

**PIET's COLLEGE OF ENGINEERING, PUNE**  
(An Autonomous Institute of Government of Maharashtra)

**END SEMESTER EXAMINATION - MAY 2012**  
**P.E. (5168) ELECTIVE-ADVANCED MATERIAL FORMING**

**Programme: F.Y. M .Tech (Production) Year: 2011-12**

**Semester II**

Date : 14 May 2012

Duration : 3 Hours  
Max. Marks – 50

**Instructions:**

1. Answer any **Five** questions
2. Draw neat figures wherever required
3. Assume suitable data if required.

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- Q.1** (a) Explain super plasticity on the basis of strain rate exponent, 'm'.  
(b) How forming limit diagram is constructed? Explain why forming limit diagram in the first quadrant is not the same as that of second quadrant.  
(c) What is anisotropy? How 'R' values are evaluated? What is the effect of 'R' value on forming operation? 10
- Q.2** For a deep drawing operation, a blank holder is used to exert pressure of 12 MPa and it has coefficient of friction  $\mu = 0.11$ . A cup of diameter 50 mm, is to be drawn from a blank of 100 mm diameter, of steel sheet of thickness 1mm. For this stress condition,  $\tau_{Max} = \bar{\sigma} / \sqrt{3}$  The stress strain relationship for the material is 10
- $$\sigma = 600 \times \epsilon^{0.2}$$
- The material has UTS 435 MPa.
- 1) Find out the maximum radial and circumferential stresses induced, during deep drawing operation.
  - 2) Calculate the drawing load, exerted by the punch analytically.
  - 3) Compare and comment on the drawing load, calculated analytically with the drawing load, estimated by using imperical relation. Use value of K for imperical relation as 0.65.
- Q.3** (a) Explain the formability of metal sheet. 10  
(b) What are different formability indices, based on different criteria, used to decide formability of metal sheet.  
(c) What is spring back? Why does spring back occur, during forming operation? Explain the methods to minimise the spring back.
- Q.4** (a) Explain the principle of slab method of analysis. 10  
(b) Derive an expression for the extrusion load, with usual notations, by using slab method of analysis.  
(c) What is the dead zone in extrusion process?

Q.5 (a) Derive an expression, using usual notations, for the pulling stress,  $\sigma_2$ , for the wire drawing operation of wire material having yield stress,  $\sigma_{yd}$ . The wire is fed with initial stress of  $\sigma_1$ .

(b) A steel wire of diameter 6 mm is to be drawn to reduce the diameter to 5.2 mm. The die angle is  $18^\circ$  and the die land is 4 mm. The wire material has yield stress  $26 \text{ kg/mm}^2$  and the coefficient of friction of wire material and die is 0.15.

(A) Estimate the drawing stress and total drawing load require to carry out wire drawing operation, without any stress on input side.

(B) What is the effect on drawing load (1) if the wire, fed for reduction in diameter, is initially stressed at  $7.5 \text{ kg/mm}^2$ ?

(2) If the die land is not Provided?

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Q.6 (a) Explain the principle and functioning of planetary rolling mill. Why two high pusher mill is necessary for planetary rolling mill?

(b) A planetary rolling mill has 26 planetary rollers, each having diameter of 50 mm. The backup roll diameter is 500 mm. The speed of rotation of backup roll is 500 rpm.

Determine the velocities of planetary rolls and exit material, if the pusher mill pushes the material in to planetary mill at  $2700 \text{ mm/min}$ . Initial thickness of the strip material is 35mm, which is reduced to 28 mm, in pusher mill and further reduced to 1.1 mm in planetary mill.

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Q.7 (a) what is hydroforming? What are the advantages and disadvantages of hydroforming process, used for metal sheet forming?

(b) What is bulging in hydroforming? How bulging is minimised?

(c) What is high velocity forming?

Explain the adantages and limitations of High Velocity forming

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Q.8 (a) Explain the conept and the principle of High Energy rate forming. How high strain rate facilitates forming process?

(b) Explain the effects of variation in distance of explosive charge from the blank, on the forming operation parameters.

(c) Explain the applications of explosive forming.

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**College of Engineering, Pune-411005.**

(An Autonomous Institute of Government of Maharashtra)

**Department of Production Engineering and Workshop**

**END-SEMESTER EXAMINATION**

Class : F. Y. MTech.

Subject: Human Factors in Design and Manufacturing

Year : 2011-2012

Time : 3 Hours

**Instructions:**

1. Solve any **FIVE** questions.
2. Figure to the right indicate full marks.

- Q.1 a. Explain the various approaches used to assess "Manual material handling" capacities. **4**
- b. Explain the various principles used in designing the hand tool and devices. **3**
- c. What is learning curve slope? Explain the various aspect of machine learning process. **3**
- Q.2 a. Explain with the help of neat sketches, general design principles of seat design. **5**
- b. What is 'anthropometry'? Explain with reference to anthropometry, static and dynamic (functional) dimensions. **5**
- Q.3 Explain with reference to motion and noise following (**Any four**):
- I. Physiological effect of vibration,
- OR
- Effect of acceleration on human body,
- II. Weightlessness, **10**
- III. Motion sickness,
- IV. Various noise exposure limits – As per OSHA recommendations,
- V. Physiological effects of heat stress.
- Q.4 Answer **any 'TWO'** of the following:
- a. With reference to human factors and automobile, explain the following parameters: **5**
- I. Behavioral errors of the drivers,
- II. Personal characteristics of the drivers.

Q.4 b. Explain following errors classification scheme related to human errors, accidents and safety:

- I. Discrete action classification,
- II. Information processing classification

5

c. Explain with the help of diagram the parameters used for calculating motion of body parts exposed to vertical vibrations used in biodynamic model of sitting and standing.

5

Q.5 Explain with reference to human factors in system design following parameters:

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- I. Characteristics of the system design process,
- II. Strategy for allocating function,
- III. Computer aids for basic design.

Q.6 Write down short notes on *any four* of the following: **(Any Four)**

- I. Dynamic allocation in system design,
- II. Control response ratio,
- III. Physiological effects of cold stress,
- IV. Methodology used for human reliability assessment,
- V. Success likelihood Index Methodology (SLIM).

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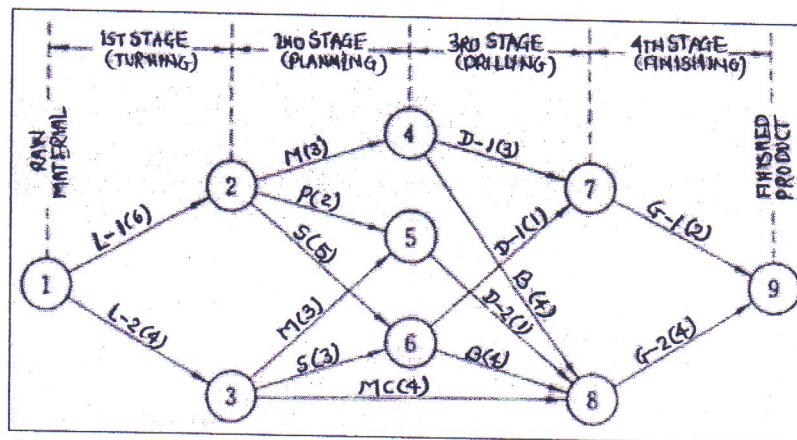


- b) In a Group Technology problem of forming cells we have five machines to process six parts, the requirement of each part to be machined, on a particular machine is shown '1' in the matrix below. Find out suitable cell formations for 'machine-part' by using binary algorithm, as a part of "rank-order clustering." (6)

| Parts<br>M/c's | Parts          |                |                |                |                |                |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
|                | P <sub>1</sub> | P <sub>2</sub> | P <sub>3</sub> | P <sub>4</sub> | P <sub>5</sub> | P <sub>6</sub> |
| M <sub>1</sub> | 0              | 0              | 1              | 0              | 1              | 0              |
| M <sub>2</sub> | 0              | 1              | 1              | 0              | 0              | 0              |
| M <sub>3</sub> | 1              | 0              | 0              | 1              | 0              | 0              |
| M <sub>4</sub> | 0              | 1              | 1              | 0              | 1              | 0              |
| M <sub>5</sub> | 1              | 0              | 0              | 1              | 0              | 1              |

- Q.3 a) "Demands for a variety of products with a short lead time can be overcome if all such products are produced and stored as finished-product inventory. However, this increases inventory costs and stored products go unsold when there is little or no demand." How do we overcome a situation as this while considering Manufacturing Systems Engineering? (4)
- b) Find the optimum route using shortest path algorithm for converting raw material into finished product through four stages of turning, planning, drilling and finishing as shown in figure 2. (6)

PROCESS SYSTEMS FOR MANUFACTURING



(NOTATION) L: LATHE, B: BORING MACHINE, D: DRILLING MACHINE, G: GRINDER  
M: MILLING MACHINE, MC: MACHINING CENTRE, P: PLANER, S: SHAPER

Figure 2

- Q.4 a) "The product quality level is a matter of product design and also process design." Comment. What is Fail-safe design? (4)

- b) Figure 3 shows the block diagram of an actuation system. Find the reliability of this system. The reliability values of units are as follows  $R_1 = 0.86$ ,  $R_2 = 0.79$ ,  $R_3 = 0.76$ ,  $R_4 = 0.77$ ,  $R_5 = 0.81$  and  $R_6 = 0.95$ . (6)

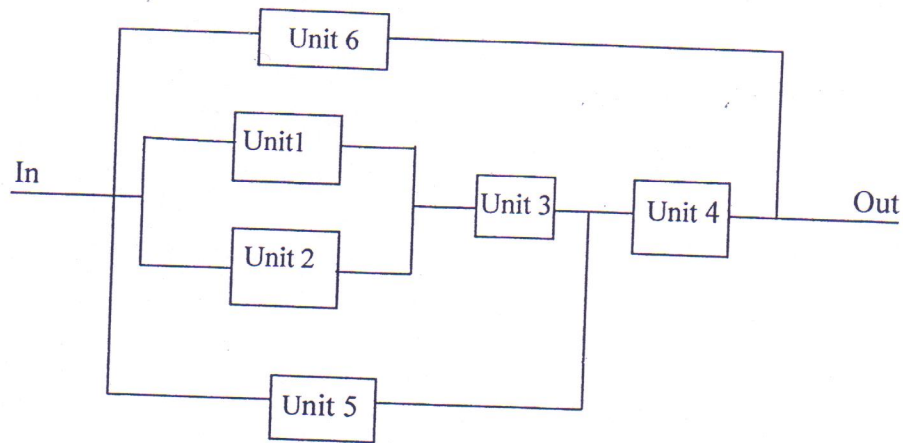


Figure 3

- Q.5 a) Using a continuous time Markov Chain Model under (i) resumption policy and (ii) discard policy, develop mathematical equations for variation in production rate in the system consisting of a single machine with set up, processing and repair rate. (4)
- b) If the setup rate is 12 per hour, processing rate 6 per hour, the failure taking place once in 75 minutes and the repair rate is one per hour, find out the average production rates in both resumption and discard policies and the percentage variation amongst them. (6)
- Q.6 a) Explain the reachability, liveness, boundedness and reversibility with reference to Petri nets with example. (4)
- b) A manufacturing unit has four machines A, B, C and D. The jobs are to be produced on any one of the machine A or B depending on availability of the machine. After getting processed they are to be processed on C and D in sequence. The jobs cannot leave the system without getting processed. Considering the preventive maintenance also, model a Petri net for the above system. (6)
- Q.7 a) How does the total production cost with increasing returns hold the optimum production scale where unit production cost is minimum? (4)
- b) Develop an expression for minimum time machining speed and maximum production rate tool life. (6)



**END-SEMESTER EXAM**

**Metrology & Computer Aided Inspection (PE 5106)**

Programme: F.Y.M.Tech. (Production)

Year: 2011 –12; Semester: II

Duration: 3 Hrs.

Date: 13/5/2012

Max. Marks: 50

Instructions:

1. Figures to the right indicate full marks.
2. Draw neat sketches wherever required.
3. Use of pocket calculators is allowed.

**Q.1 a.** What is large scale metrology? What are the different techniques used from large scale metrology to inspect the components? Describe one of the technique. 5

**b.** What is Computer Aided Inspection (CAI)? What are the different principles should be incorporated in the softwares developed for CAI? 5

OR

**c.** Explain the procedure to calibrate co-ordinate measuring machine (CMM) and describe the role of CMM to calibrate laser tracker. 5

**Q.2 a.** How online measurement system can be developed using imaging techniques? Draw and explain the flowchart for such systems. 5

**b.** Explain the working principle of camber profile gauge to measure edge profile. 5

OR

**c.** Illustrate the suitable example to explain stereo vision system. 5

**Q.3 a.** Explain the importance of surface metrology. State and explain different methods (mathematical) of surface roughness evaluation. 5

**b.** Describe briefly some recent advances in the field of surface texture measurement. 5

OR

**c.** Dimensions of two mating parts E and F are normally distributed with average of 251.0 mm and 250.0 mm and standard deviations of 0.1 mm and 0.3 mm respectively. If the parts are assembled randomly, what percent of the assemblies will have 5

i. Clearance greater than 1.2 mm

ii. No defectives parts if the specifications of E and F are  $251 \pm 0.2$  mm and  $250 \pm 0.5$  mm respectively.

**Q.4 a.** Explain the procedure to determine the flatness of the surface with reference to mean plane. Assume the grid of 4x5 and suitable values. 5

**b.** Explain the construction, working and applications of AC Laser Interferometer (ACLI) with neat sketch. 5

OR

**c.** State the importance of cube corner reflector. A slip gauge of nominal length 10 mm was measured on a gauge length interferometer using the red, green and blue light of a cadmium lamp of which the wavelengths are Red  $0.6438 \mu\text{m}$ , green  $0.5086 \mu\text{m}$  and blue  $0.4800 \mu\text{m}$ . The observed fractional displacements were respectively 0.8, 0.9 and 0.5. Determine the error in the length of gauge. 5

**Q.5** Write a short notes on any two:

1. Construction and applications of profile projector
2. Principle and applications of mechanical optical comparator
3. Nano Metrology
4. Non Contact Scanner

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