

**SAN JOSE STATE UNIVERSITY**  
**Department of Aviation and Technology**

**Tech 046: Machine Operation and Management**

**Course Syllabus**

Semester and Year: Fall, 2013  
Course Sections: 1 & 11  
Course Code: S1: 43304  
Class days & Times: W 9:00 – 10:50 AM; M 9:00-11:45 AM  
Class Locations: IS 119, 121 & 122  
Instructor: Dr. Samuel C. Obi  
Office Room: IS 105  
Office Hours: W: 11:00 AM-1:30 PM; (and by Arrangement)  
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**Course Catalog Description**

Current numerically-controlled (CNC) and manual machining processes including turning, milling, drilling, grinding, and sawing machines. Manual and computer-aided part programming. Management of machining environment including processes, tooling, instruments, equipment, personnel, safety. (Lecture 2 hours, lab 3 hours) 3 units.

**Prerequisite**

Tech 20 or equivalent

**Purpose of Course**

The purpose of this course is to develop fundamental skills needed for advanced study in manufacturing technology machine tool processes and management. To this end, areas of study will include: measurement, layout and inspection, bench work, metal-cutting saws and processes, drilling machines and processes, turning machines and processes, milling machines and processes, abrasive machining safety, computer-numerical control, and related management. There are five areas of investigation in this course, and each has its own specific objectives. Each area has related reading assignments and handbook tables designed to augment all laboratory activities. Students should read these reading assignments and refer to relative handbook tables in order to successfully fulfill the objectives of this course.

**Required Textbooks & Materials**

- 1) Kibbe, R. R., Neely, J. E., Meyer, R. O., & White, W. T. (2010). Machine tool practices, (9th ed.) Prentice Hall: NJ.
- 2) Valentino, J. V. & Goldenberg, J. (2012). Introduction to Computer Numerical Control (CNC) (5th. Edition). Prentice Hall: NJ. (Recommended)

- 3) Safety Glasses
- 4) Appropriate data storage devices
- 5) Hand calculator with trig and square root functions
- 6) One set of precision dial calipers
- 7) Two shop rags

### **References**

DeGarmo, E. Paul, Black, J. Temple & Kohser, Ronald A. (latest edition). *Materials and Processes in Manufacturing*. Macmillan, New York.

Groover, M. P. (2012). *Fundamentals of Modern Manufacturing: Materials, Processes and Systems*. John Wiley & Sons, New York.

*Machinery Handbook & Current journal and magazine technical articles.*

Thusty, G. (2000). *Manufacturing Processes and Equipment*. Prentice Hall, New Jersey.

### **Outline of Course Content and Unit Objectives**

#### **Part I: Measurement, Inspection & General Shop Management**

Reading Assignment: Kibbe et al pp. 87-191; V & G Chapter 5 & 9.

Handbook Tables: Kibbe et al Tables 1-6 (pages 752-760).

#### **Objectives:**

- a) Discuss and demonstrate an understanding of the concepts of dimensions, units of measure, blueprint reading, measurement systems, and measurement terms.
- b) Develop an understanding of, and demonstrate the proper use of, semiprecision line-graduated measuring instruments and related transfer measuring tools.
- c) Develop an understanding of, and demonstrate the proper use of, the following precision measuring instruments; micrometers, vernier calipers, depth gages, height gages, bevel protractor, indicators, and gage blocks.
- d) Discuss and develop an understanding of advanced precision measurement equipment including CMM, surface finish indicators, optical flats, microscopes, amplification comparators, optical comparators, pneumatic gaging, and fixed gages.
- e) Develop an understanding of surface texture characteristics and measurement.
- f) Develop an understanding of, and demonstrate the proper knowledge and management of shop facilities and equipment.

#### **Part II: Bench Work, Shop Safety, Layout and Tool Management**

Reading Assignment: Kibbe et al pp. 6-85; 235-299. V & G chapters 1, 8 & Appendix A. Kibbe et al Handbook Table: Table 8 (page 763). (Video: TU0952A)

#### **Objectives:**

- a) Develop an understanding of precision surface plates, angle plates, and accessories.
- b) Demonstrate the proper use of a sine bar, and develop an understanding of a sine plate, sine block, and compound sine plate.

- c) Develop techniques for checking parallelism, squareness, roundness, and concentricity.
- d) Develop an understanding of non-cutting hand processes such as hammering, fastening, and clamping.
- e) Develop an understanding of proper hand sawing processes including blade selection.
- f) Develop an understanding of chiseling, punching, and driving tools and processes.
- g) Develop an understanding of hand file characteristics and file processes.
- h) Develop an understanding of hand reamers and reaming processes.
- i) Develop an understanding of, and demonstrate proper hand tapping processes and external threading using dies.
- j) Describe and practice general machine shop safety rules.
- k) Determine proper safe working habits in a machine shop environment.
- l) Describe a computer numerically controlled machine tool and its components.
- m) Perform the Word Address programming format.
- n) Describe tool inventory control system and how to manage it.

### **Part III: Turning Machines, Processes and Management**

Reading Assignment: Kibbe et al pp. 383-506. V & G chapters 17 & 19.

Kibbe et al Handbook Tables: Tables 10, 10A, 10B & 5B.

#### **Objectives:**

- a) Identify and be able to explain the purpose of the major features of engine and CNC lathes including lathe accessories, and attachments.
- b) Describe the characteristics and specifications of basic lathe cutting tool bits and inserts.
- c) Develop an understanding of cutting tool materials.
- d) Program and calculate correct speeds and feeds for traditional and CNC lathes.
- e) Grind a turning tool bit and a threading tool bit using a high speed steel tool blank.
- f) Select the correct center drill, drill the centers in a workpiece and turn (machine) the workpiece on the machine.
- g) Correctly setup a machine to perform facing and straight turning operations.
- h) Correctly setup a machine to perform shoulder turning, chamfering and rounding a corner.
- i) Develop an understanding of form tool grinding and cutting and knurling.
- j) Develop an understanding of tapers, taper turning, and taper measurement.
- k) Develop an understanding of different types of chucks.
- l) Develop an understanding of boring bars and holders, and machining using mandrels.
- m) Machine a 60° form external thread to correct specifications.
- n) Develop an understanding of production thread making processes including casting, rolling, milling, grinding, and broaching.
- o) Develop an understanding of square threads, 29° threads, and multiple-start threads.
- p) Develop an understanding of production turning machines including turret lathes and automatic screw machines.
- q) Employ proper safe working and housekeeping habits in working with turning machines.

#### **Part IV: Milling Machines, Processes and Management**

Reading Assignment: Kibbe et al pp. 511-584. V & G chapters 2, 3, 4 & 10; Appendices B & C.

Kibbe et al Handbook Tables: Tables 10A, 10B.

##### **Objectives:**

- a) Develop an understanding of knee-and-column type milling machines.
- b) Identify the major components of a horizontal milling machine.
- c) Develop an understanding of milling tool and work holding devices.
- d) Develop an understanding of milling cutting tools, speeds, feeds, and cutting fluids.
- e) Program and machine a workpiece using CNC milling machine.
- f) Identify major components and attachments of traditional and CNC milling machines.
- g) Develop an understanding of cutting tools and basic processes for vertical milling operations.
- h) Employ proper safe working and housekeeping habits in working with milling machines.

#### **Part V: Other Machines: Metal-Cutting Saws, Drilling Machines, Grinding and Abrasive Machines, Processes and Management**

Reading Assignment: Kibbe et al pp. 301-381 & pp. 585-658.

##### **Objectives:**

- a) Develop an understanding of, and demonstrate the use of, power hacksaws, horizontal band machines, and vertical band machines.
- b) Make proper blade selection.
- c) Determine the appropriate feed, coolant, blade pitch, and velocity, using the Job Selector.
- d) Butt weld a saw blade correctly.
- e) Develop an understanding of friction sawing, diamond-edge band sawing, band filing, and knife-edge band sawing.
- f) Describe the operations of abrasive and cold saw machines.
- g) Employ proper safe working and housekeeping habits in working with metal-cutting saws.
- h) Develop an understanding of, and be able to describe the characteristics of, different drilling machines.
- i) Explain and demonstrate the correct use of work holding devices.
- j) Identify common materials used in the manufacture of drills.
- k) Identify and explain the use of, different types of twist drills.
- l) Develop an understanding of the main features of a twist drill including the shape and angles of the drill points.
- m) Develop an understanding of the standard designations of drill sizes.
- n) Be able to calculate the correct RPM and determine the correct feed rate for drilling operations.
- o) Identify and explain the use of common machine reamers.
- p) Determine the correct RPM and feed rate for reamers.
- q) Develop an understanding of machine threading on a drill press.

- r) Develop an understanding of, and demonstrate the use of countersinks, counterbors, spotfacers, and boring tools.
- s) Employ proper safe working and housekeeping habits in working with drilling machines.
- t) Develop an understanding of abrasive machines and machining processes including surface, centerless, and cylindrical grinding.
- u) Develop an understanding of grinding wheel characteristics and standards, and be able to make an appropriate wheel selection for the required operation.
- v) Describe how to identify unsafe wheels, how to properly dress grinding wheels, and the tools and techniques employed in wheel dressing.
- w) Employ proper safe working and housekeeping habits in abrasive machining.

### **Instructional Methodologies**

1. Lecture-Discussion
2. Demonstrations
3. Laboratory activities
4. Outside reading assignments
5. Video/film presentations (TU0952A and others)

### **Required Projects/Assignments**

This course has been carefully planned to provide the opportunity for students to develop skills in the use of common and computer-numerical controlled machine tools, hand tools, and in layout, planning, inspection, and developing an understanding of heat treatment. To this end, a variety of laboratory activities is required as well as assigned readings in the text. All laboratory activities must be completed in our labs (E101, I.S. 122) unless you have my permission to use another lab. In addition, readings of "outside" materials are required in order to expand the study of a particular area of interest.

#### **Lathe Project: 25 points**

A drawing, a piece of cold rolled steel (CRS), a high speed steel (HSS) tool blank, and a Quality Assurance Traveler (QAT), will be provided for the completion of this project. The tool bit will have to be ground for a right hand turning tool on one end, and a 60° threading tool on the other end. A CNC program should be prepared and the workpiece will be machined to the specifications illustrated on the drawing. Each dimension listed on the QAT must be checked by the student and written on the QAT. Each student's workpiece and QAT will be randomly checked by the instructor. If a dimension is "out of print", the student may elect to loose the points and continue to complete the project or, start over.

#### **Mill Project: 25 points**

A drawing, aluminum and QAT will be provided for the completion of this project. The project will require milling, drilling and reaming. The procedure for completion of this project follows that outlined for the lathe project.

**Final Project:**

**Option 1 (Sine Bar): 100 points:** The completion of this requirement will follow the procedures as listed above. This project will involve milling, surface grinding, cylindrical grinding, drilling, layout, tapping, heat treatment, turning, parting, chamfer turning, and countersinking.

**Option 2: (Steel Hammer): 100 points:** Students have the option of making a steel hammer in place of the sine bar. This option helps to direct some students to the lathes, and reduce the number of students on the few milling machines available. A drawing, two pieces of cold rolled steel rods, and a quality assurance traveler will be provided for the completion of this project. The project will require turning, cylindrical grinding, drilling, layout, tapping, surface grinding, knurling, parting, chamfer turning, grooving, taper turning, filing, heat treatment and sanding.

**Outside Reading: 3 @ 15 points each = 45 points**

There are three (3) out-of-class reading assignments. The readings are to be from a magazine or journal not more than three (3) years old. The subjects to be read and reported must be concerned with some aspect of processes of industry, i.e., machine processes, woodworking, laser machining, welding, robotics, etc. The assignments must be typed in the "Outside Reading Synopsis" format which will be provided. The reading assignment reports will not be accepted late and are due the first class meeting each week as indicated in the Activity Schedule. Points (from 0-15) will be assigned for each report based upon the thoroughness of your discussion, sentence structure, and spelling. You may use a direct quote in your report but you must set off the statement with quotation marks. A word processor or computer must be used in the preparation of this assignment, handwritten reports will not be accepted.

**Quizzes/Assignments: 3 @ 15 points each = 45 points**

There will be three (3) take-home and/or in-class assignments. Each assignment will be worth 15 points and students are expected to complete them within the time frame given.

**Late Assignments:**

Late assignments are not acceptable. In certain rare conditions, students submitting any assignment, outside reading or take home quiz late will lose two (2) points for each day that the assignment is late. Other projects and exams are due as scheduled.

**Exams: 150 points**

Students will take two formal exams during the semester: A midterm test (50 points) and a Comprehensive Final (100 points). The materials to be included in these tests will be announced by the instructor. Both tests should be taken during the regularly scheduled periods as shown in the university's directory of classes.

**Laboratory Safety and Clean-Up: 25 Points**

Laboratory equipment should be used in a safe manner. Every student is expected to participate in cleaning the lab and equipment at the end of each lab session. There will

be a comprehensive lab clean-up of about 30 minutes on the last lab day, and every student is expected to participate. Instructor will issue points based on his observation of how each student participated in lab clean-up throughout the semester. Students should also behave in an orderly manner in all class and lab activities.

**Note on Academic Dishonesty**

*Cheating of any kind is not acceptable, and will be reported to the campus student affairs office. It will result in loss of credit for the assignment, which cannot be made up, and it MAY result in an “F” in the class or even expulsion from the University.*

**University Policy Information**

a) Academic integrity statement (from Office of Student Conduct and Ethical Development): “Your own commitment to learning, as evidenced by your enrollment at San José State University, and the University’s Academic Integrity Policy requires you to be honest in all your academic course work.

Faculty members are required to report all infractions to the Office of Student Conduct and Ethical Development. The policy on academic integrity can be found at ([http://ss.sjsu.edu/student\\_conduct](http://ss.sjsu.edu/student_conduct)).

b) Campus policy in compliance with the Americans with Disabilities Act: “If you need course adaptations or accommodations because of a disability, or if you need special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 requires that students with disabilities requesting accommodations must register with DRC to establish a record of their disability.”

<b>Grading</b>	<b>Points Possible</b>
Quiz #1	15
Quiz #2	15
Quiz #3	15
Outside Reading #1	15
Outside Reading #2	15
Outside Reading #3	15
Lathe Project	25
Mill Project	25
Final Project	100
Mid-Term Exam	50
Lab Clean-up/Activities	25
Final Exam (Comprehensive)	<u>100</u>
<b>Total</b>	<b>415</b>

**Total/415 = % for final grade**

90 -100% = A

80 - 89 = B

70 - 79 = C

60 - 69 = D

Less than 60 = F

Percentages will be adjusted to accommodate + and – grades as follows:

93% - 100% = A      73% - 76% = C

90% - 92% = A-      70% - 72% = C-

87% - 89% = B+      67% - 69% = D+

83% - 86% = B      63% - 66% = D

80% - 82% = B-      60% - 62% = D-

77% - 79% = C+      Below 60% = F

<b>TECH 046</b>		<b>SCHEDULE OF COURSE SEMESTER ACTIVITIES</b>		<b>DR. SAMUEL C. OBI</b>	
<b>WEEK OF:</b>	<b>TOPICS TO BE DISCUSSED</b>	<b>ASSIGNMENTS</b>	<b>LAB DUTIES</b>	<b>DUE</b>	
AUG. 21	ORIENTATION	BUY MATERIALS			
AUG. 28	PART I (MEASUREMENT...)	Kibbe et al pp. 87-191; V & G Chapter 5 & 9	ALL		
SEP. 2/4	PART II (BENCH WORK ...)	Kibbe et al pp. 6-85; 235- 299; V&G 1&8. Project. 1	ALL		<b>QUIZ I</b>
SEP. 11	PART III (TURNING MACHINE...)	Kibbe et al pp. 383-506. V & G chapters 15&16	ALL		
SEP. 18	PART III (TURNING MACHINE...)	Kibbe et al pp. 383-506. V & G chapters 15 & 16	ALL		<b>1ST. O.R.</b>
SEP. 25	PART III (TURNING MACHINE...)	Kibbe et al pp. 383-506. V & G chapters 15 & 16	ALL		
OCT. 2	PART IV (MILLING MACHINES...)	Kibbe et al pp. 511-584. V & G ch. 2, 3, 4 & 18..	ALL		<b>PROJECT 1</b>
OCT. 9	PART IV (MILLING MACHINES...)	PROJECT 2	ALL		<b>QUIZ 2</b>
OCT. 16	<b>MID-TERM</b>	LAB 2 WORK	ALL		<b>2ND. O.R.</b>
OCT. 23	PART IV (MILLING MACHINES...)	PROJECT 3	ALL		<b>PROJECT 2</b>
OCT. 30	PART V (OTHER MACHINES.....)	Kibbe et al pp. 585-658; 301-381	ALL		
NOV. 6	PART V (OTHER MACHINES.....)	Kibbe et al pp. 585-658; 301-381	ALL		<b>QUIZ 3</b>
NOV. 14/13	ALL PROCESSES		ALL		
NOV. 20	ALL PROCESSES	LAB 3 WORK	ALL		<b>3RD. O.R.</b>
NOV. 27	ALL PROCESSES	LAB 3 WORK	ALL		
DEC. 4/9	LAST DAY OF CLASS IS DEC. 4/9; CLEAN UP	REVIEW & CLEAN UP	ALL		
<b>DEC. 11</b>	<b>FINAL EXAMINATION</b>	<b>WEDNESDAY, DEC. 11, 7:15-9:30 AM.</b>			<b>PROJECT 3</b>

**SUBJECT TO CHANGES DEPENDING ON CIRCUMSTANCES IN THE COURSE OF THE SEMESTER**  
 SEPTEMBER 2 IS LABOR DAY; NOVEMBER 11 IS VETERAN’S DAY. CAMPUS WILL BE CLOSED.  
 NOVEMBER 28-29 WILL BE THANKSGIVING HOLIDAY: CAMPUS WILL BE CLOSED.

