boodle can't be stilled
"Next," he cries, "comes China"
So a war plant we must build
Down South in Carolina.
Mister Boodle Beedle-Bum

Mister Boodle, what a whiz
Money is his hobby
Anywhere the action is
Is where you'll find his lobby.
Mister Boodle Beedle-Bum

Mister Boodle doesn't trust
Honest legislators
Proxmire's kind to him are just
Some Commie agitators.
Mister Boodle Beedle-Bum

Mister Boodle talks of Space
With enthusiasm
Billions needed for the race
Mean angles—and he has 'em.
Mister Boodle Beedle-Bum

Mister Boodle says one day
Our land will be peaceful
But he shoos the doves away
Till he gets his valise full.
Mister Boodle Beedle-Bum

Mister Boodle says don't cut
Pentagon expenses
Folks say we need houses but
You can't believe the census.
Mister Boodle Beedle-Bum

Mister Boodle's on the Hill
This time in his hands a
Nineteen billion dollar Bill
The A B M bonanza.
Mister Boodle Beedle-Bum

Mr. Boodle's sentiments
Soon become the nation's
Five thousand work for Defense
On just Public Relations.
Mister Boodle Beedle-Bum

Mister Boodle gets for oil
Tax depletions – many,
We who toil and till the soil
Pay taxes to the penny.
Mister Boodle Beedle-Bum

Mister Boodle doesn't waste
Time in making contacts
Mister Boodle's friends are placed
At desks that handle contracts.
Mister Boodle Beedle-Bum

Mister Boodle says that he
Never thinks of riches
But just mention S S T
And note how his palm itches.
Mister Boodle Beedle-Bum
Mister Boodle Beedle-Bum
Mister Boodle Beedle-Bum
Hanky-Panky Boodle!

Mister Boodle, what a gent!
What imagination!
Lends his dough at 10 per cent
And thinks it fights inflation!
Mister Boodle Beedle-Bum

Mister Boodle doesn't fear
Cuts in war production
All he has to do is steer
Back into road construction.
Mister Boodle Beedle-Bum

Mister Boodle farms although
Some folks call it plunder
Subsidies bring him the dough
For crops that he ploughs under.
Mister Boodle Beedle-Bum

Mister Boodle says: "My friend
Why stay out of Asia
What we lend and what we spend
Means jobs for you—it pays-ya."
Mister Boodle Beedle-Bum

Mister Boodle, knowing we
Face mass execution
Holds the fort while industry
Keeps stalling on pollution.
Mister Boodle Beedle-Bum

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