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# RESEARCH ACTIVITIES IN THE SCHOOL OF ENGINEERING

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JULY 1, 1970 to JUNE 30, 1971

by

James G. Knudsen

DISCARD

CIRCULAR 43

AUGUST, 1971

Engineering Experiment Station
Oregon State University
Corvallis, Oregon, 97331

CONTENTS

# FOREWORD

This report briefly summarizes the graduate education and research activity in the School of Engineering at Oregon State University for the period July 1, 1970 to June 30, 1971. The undergraduate and graduate programs of the School provide a basis for sound modern training of personnel for the technical community.

Programs leading to B.S., M.S., and Ph.D. are offered in the following majors:

Agricultural Engineering (Cooperative with School of Agriculture)
Chemical Engineering
Civil Engineering
Electrical and Electronic Engineering
Industrial Engineering
Mechanical Engineering
Metallurgical Engineering
Nuclear Engineering
Ocean Engineering (Master of Ocean Engineering also offered, no B.S. offered)

For 1970/71 the research and training grant activity amounts to slightly more than $1,000,000 per year. While this represents an increase of about 10% over the 1969-70 period the pattern of funding shows some change. Since the 1968-69 period fellowship and traineeship support has decreased nearly six-fold. Funding from federal grants and contracts remained approximately the same for the 1970-71 period as for the 1969-70 period. The considerable increase in federal funding over the 1967-69 period was due largely to the participation of the Engineering School in the University Sea Grant program. Some increase is noted in funding from private and state sources.

# OREGON STATE UNIVERSITY

SCHOOL OF ENGINEERING
Corvallis, Oregon 97331

**1. Officers**

President: Robert MacVicar

Dean of Eng.: Fredrick J. Burgess (Acting)

Chairmen of engineering departments or divisions: Agricultural Eng., Dale E. Kirk (Acting); Chemical Eng., C. E. Wicks; Civil Eng., Fredrick J. Burgess; Electrical & Electronics Eng., L. N. Stone; General Eng., J. C. Campbell; Industrial Eng., James L. Riggs; Mechanical & Nuclear Eng., James R. Welty, (Acting); Metallurgical Eng., Roger D. Olleman

Head of research administrative unit: F. J. Burgess, Director of Engineering Experiment Station

Directors of major engineering or engineering-related research organizations: J. G. Knudsen, Engineering Experiment Station

Address admissions inquiries to: F. J. Burgess, Dean of Engineering (Acting)

**2. Number of Faculty**

The combined total of full-time engineering faculty in the three professorial ranks is 100. The combined total of full-time and part-time instructors and other faculty is 8.

**3. Graduate Degree Requirements**

*Master's:* Forty-five quarter hours of approved graduate credit; average of at least B; 1 year of residence; thesis optional with departments; foreign language not required.

*Doctorate:* No specified credit requirements; total program about 130 term hours, with about 80 in the major field and 40 in two minor fields or an integrated minor; thesis usually 45 to 50 term hours; reading ability in 1 or 2 languages depending upon department; comprehensive examinations; thesis.

*Other:* (Professional) Master's from university or 12 term hours of graduate work completed in residence; thesis. (Master of engineering) Same as for master of science except no thesis is required; no residency requirement.

Tuition for all students is $408 per year.

Theses may be written in absentia.

**4. Off-Campus or Extension Centers for Graduate Study**

Division of Continuing Education, Portland

**Table A—Faculty, Enrollment, and Graduate Degrees Granted**

| Degree Program | Faculty | Enrollment, Fall 1970 | | Degrees Granted, 1969-70 | |
|---|---|---|---|---|---|
| | | Master's | Doctorate | Master's | Doctorate |
| Agricultural Eng. | 0 | 1 | 2 | 0 | 0 |
| Chemical Eng. | 6 | 7 | 9 | 1 | 3 |
| Civil Eng. | 22 | 40 | 17 | 19 | 1 |
| Elect. & Electron. Eng. | 18 | 43 | 12 | 16 | 4 |
| Industrial Eng. | 4 | 10 | 5 | 1 | 0 |
| Mechanical Eng. | 17 | 24 | 15 | 9 | 2 |
| Nuclear Eng. | 4 | 5 | 3 | 2 | 1 |
| Metallurgical Eng. | 5 | 4 | 3 | 0 | 2 |
| Total | | 134 | 66 | 48 | 13 |

**Table B–Appointments Available to Graduate Students**

| Title of Appointee | Appointments Available | Academic Load Allowed, in Credit Hours | Stipend for Academic Year[1] ($) |
|---|---|---|---|
| | | Quarter | |
| Research asst.[2] | 22 | 12 | 2800-3000 |
| Research asst.[3] | 8 | 12 | 2800-3000 |
| FWPCA trainee | 5 | 15 | 3000[4] |
| NSF trainee | 7 | 15 | 2400[4] |
| NASA fellow | 1 | 15 | 2400[4] |
| NIH trainee | 1 | 15 | 2400[4] |
| Ind. fellow | 4 | 15 | 3000-4500 |
| Teaching asst. | 30 | 12 | 2800-3000 |
| USBM fellow | 1 | 15 | 2200 |
| AEC trainee | 2 | 15 | 3000-4500 |

[1]Stipend not subject to income tax withholding if work for which appointment is made is in partial fulfillment of requirements for the advanced degree.
[2]Appointments on sponsored research projects.
[3]State-supported research assistantships.
[4]Plus $500 for each dependent; based on 12 months.

**5. Research Area of Accepted Doctoral Theses**

*Chemical Eng.:* transport phenomena–2; *Civil Eng.:* waste disposal; *Electrical Eng.:* holography, computer logic, simulation, networks; *Mechanical Eng.:* boiling, air sanitation; *Metallurgical Eng.:* single crystals–2; *Nuclear Eng.:* fast reactors

**6. Personnel Engaged in Separately Budgeted Research, 9/15-6/15**

| | |
|---|---|
| Professorial faculty | 60 |
| Graduate students | 125 |
| Total | 185 |

**7. Research Expenditures by Source of Support**

| | |
|---|---|
| Federal government | $725,000 |
| State and local government | 125,000 |
| Private, nonprofit organizations | 30,000 |
| Business and industry | 20,000 |
| Other | 70,000 |
| Total | $970,000 |

**Table C–Separately Budgeted Research Expenditures**

| Engineering College Unit | No. of Projects | Expenditures ($) |
|---|---|---|
| Chemical Eng. | *15* | 30,000 |
| Mass transfer | 7 | |
| Chemical reactor eng. | 3 | |
| Two phase flow | 3 | |
| Electrochemistry | 2 | |
| Civil Eng. | *29* | 390,000 |
| Construction research | 3 | |
| Hydrodynamics | 6 | |
| Hydrology | 3 | |
| Sanitary eng. | 10 | |
| Soil mechanics | 2 | |
| Structures | 2 | |
| Highway research | 2 | |
| Electronic surveying | 1 | |
| Electrical & Electronics Eng. | *20* | 100,000 |
| Network studies | 3 | |
| Solid state-integrated circuits | 8 | |
| Man-machine interactions | 1 | |
| Remote sensing | 1 | |
| High voltage transmission | 3 | |
| Digital systems | 2 | |
| Underwater acoustics | 2 | |

**Table C–Separately Budgeted Research Expenditures–Continued**

| Engineering College Unit | No. of Projects | Expenditures ($) |
|---|---|---|
| Industrial Eng. | 6 | 41,000 |
| Capital budgeting | 1 | |
| Decisionmaking | 1 | |
| Seafood harvesting & processing systems design | 3 | |
| Simulation | 1 | |
| Mechanical Eng. | 23 | 275,000 |
| Fluid mechanics | 3 | |
| Air pollution research | 15 | |
| Eng. mechanics | 3 | |
| Heat transfer | 2 | |
| Metallurgical Eng. | 5 | 10,000 |
| Fracture mechanics | 1 | |
| Material properties | 2 | |
| Deformation | 1 | |
| Diffusion | 1 | |
| Nuclear Eng. | 5 | 48,000 |
| Nuclear fuel management | 1 | |
| Thermal hydraulics | 1 | |
| Neutron radiography | 2 | |
| Fast reactor computation | 1 | |
| Total | 111 | 914,000 |

**Table D–Engineering Related Research Outside the Engineering College**

| Units Outside the Engineering College | No. of Projects | Expenditures ($) |
|---|---|---|
| Agricultural Eng. | 10 | 56,000 |
| Irrigation & drainage | 4 | |
| Mechanical harvesting | 2 | |
| Pollution control | 4 | |

1970/71

SUMMARY

RESEARCH AND TRAINING ACTIVITY

SCHOOL OF ENGINEERING

| | Amount | % |
|---|---|---|
| Fellowships and Traineeships (Federal) | 21,700 | 2.1 |
| Industrial and Private Sources | 85,800 | 8.3 |
| Federal Sources | 703,450 | 68.5 |
| All State Sources | 217,230 | 21.1 |
| TOTAL | 1,028,180 | 100% |

OREGON STATE UNIVERSITY
SCHOOL OF ENGINEERING
RESEARCH AND TRAINING ACTIVITY - 7/1/70 to 6/30/71

| Department | Fellowships & Traineeships | Industrial & Private | Federal | State Agency | EES RA's | Dept. Instruction & Related Research | Total $ | Faculty Hours/week* |
|---|---|---|---|---|---|---|---|---|
| Agricultural Engineering (Res. funded thru Ag Exp Sta) | | | 3,500 (USDI) | | | 72,450 (thru AES) | 75,950 | |
| Chemical Engineering | 2,700 (NDEA) | 5,000 (Shell) | 9,000 (NSF)<br>6,000 (FWQA)<br>3,000 (USBM) | | 3,000 | 2,850 | 31,550 | 39 |
| Civil Engineering | 11,000 (NSF) | 6,400 (AGC)<br>15,000 (Hill) | 9,000 (NSF)<br>203,100 (FWQA)<br>15,080 (USDI)<br>50,000 (C of Engrs)<br>25,940 (NSF, NOAA) | 6,000 ECC<br>17,470 (Sea Gr) | 3,160 | 3,100 | 365,250 | 13 |
| Electrical Engineering | 4,000 (NSF) | 7,400 (Tektroniks) | 10,600 (NSF)<br>10,200 (BPA)<br>4,000 (NOO)<br>27,380 (NSF, NOAA) | 15,300 (Sea Gr) | 3,000 | 4,200 | 86,080 | 58 |
| General Engineering | | | 7,000 (PHS) | | | | 7,000 | |
| Industrial Engineering | | | 10,110 (NSF, NOAA) | 11,000 ECC<br>11,080 (Sea Gr) | | 3,760 | 35,950 | 9 |
| Mechanical & Nuclear Engineering | 4,000 (AEC) | 20,000 (Nuc. Chair)<br>7,000 (NWN Gas) | 25,370 (DOD)<br>20,840 (AEC)<br>126,530 (PHS)<br>3,700 (NSF, NOAA)<br>33,630 (FWQA) | | 6,350 | 1,300 | 248,720 | 52 |
| Metallurgical Engineering | | | 3,730 (NSF) | | 2,810 | 400 | 6,940 | 28 |
| Engineering Experiment Station | | 10,000 (NCASI)<br>15,000 (NCASI Aquatic Biol.) | 55,740 (NOAA, NSF)<br>40,000 (Themis) | | | 50,000 (EES Budget) | 170,740 | |
| TOTALS | 21,700 | 85,800 | 703,450 | 60,850 | 18,320 | 138,060 | 1,028,180 | 199 |

* Not supported by any of the funds indicated in other columns.

RESEARCH AND GRADUATE TRAINING SUPPORT

SCHOOL OF ENGINEERING

Department Agricultural Engineering

(Research funded through Ag. Exp. Sta.)

| Principal Investigator | Grad. Student (s) | Project | Amount and Source | Faculty Time (Hrs/Week)* |
|---|---|---|---|---|
| Backus | | Mechanical Cherry Harvester | 3,000 (state) | |
| Bonlie | | Portable Field Incinerator | 24,000 (state) | |
| Booster | | Harvesting and Handling of Crops | 4,500 (state) | |
| Brooks | | Drainage of Stratified Soils | 23,000 (state) | |
| Brooks | | Infiltration onto Sloping Lands | 3,500 (USDI) | |
| Cropsey | | Filters for Animal Wastes | 4,000 (state) | |
| Long | | Air Supported Plastic Greenhouses | 450 (state) | |
| Page | | Field Burning Air Pollution Abatement | 2,300 (state) | |
| Vance | | Irrigation Water Forecasts | 7,200 (state) | |
| Wolf | | Dynamics of Flow into Drainage Facilities | 2,000 (state) | |
| Wolf | | Sprinkler Irrigation Systems | 2,000 (state) | |
| | | TOTAL | $75,950 | |

* Not supported by funds in previous column,
i.e. research done as part of regular faculty appointment.

RESEARCH ACTIVITY
Department Agricultural Engineering
From 7/1/70 to 6/30/71

RESEARCH AND GRADUATE TRAINING SUPPORT

SCHOOL OF ENGINEERING

Department Chemical Engineering

| Principal Investigator | Grad. Student (s) | Project | Amount and Source | Faculty Time (Hrs/Week)* |
|---|---|---|---|---|
| Fitzgerald | Lai | Mixing in Flow Vessels | | 8 hrs/week |
| Knudsen | Dev | Flow of Dispersions | 3,000 (NSF) | |
| Knudsen | Vierra | Climbing Film Flow | 2,000 (NSF) | |
| Knudsen | Vierra | Climbing Film Flow | 3,000 (EES, RA) | 1 hr/week |
| Knudsen | Galbraith | Turbulent Mixing in Rod Bundles | 2,700 (NDEA) | 1 hr/week |
| Knudsen | Mohandes | Pressure Losses in Rod Bundles | 500 (state) | 1 hr/week |
| Levenspiel | Khang | Catalyst Deactivation | | 8 hrs/week |
| Meredith | Lee | Solid Electrolyte for Battery Application | 4,000 (NSF) | |
| Meredith | Fan | Reaction Kinetics with Electrode Studies | | 6 hrs/week |
| Meredith | | Onion Oil Extraction | 350 (state) | |
| Mrazek | Hill | Simulation of Drying Kroll-Process Sponge | 3,000 (USBM) | |
| Mrazek | Waller | Concentration Gradients in Diffusing Binary Mixtures | | 6 hrs/week |
| Wicks | Chatlynne | Thermal Distillation | 1,000 (state) | 4 hrs/week |
| Wicks | Hauxwell | Mass Transfer to a Plunging Stream | 5,000 (Shell Oil) | 2 hrs/week |
| Wicks | Henning | Formation of Isomeric Ketones from n-Hexadecane | | 2 hrs/week |
| Wicks | Lee | Diffusivities of Binary Gases | 1,000 (state) | 4 hrs/week |
| Wicks | Spink | Absorption of Nitrogen in Water at Various Pressures | 6,000 (FWQA) | 2 hrs/week |
| | | TOTAL | 31,550 | |

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i.e. research done as part of regular faculty appointment.

RESEARCH ACTIVITY

Department Chemical Engineering

From 7/1/70 to 6/30/71

RESEARCH AND GRADUATE TRAINING SUPPORT

SCHOOL OF ENGINEERING

Department Civil Engineering

RESEARCH ACTIVITY
Department Civil Engineering
From 7/1/70 to 6/30/71

| Principal Investigator | Grad. Student (s) | Project | Amount and Source | Faculty Time (Hrs/Week)* |
|---|---|---|---|---|
| Bella | Grenney | Computer Simulation of Eutrophication | 10,000 (USDI) | |
| Bella | Grenney | Computer Simulation of Estuarine Dispersions | 6,000 (NSF) | |
| Bella | Peterson | Tidal Flats in Estuarine Water Quality | 39,590 (FWQA) | |
| Burgess | James | Airphoto Analyses of Ocean Outfall Dispersion | 39,120 (FWQA) | |
| Burgess | Emmett, Glanzman | Netarts Bay Water Quality Studies | 15,000 (Hill Found.) | |
| Burgess | | Graduate Training in Water Quality Engrg. | 84,680 (FWQA) | |
| Burgess | | Graduate Training in Environmental Engrg. | 19,060 (FWQA) | |
| Burgess | | NSF - Graduate Training | 11,000 (NSF) | |
| Burgess | | Construction Engineering Technology | 4,000 (AGC) | |
| Filmer | Dearstyne | The Engineer and Society | 6,000 (ECC) | |
| Filmer | Felton, Yamamoto | Virus Adsorption on Soils | 3,000 (NSF, RA) | |
| Klingeman | Helland-Hansen, Milhous | Hydrology of Water Yield Prediction | 8,240 (USDI) | |
| Klingeman | Ramm | Sources and Causes of Turbidity at Hills Creek Reservoir | 50,000 (C. of Engrs.) | |
| Laursen | Polensek | Dynamic Analyses of Floor Systems | (EES,RA) | 1 hr/week |

TOTAL

continued

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RESEARCH AND GRADUATE TRAINING SUPPORT

SCHOOL OF ENGINEERING

Department Civil Engineering (cont.)

| Principal Investigator | Grad. Student (s) | Project | Amount and Source | Faculty Time (Hrs/Week)* |
|---|---|---|---|---|
| Laursen | Shugar | Finite Elements Analyses of Penstock Bifurcation | | 2 hrs/week |
| Peterson | Cheung | Exact Solution for Continuous Chord Bowstring Truss | 200 (state) | 1 hr/week |
| Peterson | Kao | Analog Computer Solutions for Vibrating Systems | 100 (state) | 1 hr/week |
| Peterson | Magruder | Square Wood Beam Loaded on Diagonal | 50 (state) | 1 hr/week |
| Phillips | Chang | Kinetics Rotating Biological Filters | 400 (state) | 1 hr/week |
| Pritchett | | Construction Grants Award | 2,400 (AGC) | |
| Schaumburg | Williamson | Influence of Log Rafting on Water Quality | 20,630 (FWQA) | |
| Schultz | Emerson | Electronic Surveying Errors | | 2 hrs/week |
| Slotta;Filmer | | Applied Hydrodynamics - Sea Grant | 25,940 (NSF, NOAA)<br>17,470 (state) | |
| White | Bahk | Torsional Vibration of Roadside Signs | 2,150 (state) | 2 hrs/week |
| White | Patel | Bending Analyses of Paraboloid Shelves with Flexible Supports | 100 (state) | 1 hr/week |
| White | Uswarang-sri | Analyses of Rectangular Plates with Flexible Supports | 100 (state) | 1 hr/week |
| | | TOTAL | $365,250 | |

RESEARCH ACTIVITY
Department Civil Engineering
From 7/1/70 to 6/30/71

* Not supported by funds in previous column,
i.e. research done as part of regular faculty appointment.

RESEARCH AND GRADUATE TRAINING SUPPORT

SCHOOL OF ENGINEERING

Department Electrical Engineering

| Principal Investigator | Grad. Student (s) | Project | Amount and Source | Faculty Time (Hrs/Week)* |
|---|---|---|---|---|
| Amort, Jensen | | NSF Instructional Equipment | 10,600 (NSF) | |
| Chang | Shimoda | Investigation of Adjustable Adsorption Coefficient of Semi-conductor films by varying Field | | 4 hrs/week |
| Chang | | Investigation of Thickness Measurements of Thin $SiO_2$ Film | | 2 hrs/week |
| Herzog | Duwaik | Program Adaptive Computer Instruction Sets | | 1 hr/week |
| Herzog | Nondia | Optimal Output Control | | 3 hrs/week |
| Herzog | | Remote Sensing | 4,000 (Nat'l. Oceanogr. Office) | |
| Holmes | Hun | Thin Film Traveling Wave Amplifier | | |
| Holmes | Seitz | Digital Wave Height Sensor | | 1 hr/week |
| Holmes | Yamamoto | Resolution Enhancement of Fabry-Perot Interferometers | 3,000 (EES, RA, state) | |
| Holmes | Yamamoto | Spatial Mode Control in Lasers | | 1 hr/week |
| Holmes | | Scattering from Moving Objects | 100 (state) | 1 hr/week |
| Holmes | | Infrared Coastal Navigation System | | 3 hrs/week |
| Holmes | | Infrared Automobile Collision Avoidance System | | |
| Jensen | | Underwater Acoustics for Location of Edible Marine Species - Sea Grant | 16,780 (NSF, NOAA) 3,240 (state) | |

TOTAL

continued

* Not supported by funds in previous column, i.e. research done as part of regular faculty appointment.

RESEARCH ACTIVITY
Department Electrical Engineering
From 7/1/70 to 6/30/71

RESEARCH AND GRADUATE TRAINING SUPPORT

SCHOOL OF ENGINEERING

Department Electrical Engineering (cont.)

| Principal Investigator | Grad. Student (s) | Project | Amount and Source | Faculty Time (Hrs/Week)* |
|---|---|---|---|---|
| Looney | | Solid State Electronics | 7,400 (Tektroniks) | |
| Magnusson | | Wave Propogation | | 1 hr/week |
| Michael | | Digital Data Acquisition | 300 (state) | 8 hrs/week |
| Michael | | Sounds of Douglas Fir Bark Beetle | 700 (state) | 2 hrs/week |
| Park | | Optimization of Distributed RC networks | 600 (state) | 10 hrs/week |
| Perkins | | Thin Film (magnetic) Preparation and Study | 2,500 (state) | 4 hrs/week |
| Perkins | | Fault Locator Logic System | | 2 hrs/week |
| Saugen | Lankford | Computer Aided Management of Salicylate Intoxication | 4,000 (NSF fellowship) | |
| Saugen | Sohrab | Control of Wall Stress of the Human Heart | | 2 hrs/week |
| Saugen | Wagner | Man-Machine Interaction and Computer Training in a Parameter Estimation Problem | | 5 hrs/week |
| Saugen | | Simulation of Biological Productivity | 10,600 (NSF, NOAA) 12,060 (state) | |
| Stone | | Audible Noise Characteristics of Conductors | 10,200 (BPA) | |
| Stone | | Multiple Conductor of Electrostatic Field Calculation | | 8 hrs/week |
| | | TOTAL | $86,080 | |

RESEARCH ACTIVITY
Department Electrical Engineering
From 7/1/70 to 6/30/71

* Not supported by funds in previous column,
i.e. research done as part of regular faculty appointment.

RESEARCH AND GRADUATE TRAINING SUPPORT

SCHOOL OF ENGINEERING

Department Engineering Experiment Station

| Principal Investigator | Grad. Student (s) | Project | Amount and Source | Faculty Time (Hrs/Week)* |
|---|---|---|---|---|
| Burgess & Staff | | Sea Grant - Ocean Engineering Training | 55,740 (NSF-NOAA) | |
| Burgess-Knudsen | | EES Budget (Less RA's) | 50,000 | |
| Caron | | Aquatic Biology | 15,000 (NCASI) | |
| Caron | | Sulfite Waste Liquor & Air Pollution Control | 10,000 (NCASI) | |
| Knudsen | | Project Themis | 40,000 | |
| | | TOTAL | $170,740 | |

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RESEARCH ACTIVITY
Department Engineering Experiment Station
From 7/1/70 to 6/30/71

RESEARCH AND GRADUATE TRAINING SUPPORT

SCHOOL OF ENGINEERING

Department General Engineering

| Principal Investigator | Grad. Student (s) | Project | Amount and Source | Faculty Time (Hrs/Week)* |
|---|---|---|---|---|
| Staton | | Environmental Engineering and Management Factors for Urban and Regional Planning of the Willamette Valley | 7,000 (EHSC) (PHS) | |
| | | TOTAL | $7,000 | |

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RESEARCH ACTIVITY

Department General Engineering

From 7/1/70 to 6/30/71

RESEARCH AND GRADUATE TRAINING SUPPORT

SCHOOL OF ENGINEERING

Department Industrial Engineering

| Principal Investigator | Grad. Student (s) | Project | Amount and Source | Faculty Time (Hrs/Week)* |
|---|---|---|---|---|
| Engesser | Cholvanich, Adams, Slack, Walls, Willis | Sea Food Industry Standards - Sea Grant | 10,110 (NSF, NOAA) 11,080 (state) | |
| Engesser | Fitzwater | Sensitivity Analyses of Sea Food Processing Variables | | 1 hr/week |
| Inoue | Rawal | Saury Research (included w/WFE) | (900) (NSF, NOAA) | |
| Inoue | Rao | Inter-Institutional Plan for Industrial Engineering and Data Processing Technology | 11,000 (ECC) | |
| Inoue | Shirland | Information Models for Marketing | 300 (state) | 1 hr/week |
| Inoue | | Study of Orthogonal Design of Experiments | 760 (state) | 2 hrs/week |
| Inoue | | Simulation Study | 900 (state, Comp. Cent) | |
| Inoue | | Job Shop Scheduling | 900 (state, Comp. Cent) | |
| Inoue | | PPBS | 900 (state, Comp. Cent) | |
| Love | Puranmulka | Q-R Inventory Models | | 2 hrs/week |
| Riggs | Andrade | Quality Analysis of a Self-Purging Paperwork System | | 1 hr/week |

TOTAL

continued

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RESEARCH ACTIVITY
Department Industrial Engineering
From 7/1/70 to 6/30/71

RESEARCH AND GRADUATE TRAINING SUPPORT

SCHOOL OF ENGINEERING

Department Industrial Engineering (cont.)

| Principal Investigator | Grad. Student (s) | Project | Amount and Source | Faculty Time (Hrs/Week)* |
|---|---|---|---|---|
| Riggs | Chiu | Scheduling Algorithms for Repetitive Projects | | 1 hr/week |
| Riggs | Hansen | Capital Budgeting | | 1 hr/week |
| | | TOTAL | $35,950 | |

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i.e. research done as part of regular faculty appointment.

RESEARCH ACTIVITY
Department Industrial Engineering
From 7/1/70 to 6/30/71

RESEARCH AND GRADUATE TRAINING SUPPORT

SCHOOL OF ENGINEERING

Department Mechanical & Nuclear Engineering

| Principal Investigator | Grad. Student (s) | Project | Amount and Source | Faculty Time (Hrs/Week)* |
|---|---|---|---|---|
| Boubel | Junge, Nelson, Anderson | Graduate Training in Air Pollution | 126,530 (PHS) | |
| Dahlke | Brownlow | Applied Hydrodynamics (Sea Gr. incl. w/CE) | (6,000) | |
| Davis | Slegel | Transient Temperature Response in X-ray Targets | | 3 hrs/week |
| Davis | | Supersonic Wake Studies | | 1 hr/week |
| Hughes | Reichal | Waste Fuel Burner | | 3 hrs/week |
| Hughes | | Mint Distillation Equipment | | 2 hrs/week |
| Johnson | Basset | Unitary Vehicle Control | | 2 hrs/week |
| Kinney | | Threadline Dynamics | 550 (state) | 10 hrs/week |
| Larson | | Heat Transfer and Fluid Mechanics of Separated Flows | | 12 hrs/week |
| Mingle | Marshall | Mechanization of Fishing Gear-Sea Grant | 3,700 (NSF, NOAA) | |
| Mingle | Rossman | Methane Fuel Exhaust | 7,000 (NW Nat. Gas) | |
| Ringle | Akomine | Atmospheric Studies of TRIGA Reactor Effluent | | 3 hrs/week |
| Ringle | Phoenix | Instrument Calibration Facility | 1,500 (EES, RA) | 2 hrs/week |
| | | TOTAL | | |

continued

* Not supported by funds in previous column, i.e. research done as part of regular faculty appointment.

RESEARCH ACTIVITY
Department Mechanical & Nuclear Engrg.
From 7/1/70 to 6/30/71

RESEARCH AND GRADUATE TRAINING SUPPORT

SCHOOL OF ENGINEERING

Department Mechanical & Nuclear Engineering (cont.)

| Principal Investigator | Grad. Student (s) | Project | Amount and Source | Faculty Time (Hrs/Week)* |
|---|---|---|---|---|
| Ringle | Tang | TRIGA Flux Measurements | 1,350 (EES, RA) | 2 hrs/week |
| Robinson, Wang | Olson | Model Methods for Fast Reactor Spectra | 2,000 (AEC) | |
| Robinson | Porter | Neutron Radiography Studies | 25,370 (DOD) | |
| Robinson, Wang | Stout | Nuclear Fuel Cycles | 2,000 (AEC) | |
| Smith | | Dynamics of Cable Systems | | 3 hrs/week |
| Wang | | Elec. Industries - Nuclear Power Chair | 20,000 (Industry) | |
| Welty | Bassett | An Experimental Study of Heat Transfer in the Thermal Entry Length Region of Non-newtonian Fluids | 3,500 (EES, RA) | 3 hrs/week |
| Welty | Etchart | Thermal Entry Length Heat Transfer Studies for Powell-Eyring Fluids in Pipes | 750 (state) | 2 hrs/week |
| Welty | Kim | Natural Convection in Vertical Slots | | 2 hrs/week |
| Welty | Trent, Loity | Thermal Plume Dispersion | 33,630 (FWQA) | |
| Welty | White Colwell | Heat Transfer in Liquid Metals | 20,840 (AEC) | |
| Zaworski | Stock | Flow-Coupled Diffusion | | 2 hrs/week |
| | | TOTAL | $248,720 | |

* Not supported by funds in previous column, i.e. research done as part of regular faculty appointment.

RESEARCH ACTIVITY
Department Mechanical & Nuclear Engrg.
From 7/1/70 to 6/30/71

RESEARCH AND GRADUATE TRAINING SUPPORT

SCHOOL OF ENGINEERING

Department Metallurgical Engineering

| Principal Investigator | Grad. Student (s) | Project | Amount and Source | Faculty Time (Hrs/Week)* |
|---|---|---|---|---|
| Bainbridge | | Reduction of Nickel Laterites | 200 (state) | 12 hrs/week |
| McComb | Blickensderfer | Dispersion Strengthening in Tungsten Alloys | | 4 hrs/week |
| McComb | McBee | Precipitation in Aluminum-Copper Films | 200 (state) | 4 hrs/week |
| McMullen | Sokaski | Deformation of Yttrium | 3,730 (NSF) | |
| McMullen | Sokaski | Deformation of Yttrium | 2,810 (EES, RA) | 8 hrs/week |
| | | TOTAL | $6,940 | |

* Not supported by funds in previous column, i.e. research done as part of regular faculty appointment.

GRAND TOTAL $1,028,180

RESEARCH ACTIVITY

Department Metallurgical Engineering

From 7/1/70 to 6/30/71

| | | | | | | |
|---|---|---|---|---|---|---|
| 01-07 | CE-N EES-70/71 | USOE | BURGESS | 178,207 | 03Y | TECH EDUC CONSTR |
| 02-08 | NEI-N 70/71 | NSF | WANG | 109,500** | 03Y | ENV IMP NUC POWER |
| 03-09 | EE-N 70/71 | NSF | AMORT | 6,240 | 02M | UGRAD RES PARTIC |
| 04-09 | CE-R EES-70/71 | PHS | BURGESS | 19,050 | 01Y | EV HLTH TRNEE |
| 05-09 | CE-N EES-70/71 | USDI | KLINGEMAN | 25,065 | 01Y | EFF WATERSH STR SED1 |
| 06-10 | CE-N 70/71 | NSF | BURGESS | 174,500 | 03Y | TECH EDUC CONSTR |
| 07-10 | ME-N EES-70/71 | NSF | ZAWORSKI | 35,700 | 02Y | FLOW-COUPLD DIFFSN |
| 08-11 | CE-N EES-70/71 | NSF | FILMER | 11,525 | 10W | STDNT ORIG STUDIES |
| 09-11 | CE-N EES-70/71 | NSF | FILMER | 14,060 | 11W | STDNT ORIG STUDIES |
| 10-11 | EEE-N EES-70/71 | NSF | HOLMES | 14,900 | 18M | AUTO COLSN AVDCE SYS |
| 11-11 | ME-N EES-70/71 | NSF | REISTAD | 15,100 | 18M | TOTAL ENERGY SYSTEMS |
| 12-11 | NE-M 70/71 | NSF | RINGLE | 11,900 | 12W | STDNT ORIG STUDIES |
| 13-11 | ME-N EES-70/71 | NSF | THRESHER | 16,100 | 16M | SEMICIRC SURF CRACK |
| 14-11 | NEI-N 70/71 | AEC | WANG | | 01Y | TRAINEESHIPS |
| 15-11 | EES-N EES-70/71 | DOT | KNUDSEN | 544,290** | 03Y | TRANSPORTN RESEARCH |
| 16-12 | NE-R 70/71 | DOD | ROBINSON | 31,687 | 01Y | NEUTRON RADIOGRAPHY |
| 17-01 | ME-N EES-70/71 | NSF | LARSON-DAVIS | 40,953 | 02Y | SPRTD REGIONS-BENDS |
| 18-01 | ME-N EES-70/71 | WRRI | LARSON | 20,020 | 03Y | STRFD FLOW IN BENDS |
| 19-01 | CHE-N EES-70/71 | NSF | KNUDSEN | 90,090 | 05Y | TURB MIX FLOW CHANLS |
| 20-01 | CE-N EES-70/71 | WRRI | BELLA | 7,900 | 02Y | BENTHAL SULFD RLESE |
| 21-01 | CE-R EES-70/71 | WRRI | KLINGEMAN | 5,000 | 01 | ENGRG HYDROLOGY |
| 22-01 | CE-N EES-70/71 | WRRI | SCHAUMBERG | 17,000 | 02Y | BENTH BARK DEPOSITS |
| 22-01 | ME-R EES-70/71 | AEC | WELTY | 19,974 | 01Y | NTRL COHV LQ METALS |
| 24-01 | IE-N EES-70/71 | PHS | RIGGS | 114,298 | 05Y | HOSP ENGRG TRNG |
| 25-01 | CE-N 70/71 | WRRI | SCHROEDER | 14,600 | 02Y | PERM CMPCTD SOILS |
| 26-01 | CE-N 70/71 | WRRI | SLOTTA | 14,900 | 02Y | AIRPHTO STDYS RESVRS |
| 28-01 | ME-N EES-70/71 | PHS | BOUBEL | 58,615 | 01Y | MESO-METEOR STUDY |
| 29-01 | ME-N EES-70/71 | PHS | DAHLKE | 34,275 | 01Y | STRUCT ANAL TEETH |
| 30-01 | CE-R EES-70/71 | USDI | BELLA | 40,490 | 01Y | TDL FLTS WTR QUAL |
| 31-01 | EEE-N EES-70/71 | PHS | SAUGEN-LARSON | 75,690 | 01Y | MGMNT ASPIRIN POISNG |
| 32-01 | CE-N EES-70/71 | ARMY | SLOTTA | 21,410 | 02Y | FLD STDYS RSVR CRNTS |
| 33-01 | CE-N EES-70/71 | ARMY | SLOTTA | 37,610 | 01Y | DNSTY CRNTS |
| 34-02 | CE-N 70/71 | ARMY | KLINGEMAN | 10,000 | 01Y | SDMNT TRSPRT FRST ST |
| 35-02 | CHE-N EES-70/71 | NSF | LEVENSP-FITZG | 196,790 | 05Y | EFF STM FLUID BED BL |
| 36-03 | CE-R EES-70/71 | EPA | BURGESS | 68,290 | 01Y | GRA TR WA QU ENG |
| 37-03 | CE-N EES-70/71 | ECC | FILMER | 19,520 | 01Y | COMMUNITY UNIVERSITY |
| 38-04 | ME-R EES-70/71 | PHS | BOUBEL | 104,743 | 01Y | GR TR AIR POLL CONTR |
| 39-04 | ME-N EES-70/71 | ONR | THRESHER | 22,640 | 01Y | STRESSES NEAR SUR CR |
| 40-04 | NEI-N 70/71 | PHS | WANG | 385,031** | 01Y | ENV IMP NUC POWER |
| 41-05 | ME-N-EES-70/71 | PHS | DAHLKE | 32 620 | 01Y | STRUC ANAL TEETH |
| 42-05 | EEE-N-EES-70/71 | USDI | ENGLE | 15 030 | 01Y | SYNCHR MACH MODELS |
| 43-05 | EEE-N 70/71 | NSF | HERZOG | 58 004 | 02Y | APPL ANA REMOTE SENS |
| 44-05 | IE-N-EES-70/71 | NSF | INOUE | 40 890 | 03W | SOCIAL SYST ENG |
| 45-05 | CE-N-EES-70/71 | NSF | SCHAUMBURG | 64 077 | 02Y | CON TOX POLL BIOASS |
| 46-05 | CE-N EES-70/71 | NSF | SCHROEDER | 33 335 | 02Y | SLIDE CONT SLOPE REV |
| 47-05 | CE-N-EES-70/71 | NSF | SCHULTZ | 56 379 | 06W | PHOTOGRAM COLL TEACH |
| 48-05 | CE-N-EES-70/71 | NSF | SLOTTA | 346 414 | 03Y | SPOIL DISTR EST EFFS |
| 49-05 | CE-N-EES-70/71 | HILL | SLOTTA | 71 610 | 03Y | BAY OC WA EXC NETART |

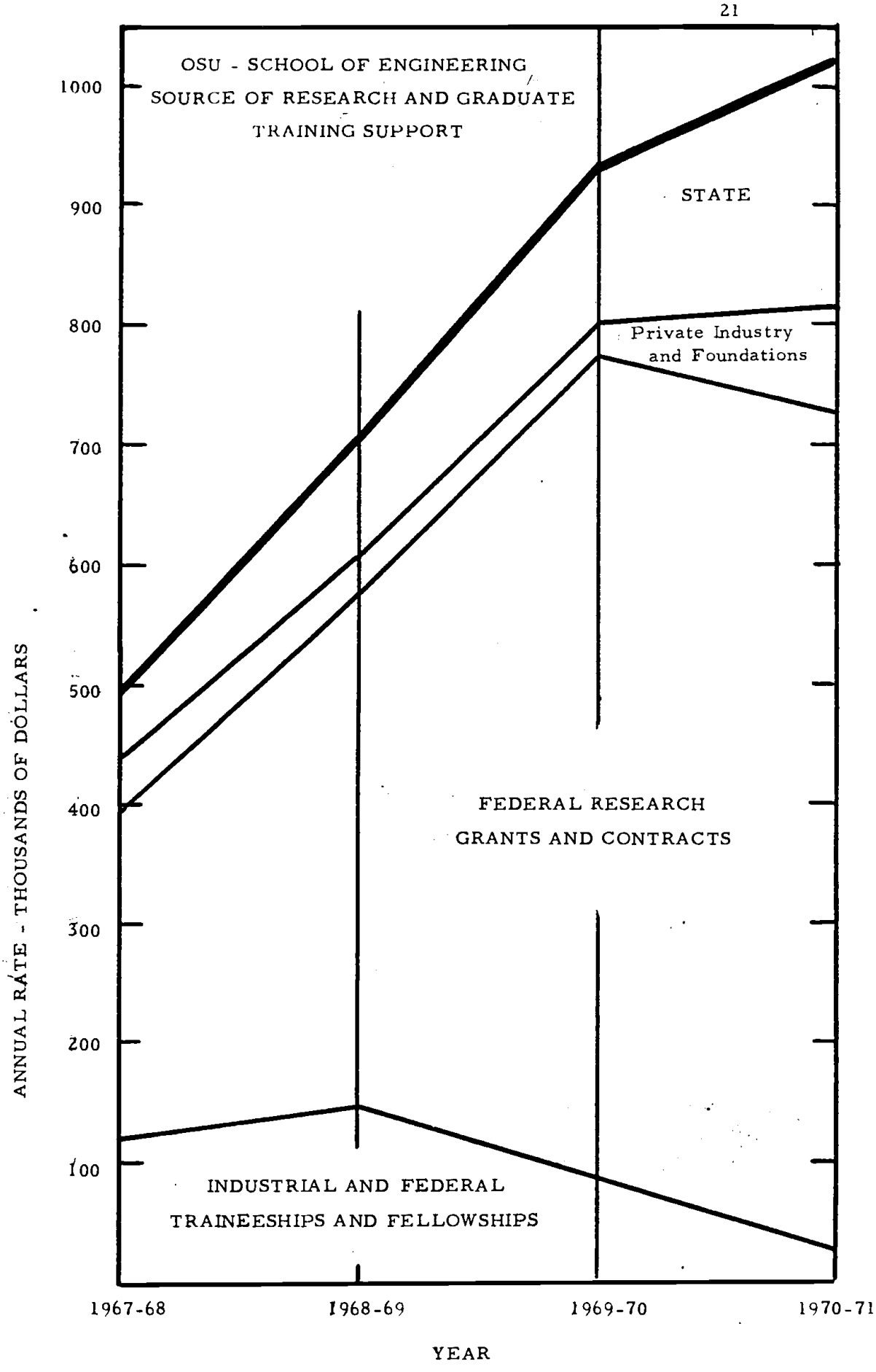
* DOES NOT INCLUDE SEA GRANT PROPOSAL

** INTERDISCIPLINARY PROPOSALS IN WHICH ENGINEERING PARTICIPATED

OSU ENGINEERING SCHOOL

SOURCE OF RESEARCH AND TRAINING GRANT SUPPORT

| Source | 1970-71 | | 1969-70 | | 1968-69 | | 1967-68 | |
|---|---|---|---|---|---|---|---|---|
| | Amount | % | Amount | % | Amount | % | Amount | % |
| Fellowships & Traineeships (Federal and Industrial) | $ 21,700 | 2.1 | $ 88,000 | 9.4 | $144,000 | 20.3 | $120,000 | 24.0 |
| Federal Grants and Contracts | 703,450 | 68.5 | 690,000 | 73.9 | 433,000 | 61.0 | 275,000 | 55.0 |
| Private Industry and Foundations | 85,800 | 8.3 | 24,000 | 2.7 | 33,000 | 4.6 | 45,000 | 9.0 |
| State | 217,230 | 21.1 | 131,000 | 14.0 | 100,000 | 14.1 | 60,000 | 12.0 |
| | $1,028,180 | 100.0 | $933,000 | 100.0 | $710,000 | 100.0 | $500,000 | 100.0 |


OSU - SCHOOL OF ENGINEERING
SOURCE OF RESEARCH AND GRADUATE
TRAINING SUPPORT
STATE
Private Industry
and Foundations
FEDERAL RESEARCH
GRANTS AND CONTRACTS
INDUSTRIAL AND FEDERAL
TRAINEESHIPS AND FELLOWSHIPS
1000
900
800
700
600
500
400
300
200
100
ANNUAL RATE - THOUSANDS OF DOLLARS
1967-68
1968-69
1969-70
1970-71
YEAR

# SCHOOL OF ENGINEERING STATISTICS

## ENROLLMENT AND DEGREES

| | Enrollment | | Professional Degrees Awarded | | |
|---|---|---|---|---|---|
| Year | Undergraduate | Graduate | B.S. | M.S. | Ph.D. |
| 1970-71 | 1726 | 182 | 335 | 52 | 17 |
| 1969-70 | 1810 | 188 | 300 | 48 | 13 |
| 1968-69 | 1800 | 166 | 347 | 47 | 14 |
| 1967-68 | 1717 | 172 | 266 | 43 | 15 |
| 1966-67 | 1566 | 149 | 248 | 39 | 11 |
| 1965-66 | 1493 | 137 | 222 | 41 | 8 |
| 1964-65 | 1388 | 122 | 269 | 42 | 9 |
| 1963-64 | 1408 | 117 | 223 | 37 | 4 |
| 1962-63 | 1418 | 101 | 209 | 47 | 1 |
| 1961-62 | 1278 | 83 | 252 | 38 | 5 |
| 1960-61 | 1275 | 83 | 257 | 26 | -- |
| 1959-60 | 1334 | 59 | 311 | 29 | 1 |

# FACULTY

# OF

# THE SCHOOL OF ENGINEERING

# OREGON STATE UNIVERSITY

# CORVALLIS, OREGON 97331

1970-71

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| AGE | BACKUS,DONALD A | 3 | 21 | | | | | | |
| AGE | BOOSTER,DEAN E | 3B | | | | | | | |
| AGE | BROOKS,ROYAL H | 22F | 22H | 22K | | | | | |
| AGE | CHRISTENSEN,LENO V | 3 | | | | | | | |
| AGE | CROPSEY,MYRON G | 3 | | | | | | | |
| AGE | KIRK,DALE E | 3A | 3C | | | | | | |
| AGE | LONG,DAVID R | 3 | 3A | 3B | | | | | |
| AGE | PAGE,GLEN E | 3B | 30 | | | | | | |
| AGE | RODGERS,JEFFERSON R | 3B | | | | | | | |
| AGE | SINNARD,HERBERT R | 3 | 21 | 44A | | | | | |
| AGE | WOLFE,JOHN W | 42A | 48A | 22F | | | | | |
| CHE | FITZGERALD,THOMAS J | | | | | | | | |
| CHE | GLEESON,GEORGE W | 7 | 32D | | | | | | |
| CHE | KNUDSEN,JAMES G | 19C | 22 | 33 | | | | | |
| CHE | LEVENSPIEL,OCTAVE | 8A | | | | | | | |
| CHE | MEREDITH,ROBERT E | 16 | | | | | | | |
| CHE | MRAZEK,ROBERT V | 31I | 33 | 47 | | | | | |
| CHE | WALTON,JESSE S | 7 | | | | | | | |
| CHE | WICKS,CHARLES E | 7B | 30 | 46A | | | | | |
| CIVE | BEECROFT,GORDON W | 2A | 13K | | | | | | |
| CIVE | BELL,RICHARD J | 13H | 42B | | | | | | |
| CIVE | BELLA,DAVID A | 10H | 33B | 41 | 41D | 41G | | | |
| CIVE | BURGESS,FREDRICK J | 21 | 21B | 41 | 41K | 41L | 48 | | |
| CIVE | FILMER,ROBERT W | 1B | 13N | 22E | 22G | 22H | 24 | 42C | |
| CIVE | HOLCOMB,GLENN W | 44 | | | | | | | |
| CIVE | JAMES,WESLEY P | 41 | 45A | | | | | | |
| CIVE | KLINGEMAN,PETER C | 22E | 22J | 26C | 48 | 48B | | | |
| CIVE | LABAUN,GEORGE B | 12 | 20B | 21B | 40 | | | | |
| CIVE | LAURSEN,HAROLD I | 34B | 44 | | | | | | |
| CIVE | MCCLELLAN,THOMAS J | 31J | 34B | 44 | | | | | |
| CIVE | MEZERA,DAVID F | 45 | 45C | | | | | | |
| CIVE | NORTHCRAFT,MARTIN F | 41 | 41T | 41K | 41L | 48 | 48C | 48E | 49 |
| CIVE | PETERSON,JOHN | 34B | 34C | 44 | | | | | |
| CIVE | PHELPS,ROBERT E | 2A | 2D | 12 | 13C | 13K | 13M | 22F | |
| CIVE | PHILLIPS,DONALD C | 41 | | | | | | | |
| CIVE | PRITCHETT,HAROLD D | 14 | 23C | 27A | 34B | 38B | 44F | | |
| CIVE | SCHAUMBERG,FRANK D | 41 | | | | | | | |
| CIVE | SCHROEDER,W L | 13H | 42B | | | | | | |
| CIVE | SCHULTZ,ROBERT J | 45 | 45A | 45B | | | | | |
| CIVE | SEADERS,JOHN | 4 | 45 | 45A | 45C | | | | |
| CIVE | SLOTTA,LARRY S | 10A | 22 | 26 | 46 | | | | |
| CIVE | STEPHENS,CHARLES T | 44 | | | | | | | |
| CIVE | WHITE,WILLIAM H | 44L | | | | | | | |
| EEE | ALEXANDER,GERALD C | 15 | | | | | | | |
| EEE | AMORT,DONALD L | 17 | | | | | | | |
| EEE | CHANG,CHENG-CHENG | 17E | 17I | | | | | | |
| EEE | ENGLE,JOHN F | 10A | 10H | 19D | | | | | |
| EEE | FEIKERT,GRANT S | 9 | | | | | | | |
| EEE | HERZOG,JAMES H | 6 | 10C | 10E | 11F | | | | |
| EEE | HOLMES,J FRED | 9 | 15 | | | | | | |
| EEE | JENSEN,LELAND C | 1B | 17B | | | | | | |
| EEE | LOONEY,JAMES C | 17I | | | | | | | |
| EEE | MAGNUSSON,PHILIP C | 17B | 17F | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| EEE | MESECAR,RODERICK S | 17 | 38 | | | | | | | |
| EEE | MICHAEL,ROBERT R | 6 | 17 | 17D | 28A | 38 | | | | |
| EEE | OORTHUYS,HENDRIK J | 15 | | | | | | | | |
| EEE | PARK,SONG B | 17G | | | | | | | | |
| EEE | PERKINS,HARLEY A JR | 10G | 11F | 15B | 17I | | | | | |
| EEE | SAUGEN,JOHN L | 10E | 11C | 11F | 15 | 46A | | | | |
| EEE | SHORT,ROBERT A | 10B | 10F | 17J | | | | | | |
| EEE | STONE,LOUIS N | 10B | 10I | 15 | | | | | | |
| EEE | STONE,SOLON A | 6 | 10H | 11F | 15 | | | | | |
| EEE | WEBER,LEONARD J | 9 | 17D | | | | | | | |
| GE | BUCEY,DAVID A | 31 | 44 | | | | | | | |
| GE | CAMPBELL,JOHN C | 20 | 22E | 48 | | | | | | |
| GE | CROFF,HOWARD L | 5 | 23 | 23B | 31C | | | | | |
| GE | GARRARD,JAMES L | 20C | | | | | | | | |
| GE | GRAY,JAMES L | 12 | 21B | | | | | | | |
| GE | HAITH,MARVIN R | | | | | | | | | |
| GE | JARVI,ALBERT O | 44 | | | | | | | | |
| GE | STATON,WARREN S | 13K | 21B | 21C | 41 | | | | | |
| INDE | ENGESSER,WILLIAM F | 11F | 20A | 21A | 27 | 28A | 29 | 31C | 40 | |
| INDE | INOUE,MICHAEL S | 10 | 10C | 27C | 28A | 40N | 44 | | | |
| INDE | LOVE,STEPHEN | | | | | | | | | |
| INDE | RIGGS,JAMES L | 14 | 27 | 27B | 27C | | | | | |
| MECH | BOUBEL,RICHARD W | 34 | 41A | 41F | | | | | | |
| MECH | DAHLKE,HANS J | 34D | 43B | | | | | | | |
| MECH | DAVIS,LORIN R | 19C | 22B | | | | | | | |
| MECH | HUGHES,ARTHUR D | 3A | 18A | 18E | 18F | 18G | | | | |
| MECH | JOHNSON,LINWOOD F | 13N | 34 | | | | | | | |
| MECH | KINNEY,J ROLLY | 22 | 33 | | | | | | | |
| MECH | LARSON,MILTON B | 19C | 22 | 47 | | | | | | |
| MECH | MINGLE,JOHN G | 18A | 18E | 39B | | | | | | |
| MECH | MORRIS,CHARLES O | 2B | 2C | 44D | | | | | | |
| MECH | PAUL,WILLIAM H | 13A | 18 | | | | | | | |
| MECH | REISTAD,GORDON M | 13A | | | | | | | | |
| MECH | SLEGAL,LOUIS | 34 | | | | | | | | |
| MECH | SMITH,CHARLES E | 34B | | | | | | | | |
| MECH | SMITH,WESLEY W | 10F | 13B | 13D | 13J | 18E | 31C | 35 | 40 | 40N |
| MECH | THORNBURGH,GEORGE E | 24 | 34 | 47 | | | | | | |
| MECH | THRESHER,R W | | | | | | | | | |
| MECH | WELTY,JAMES R | 7B | 34 | 47 | | | | | | |
| MECH | WILSON,ROBERT E | 19C | 22 | 22B | | | | | | |
| MECH | ZAWORSKI,ROBERT J | 34 | 38A | 47 | | | | | | |
| MET | FRAZIER,LLOYD M | 40C | 40D | | | | | | | |
| MET | HOEYE,WYMAN D | 40Q | | | | | | | | |
| MET | RIESLAND,EDWARD E | 11 | 13Z | 40 | 40A | 40D | 40E | 40P | | |
| MET | ROBLEY,ASA A | 40P | | | | | | | | |
| MET | SHEELY,MILTON C | 13Z | 40 | 40G | | | | | | |
| MET | WILSON,ROBERT C | 40F | 40L | 40R | | | | | | |
| MTLE | BAINBRIDGE,DOUGLAS W | 31 | 35 | 35D | | | | | | |
| MTLE | | | | | | | | | | |
| MTLE | MCCOMB,JOHN A | 31 | 35 | 35A | 35D | | | | | |
| MTLE | MCMULLEN,WILLIAM D | 35 | | | | | | | | |
| MTLE | OLLEMAN,ROGER D | 31 | | | | | | | | |
| MTLE | PAASCHE,OLAF G | 31 | 35 | | | | | | | |
| NUCL | BUPP,LAMAR P | 27 | 27I | 31B | 31K | 37A | | | | |
| NUCL | BURGER,LELAND L | 7 | 37E | | | | | | | |
| NUCL | HORNYIK,KARL | 37D | | | | | | | | |
| NUCL | MOORE,BILL M | | | | | | | | | |
| NUCL | RINGLE,JOHN C | 37 | 37D | | | | | | | |
| NUCL | ROBINSON,ALAN H | 33 | 37D | | | | | | | |

# SPECIALTIES

| | | | | |
|---|---|---|---|---|
| 1 | ACOUSTICS | | | |
| | A) MEASUREMENT AND CONTROL | | | |
| | B) ULTRASONICS | FILMER,ROBERT W | JENSEN,LELAND C | |
| 2 | AEROSPACE ENGINEERING | | | |
| | A) AIRPORT DESIGN | BEECROFT,GORDON W | PHELPS,ROBERT E | |
| | B) AERODYNAMICS | MORRIS,CHARLES C | | |
| | C) AEROELASTICITY | MORRIS,CHARLES C | | |
| | D) MISSLE BASE CONSTRUCTION AND DESIGN | PHELPS,ROBERT E | | |
| 3 | AGRICULTURAL ENGINEERING | BACKUS,DONALD A | CHRISTENSEN,LENO V | CROPSEY,MYRON G |
| | | LONG,DAVID R | SINNARD,HERBERT R | |
| | A) CROP PROCESSING | KIRK,DALE E | LONG,DAVID R | HUGHES,ARTHUR D |
| | B) FARM POWER AND MACHINERY | BOOSTER,DEAN E | LONG,DAVID R | PAGE,GLEN E |
| | | RODGERS,JEFFERSON B | | |
| | C) FOOD ENGINEERING | KIRK,DALE E | | |
| 4 | ATMOSPHERIC SCIENCES | SEADERS,JOHN | | |
| 5 | AUDIO VISUAL EQUIPMENT | CROFF,HOWARD L | | |
| 6 | BIOENGINEERING | HERZOG,JAMES H | MICHAEL,ROBERT R | STONE,SOLON A |
| 7 | CHEMICAL ENGINEERING | GLEESON,GEORGE W | WALTON,JESSE S | BURGER,LELAND L |
| | A) CHEMICAL REACTION ENGINEERING | | | |
| | B) TRANSPORT PHENOMENA | WICKS,CHARLES E | WELTY,JAMES R | |
| 8 | CHEMICAL KINETICS | | | |
| | A) REACTOR DESIGN | LEVENSPIEL,OCTAVE | | |
| 9 | COMMUNICATION | FEIKERT,GRANT S | HOLMES,J FRED | WERER,LEONARD J |
| | A) DATA TRANSMISSION | | | |
| | B) MICROWAVE | | | |
| | C) RADIO | | | |
| | D) TELEPHONE | | | |
| | E) TELEVISION | | | |
| | F) VIDEO RECORDING AND REPRODUCTION | | | |
| 10 | COMPUTERS | INOUE,MICHAEL S | | |
| | A) APPLICATION | SLOTTA,LARRY S | ENGLE,JOHN F | |
| | B) AUTOMATA THEORY | SHORT,ROBERT A | STONE,LOUIS N | |
| | C) CYBERNETICS | HERZOG,JAMES H | INOUE,MICHAEL S | |
| | D) DESIGN | | | |
| | E) HYBRID COMPUTATION | HERZOG,JAMES H | SAUGEN,JOHN L | |
| | F) LOGICAL DESIGN | SHORT,ROBERT A | SMITH,WESLEY W | |
| | G) MEMORIES | PERKINS,HARLEY A JR | | |
| | H) SIMULATION | BELLA,DAVID A | ENGLE,JOHN F | STONE,SOLON A |
| | I) SYSTEMS | STONE,LOUIS N | | |
| 11 | CONTROL | RIESLAND,EDWARD E | | |
| | A) COMPETANCE AND RELIABILITY | | | |
| | B) DYNAMICS | | | |
| | C) LEARNING CONTROL SYSTEMS | SAUGEN,JOHN L | | |
| | D) MEASUREMENT | | | |

| | | | | |
|---|---|---|---|---|
| | E) SPECIAL AREAS | | | |
| | F) SYSTEMS | HERZOG,JAMES H | PERKINS,HARLEY A JR | SAUGEN,JOHN L |
| | | STONE,SOLON A | ENGESSER,WILLIAM F | |
| 12 | CONSTRUCTION | LABAUN,GEORGE B | PHELPS,ROBERT E | GRAY,JAMES L |
| 13 | DESIGN | | | |
| | A) AUTOMOTIVE | PAUL,WILLIAM H | REISTAD,GORDON M | |
| | B) COMPUTER AIDED | SMITH,WESLEY W | | |
| | C) CONCRETE | PHELPS,ROBERT E | | |
| | D) COOLING TOWERS | SMITH,WESLEY W | | |
| | E) DYNAMIC | | | |
| | F) EARTH DAMS | | | |
| | G) FOOTINGS | | | |
| | H) FOUNDATIONS | BELL,RICHARD J | SCHROEDER,W L | |
| | I) FURNITURE | | | |
| | J) GOVERNORS | SMITH,WESLEY W | | |
| | K) HIGHWAY | BEECROFT,GORDON W | PHELPS,ROBERT E | STATON,WARREN S |
| | L) JIGS AND FIXTURES | | | |
| | M) LIGHTWEIGHT CONCRETE | PHELPS,ROBERT E | | |
| | N) MACHINE | FILMER,ROBERT W | JOHNSON,LINWOOD E | |
| | O) MECHANISMS | | | |
| | P) PLASTIC ANALYSIS | | | |
| | Q) POWER PLANTS | | | |
| | R) PRODUCT | | | |
| | S) REACTORS(CHEMICAL) AND VESSELS | | | |
| | T) RETAINING WALLS | | | |
| | U) RIGID FRAMES | | | |
| | V) SHELLS | | | |
| | W) STEEL | | | |
| | X) STRUCTURAL | | | |
| | Y) TIMBER | | | |
| | Z) TOOL | RIESLAND,EDWARD E | SHEELY,MILTON C | |
| 14 | ECONOMY | PRITCHETT,HAROLD D | RIGGS,JAMES L | |
| 15 | ELECTRICAL ENGINEERING | ALEXANDER,GERALD C | HOLMES,J FRED | OORTHUYS,HENDRIK J |
| | | SAUGEN,JOHN L | STONE,LOUIS N | STONE,SOLON A |
| | A) HIGH VOLTAGE | | | |
| | B) MAGNETIC DEVICES AND MATERIALS | PERKINS,HARLEY A JR | | |
| 16 | ELECTROCHEMISTRY | MEREDITH,ROBERT E | | |
| | A) BATTERIES | | | |
| | B) CORROSION | | | |
| | C) ELECTROCHEMICAL CELLS | | | |
| | D) ELECTRO DEPOSITION | | | |
| | E) ENERGY CONVERSION | | | |
| 17 | ELECTRONICS | AMORT,DONALD L | MESECAR,RODERICK S | MICHAEL,ROBERT R |
| | A) CIRCUIT RELIABILITY | | | |
| | B) CIRCUIT THEORY AND DESIGN | JENSEN,LELAND C | MAGNUSSON,PHILIP C | |
| | C) DISPLAY DEVICES | | | |
| | D) INSTRUMENTATION | MICHAEL,ROBERT R | WEBER,LEONARD J | |
| | E) LASER OPTICS | CHANG,CHENG-CHENG | | |
| | F) MATHEMATICAL ASPECTS | MAGNUSSON,PHILIP C | | |
| | G) NETWORK THEORY | PARK,SONG B | | |
| | H) PULSE CIRCUITS | | | |
| | I) SOLID-STATE | CHANG,CHENG-CHENG | LOONEY,JAMES C | PERKINS,HARLEY A JR |
| | J) SWITCHING AND CODING | SHORT,ROBERT A | | |
| 18 | ENERGY PRODUCTION AND USE | PAUL,WILLIAM H | | |
| | A) AUTOMOTIVE | HUGHES,ARTHUR D | MINGLE,JOHN G | |
| | B) ELECTRIC POWER | | | |
| | C) ELECTROCHEMICAL | | | |

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| | D) ENERGY CONVERSION | | | |
| | E) FUELS, COMBUSTION | HUGHES,ARTHUR D | MINGLE,JOHN G | SMITH,WESLEY W |
| | F) HEAT POWER | HUGHES,ARTHUR D | | |
| | G) SOLAR POWER | HUGHES,ARTHUR D | | |
| 19 | ENERGY TRANSFER | | | |
| | A) CALORIMETRY | | | |
| | B) ELECTRICAL TRANSMISSION SYSTEMS | | | |
| | C) HEAT TRANSFER | KNUDSEN,JAMES G<br>WILSON,ROBERT E | DAVIS,LORIN R | LARSON,MILTON R |
| | D) POWER SYSTEMS | ENGLE,JOHN F | | |
| | E) SUPER CONDUCTION | | | |
| 20 | ENGINEERING EDUCATION | CAMPBELL,JOHN C | | |
| | A) EDUCATIONAL METHODS | ENGESSER,WILLIAM F | | |
| | B) CONSTRUCTION EDUCATION | LABAUN,GEORGE B | | |
| | C) LATIN AMERICAN EDUCATION | GARRARD,JAMES L | | |
| 21 | ENVIRONMENTAL ENGINEERING | BACKUS,DONALD A | SINNARD,HERBERT R | BURGESS,FREDRICK J |
| | A) CITY PLANNING | ENGESSER,WILLIAM F | | |
| | B) PLANNING AND DEVELOPMENT | BURGESS,FREDRICK J<br>STATON,WARREN S | LABAUN,GEORGE B | GRAY,JAMES L |
| | C) URBAN AND REGIONAL DEVELOPMENT | STATON,WARREN S | | |
| 22 | FLUID MECHANICS | KNUDSEN,JAMES G<br>LARSON,MILTON R | SLOTTA,LARRY S<br>WILSON,ROBERT E | KINNEY,J ROLLY |
| | A) CANALS | | | |
| | B) GAS DYNAMICS | DAVIS,LORIN R | WILSON,ROBERT E | |
| | C) GROUNDWATER MOVEMENT | | | |
| | D) HYDRODYNAMICS | | | |
| | E) HYDROLOGY | FILMER,ROBERT W | KLINGEMAN,PETER C | CAMPBELL,JOHN C |
| | F) IRRIGATION AND DRAINAGE | BROOKS,ROYAL H | WOLFE,JOHN W | PHELPS,ROBERT E |
| | G) MEASUREMENTS | FILMER,ROBERT W | | |
| | H) POROUS SOLIDS | BROOKS,ROYAL H | FILMER,ROBERT W | |
| | I) RIVER SYSTEMS | | | |
| | J) SEDIMENT TRANSPORT | KLINGEMAN,PETER C | | |
| | K) TWO PHASE FLOW | BROOKS,ROYAL H | | |
| 23 | GRAPHICS | CROFF,HOWARD L | | |
| | A) DESCRIPTIVE GEOMETRY | | | |
| | B) INDUSTRIAL DRAFTING | CROFF,HOWARD L | | |
| | C) INDUSTRIAL PHOTOGRAPHY | PRITCHETT,HAROLD D | | |
| 24 | HEATING, AIR CONDITIONING AND REFRIGERATION | THORNBURGH,GEORGE E | | |
| | A) CONSTRUCTION | | | |
| | B) PLANT DESIGN | | | |
| | C) TESTING | | | |
| 25 | HIGH VOLTAGE | | | |
| | A) CORONA | | | |
| | B) RADIO NOISE | | | |
| 26 | HYDRAULICS | FILMER,ROBERT W | SLOTTA,LARRY S | |
| | A) HYDRAULIC MACHINERY | | | |
| | B) PUMPS | | | |
| | C) RIVER AND COASTAL HYDRAULICS | KLINGEMAN,PETER C | | |
| | D) TURBINES | | | |
| 27 | INDUSTRIAL ENGINEERING | ENGESSER,WILLIAM F | RIGGS,JAMES L | BUPP,LAMAR P |
| | A) CONSTRUCTION MANAGEMENT | PRITCHETT,HAROLD D | | |
| | B) HUMAN ENGINEERING | RIGGS,JAMES L | | |
| | C) OPERATIONS RESEARCH | INOUE,MICHAEL S | RIGGS,JAMES L | |
| | D) PROCESS SYSTEMS SIMULATION | | | |
| | E) SAFETY | | | |
| | F) SYSTEMS ANALYSIS | | | |
| | G) SYSTEMS ENGINEERING | | | |

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| | H) WORK DESIGN FOR THE DISABLED | | | |
| | I) WORK MANAGEMENT | BUPP,LAMAR P | | |
| | J) WORK METHODS AND SIMPLIFICATION | | | |
| 28 | INFORMATION RETRIEVAL | | | |
| | A) DATA AND INFORMATION SYSTEMS | MICHAEL,ROBERT R | ENGESSER,WILLIAM F | INOUE,MICHAEL S |
| 29 | INFORMATION THEORY | ENGESSER,WILLIAM F | | |
| 30 | MASS TRANSFER | PAGE,GLEN E | WICKS,CHARLES E | |
| | A) DIFFUSION | | | |
| | B) VAPOR-LIQUID | | | |
| 31 | MATERIALS | BUCEY,DAVID A | BAINBRIDGE,DOUGLAS W | MCCOMB,JOHN A |
| | | OLLEMAN,ROGER D | PAASCHE,OLAF G | |
| | A) EXAMINATION | | | |
| | B) FAILURES | BUPP,LAMAR P | | |
| | C) HANDLING | CROFF,HOWARD L | ENGESSER,WILLIAM F | SMITH,WESLEY W |
| | D) LOW TEMPERATURE | | | |
| | E) MEASUREMENT | | | |
| | F) METALLIC | | | |
| | G) NONMEATALLIC | | | |
| | H) NUCLEAR | | | |
| | I) PROPRERTIES | MRAZEK,ROBERT V | | |
| | J) STRUCTURAL | MCCLELLAN,THOMAS J | | |
| | K) TESTING | BUPP,LAMAR P | | |
| 32 | MATERIAL SEPERATION | | | |
| | A) ADSORPTION | | | |
| | B) CRYSTALLIZATION | | | |
| | C) ION EXCHANGE | | | |
| | D) ORE DRESSING | GLEESON,GEORGE W | | |
| | E) SOLVENT EXTRACTION | | | |
| 33 | MATHEMATICAL AND NUMERICAL | KNUDSEN,JAMES G | MRAZEK,ROBERT V | KINNEY,J ROLLY |
| | | ROBINSON,ALAN H | | |
| | A) ANALYSIS | | | |
| | B) MODELS | BELLA,DAVID A | | |
| | C) SYSTEMS | | | |
| 34 | MECHANICAL ENGINEERING | BOUBEL,RICHARD W | JOHNSON,LINWOOD E | SLEGAL,LOUIS |
| | | THORNBURGH,GEORGE E | WELTY,JAMES R | ZAWORSKI,ROBERT J |
| | A) PRESSURE SYSTEMS | | | |
| | B) APPLIED MECHANICS | LAURSEN,HAROLD I | MCCLELLAN,THOMAS J | PETERSON,JOHN |
| | | PRITCHETT,HAROLD D | SMITH,CHARLES E | |
| | C) DYNAMICS | PETERSON,JOHN | | |
| | D) ENGINEERING MECHANICS | DAHLKE,HANS J | | |
| 35 | METALLURGICAL ENGINEERING | SMITH,WESLEY W | BAINBRIDGE,DOUGLAS W | MCCOMB,JOHN A |
| | | MCMULLEN,WILLIAM D | PAASCHE,OLAF G | |
| | A) ELECTRON MICROSCOPY | MCCOMB,JOHN A | | |
| | B) PHYSICAL | | | |
| | C) RARE EARTH | | | |
| | D) SOLID STATE | BAINBRIDGE,DOUGLAS W | MCCOMB,JOHN A | |
| 36 | MICROBIOLOGICAL | | | |
| | A) FERMENTATION | | | |
| | B) FOOD | | | |
| | C) SANITATY | | | |
| | D) STREAM | | | |
| 37 | NUCLEAR ENGINEERING | RINGLE,JOHN C | | |
| | A) FUELS | BUPP,LAMAR P | | |
| | B) INSTRUMENTATION | | | |
| | C) MATERIALS | | | |
| | D) REACTOR ANALYSIS | HORNYIK,KARL | RINGLE,JOHN C | ROBINSON,ALAN H |
| | E) SEPARATIONS | BURGER,LELAND L | | |
| | F) SYSTEMS | | | |

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| 38 | OCEAN ENGINEERING | | | |
| | A) MECHANICS AND MARINE EQUIPMENT | MESECAR,RODERICK S | MICHAEL,ROBERT R | |
| | B) UNDERWATER TECHNOLOGY | ZAWORSKI,ROBERT J | | |
| | | PRITCHETT,HAROLD D | | |
| 39 | OILS | | | |
| | A) ESSENTIAL OIL DISTILLATION | | | |
| | B) LUBRICANTS | | | |
| 40 | PRODUCTION OPERATIONS | MINGLE,JOHN G | | |
| | | LARAUN,GEORGE B | ENGESSER,WILLIAM F | SMITH,WESLEY W |
| | A) CASTING | RIESLAND,EDWARD E | SHEELY,MILTON C | |
| | B) FINISHING | RIESLAND,EDWARD E | | |
| | C) FOUNDARY PRACTICES | | | |
| | D) MACHINE TOOL PRACTICES | FRAZIER,LLOYD M | | |
| | E) MACHINING | FRAZIER,LLOYD M | RIESLAND,EDWARD E | |
| | F) METAL AND ARTCRAFTS | RIESLAND,EDWARD E | | |
| | G) METAL FORMING | WILSON,ROBERT C | | |
| | H) MILLWORK | SHEELY,MILTON C | | |
| | I) OPERATIONAL ANALYSIS | | | |
| | J) OPTIMIZATION | | | |
| | K) PACKAGING | | | |
| | L) PATTERN MAKING | WILSON,ROBERT C | | |
| | M) PROCESS DYNAMICS | | | |
| | N) QUALITY CONTROL | INOUE,MICHAEL S | SMITH,WESLEY W | |
| | O) SCHEDULING | | | |
| | P) WELDING AND FABRICATING | RIESLAND,EDWARD E | ROBLEY,ASA A | |
| | Q) WOOD INDUSTRIES | HOFYE,WYMAN D | | |
| | R) WOODWORKING | WILSON,ROBERT C | | |
| 41 | SANITARY ENGINEERING | BELLA,DAVID A | BURGESS,FREDRICK J | JAMES,WESLEY P |
| | | NORTHCRAFT,MARTIN E | PHILLIPS,DONALD C | SCHAUMBERG,FRANK D |
| | | STATON,WARREN S | | |
| | A) AIR | BOUBEL,RICHARD W | | |
| | B) BIO-OXIDATION AND BIOLOGICAL | | | |
| | C) DOMESTIC | | | |
| | D) ESTUARY | BELLA,DAVID A | | |
| | E) INDUSTRIAL | | | |
| | F) INDUSTRIAL HYGENE | BOUBEL,RICHARD W | | |
| | G) RIVER | BELLA,DAVID A | | |
| | H) SAWMILL | | | |
| | I) SEWERS | NORTHCRAFT,MARTIN E | | |
| | J) WASTE DISPOSAL | | | |
| | K) WASTE TREATMENT | BURGESS,FREDRICK J | NORTHCRAFT,MARTIN E | |
| | L) WATER | BURGESS,FREDRICK J | NORTHCRAFT,MARTIN E | |
| 42 | SOILS | | | |
| | A) CONSERVATION | WOLFE,JOHN W | | |
| | B) MECHANICS | BELL,RICHARD J | SCHROEDER,W L | |
| | C) ADSORPTION | FILMER,ROBERT W | | |
| 43 | STRESS ANALYSIS | | | |
| | A) DATA REDUCTION | | | |
| | B) EXPERIMENTAL | DAHLKE,HANS J | | |
| | C) PHOTOELECTRIC | | | |
| | D) VIBRATIONS | | | |
| 44 | STRUCTURES | HOLCOMB,GLENN W | LAURSEN,HAROLD I | MCCLELLAN,THOMAS J |
| | | PETERSON,JOHN | STEPHENS,CHARLES T | BUCEY,DAVID A |
| | | JARVI,ALBERT C | | |
| | A) ARCHETECTURAL DESIGN | SINNARD,HERBERT R | | |
| | B) CONCRETE | | | |
| | C) DESIGN | | | |
| | D) DYNAMICS | MORRIS,CHARLES O | | |
| | E) FOLDED PLATE | | | |
| | F) INSPECTION | PRITCHETT,HAROLD D | | |
| | G) MINIMUM WEIGHT | | | |
| | H) PRESTRESSED | | | |
| | I) RELIABILITY | | | |

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| | J) STABILITY | | | |
| | K) STEEL | | | |
| | L) STRUCTURAL ANALYSIS | WHITE,WILLIAM H | | |
| | M) TESTING | | | |
| | N) TIMBER | | | |
| 45 | SURVEYING | MEZERA,DAVID F | SCHULTZ,ROBERT J | SEADERS,JOHN |
| | A) PHOTOGRAMMETRY | JAMES,WESLEY P | SCHULTZ,ROBERT J | SEADERS,JOHN |
| | B) GEODESY | SCHULTZ,ROBERT J | | |
| | C) GEOPHYSICS | MEZERA,DAVID F | SEADERS,JOHN | |
| 46 | SYSTEMS ENGINEERING | SLOTTA,LARRY S | INOUE,MICHAEL S | |
| | A) SYSTEMS ANALYSIS | WICKS,CHARLES E | SAUGEN,JOHN L | |
| 47 | THERMODYNAMICS | MRAZEK,ROBERT V | LARSON,MILTON B | THORNBURGH,GEORGE E |
| | | WELTY,JAMES R | ZAWORSKI,ROBERT J | |
| | A) HIGH TEMPERATURES | | | |
| | B) LIQUIDS AND GASSES | | | |
| | C) METALLURGICAL | | | |
| 48 | WATER RESOURCES | BURGESS,FREDRICK J | KLINGEMAN,PETER C | NORTHCRAFT,MARTIN E |
| | | CAMPBELL,JOHN C | | |
| | A) CONSERVATION | WOLFE,JOHN W | | |
| | B) DEVELOPMENT | KLINGEMAN,PETER C | | |
| | C) QUALITY | NORTHCRAFT,MARTIN E | | |
| | D) RIVER BASIN ANALYSIS | | | |
| | E) TREATMENT | NORTHCRAFT,MARTIN E | | |