

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Find a local minimum point for the function (16)

$$f(x) = x_1 + \frac{(4 \times 10^6)}{x_1 x_2} + 250x_2$$

- (b) Write the KKT necessary conditions and solve them for the problem (30^{2/3})

$$\text{Minimize } f(x) = \frac{1}{3}x^3 - \frac{1}{2}(b+c)x^2 + bcx + f_0$$

$$\text{subject to } a \leq x \leq d$$

where $0 < a < b < c < d$ and f_0 are specified constant.

2. (a) Define *shadow price*. Also, discuss its relationship with the complementary optimal solutions property. (6^{2/3})

(b) Suppose that a primal problem has a degenerate BF solution as its optimal solution. What does this degeneracy imply about the dual problem? Why? Is the converse also true? (10)

- (c) Consider the following problem (30)

$$\text{Maximize } Z = 2x_1 - 4x_2$$

subject to

$$x_1 - x_2 \leq 1$$

$$\text{and } x_1 \geq 0 \quad x_2 \geq 0$$

- (i) Construct the dual problem, and find its optimal solution by inspection.
 (ii) Use the complementary slackness property and the optimal solution for the dual problem to find the optimal solution for the primal problem.
 (iii) Suppose that c_1 , the coefficient of x_1 in the primal objective function, actually can have any value in the model. For what values of c_1 does the dual problem have no feasible solutions? For these values, what does duality theory then imply about the primal problem?

IPE 307

3. (a) Machinists who work at a tool-and-die plant must check out tools from a tool center. An average of ten machinists per hour arrive seeking tools. At present, the tool center is staffed by a clerk who is paid \$6 per hour and who takes an average of 5 minutes to handle each request for tools. Since each machinist produces \$10 worth of goods per hour, each hour that a machinist spends at the tool center costs the company \$10. The company is deciding whether or not it is worthwhile to hire (at \$4 per hour) a helper for the clerk. If the helper is hired, the clerk will take an average of only 4 minutes to process requests for tools. Assume that service and interarrival times are exponential. Should the helper be hired? (20 ²/₃)

(b) Derive the expressions for the expected number of customers in queuing system for the finite queue variation of the *M/M/s* model. (20)

(c) What is a stochastic process? Provide an example. (6)

4. (a) Briefly discuss two applications of dynamic programming with suitable examples. (10)

(b) Suppose we add a constant *c* to every element in a payoff matrix *A*. Call the new game matrix *A'*. Show that *A* and *A'* have the same optimal strategies and that value of *A'* = (value of *A*) + *c*. (12)

(c) Two politicians soon will be starting their campaigns against each other for a certain political office. Each must now select the main issue she will emphasize as the theme of her campaign. Each has three advantages issues from which to choose, but the relative effectiveness of each one would depend upon the issue chosen by the opponent. In particular, the estimated increase in the vote for politician 1 (expressed as a percentage of the total vote) resulting from each combination of issues is as follows: (24 ²/₃)

| | | Issue for Politician 2 | | |
|------------------------|---|------------------------|----|----|
| | | 1 | 2 | 3 |
| Issue for Politician 1 | 1 | 7 | -1 | 3 |
| | 2 | 1 | 0 | 2 |
| | 3 | -5 | -3 | -1 |

However, because considerable staff work is required to research and formulate the issue chosen, each politician must make her own choice before learning the opponent's choice. Which issue should she choose?

For each of the situations described here, formulate this problem as a two-person, zero-sum game, and then determine which issue should be chosen by each politician according to the specified criterion.

(i) The current preferences of the voters are very uncertain, so each addition percent of votes won by one of the politician has the same value to her. Use the minimax criterion.

IPE 307

Contd ... Q. No. 4(c)

- (ii) A reliable pool has found that the percentage of the voters currently preferring politician 1 (before the issues have been raised) lies between 45 and 50 percent. (Assume a uniform distribution over this range). Use the concept of dominated strategies, beginning with the strategies for politician 1.
- (iii) Suppose that the percentage described in part (ii) actually were 45 percent. Should politician 1 use the minimax criterion? Explain. Which issue would you recommend? Why?

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

- 5. (a) Write the properties of basic solution and explain that a basic solution is an augmented corner point solution. (15)
- (b) Explain with examples the assumptions in linear programming. (15)
- (c) Suppose that the following constraints have been provided for a linear programming model with decision variables x_1 and x_2 . (16 ²/₃)

$$\begin{aligned}
 -x_1 + 3x_2 &\leq 30 \\
 -3x_1 + x_2 &\leq 30 \\
 \text{and } x_1 \geq 0 \quad x_2 \geq 0
 \end{aligned}$$

- (i) Demonstrate that the feasible region is unbounded.
 - (ii) If the objective is to maximize $Z = -x_1 + x_2$ does the model have an optimal solution? Is so find it. If not explain why.
 - (iii) Repeat part (ii) when the objective is $Z = x_1 - x_2$.
 - (iv) For the objective function where this model has no optimal solution, does this mean that there are no good solutions according to the model?
- 6. (a) Consider the transportation problem having following parameter table. Calculate initial BF solution in Vogel's approximation method: (26 ²/₃)

| | | Destination | | | | | | Supply |
|--------|---|-------------|----|----|----|----|---|--------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | |
| Source | 1 | 13 | 10 | 22 | 29 | 18 | 0 | 5 |
| | 2 | 14 | 13 | 16 | 21 | M | 0 | 6 |
| | 3 | 3 | 0 | M | 11 | 6 | 0 | 7 |
| | 4 | 18 | 9 | 19 | 23 | 11 | 0 | 4 |
| | 5 | 30 | 24 | 34 | 36 | 28 | 0 | 3 |
| Demand | | 3 | 5 | 4 | 5 | 6 | 2 | |

- (b) Differentiate transportation and assignment problems. (10)
- (c) State and explain requirements assumption and cost assumption of transportation problem. (10)

IPE 307

7. (a) Maximize $Z = 2x_1 + 5x_2 + 3x_3$
subject to
 $x_1 - 2x_2 + x_3 \geq 30$
 $2x_1 + 4x_2 + x_3 = 50$
and $x_1 \geq 0, x_2 \geq 0, x_3 \geq 0$

Using big M method, construct the complete first simplex tables for the simplex method and identify corresponding initial BF solution. Work through simplex method step by step to solve the problem.

(26 ²/₃)

- (b) Describe the following terms with examples

(4×5=20)

- (i) Parameter uncertainty
- (ii) Re-optimization
- (iii) Sensitivity Analysis
- (iv) Degeneracy

8. (a) Pawtucket University is planning to buy new copier machines for its library. Three members of its Operation Research Department are analyzing what to buy. They are considering two different models: Model A, a high-speed copier, and Model B, a lower-speed but less expensive copier. Model A can handle 20,000 copies a day, and costs \$6,000. Model B can handle 10,000 copies a day, but costs only \$4,000. They would like to have at least six copies so that they can spread them throughout the library. They also would like to have at least one high-speed copier. Finally, the copiers need to be able to handle a capacity of at least 75,000 copies per day. The objective is to determine the mix of these two copies which will handle all these requirements at minimum cost.

(20)

- (i) Formulate an IP model for this problem.
- (ii) Use a graphical approach to solve this model.

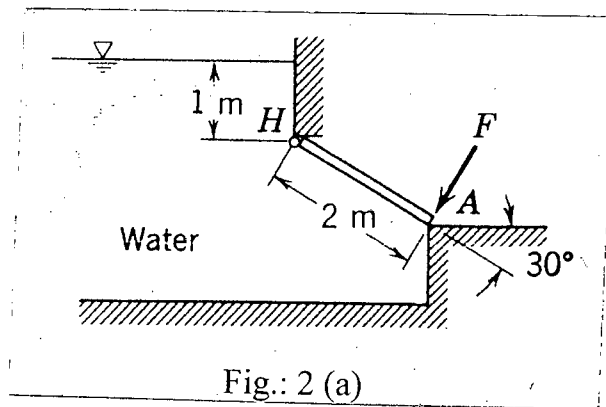
(b) Weenies and Buns is a food processing plant which manufactures hot dogs and hot dog buns. They grind their own flour for the hot dog buns at a maximum rate of 200 pounds per week. Each hot dog bun requires 0.1 pound of flour. They currently have a contract with a company which specifies that a delivery of 800 pounds of mutton product is delivered every Monday. Each hot dog requires 0.25 pound of mutton product. All other ingredients in the hot dogs and hot dog buns are in plentiful supply. Finally the labor force at Wennie and Buns consists of 5 employees working full time (40 hours per week each). Each hot dog requires 3 minutes of labor and each hot dog bun requires 2 minutes of labor. Each hot dog yield a profit of \$0.20 and each bun yields a profit of \$0.10.

(26 ²/₃)

Wennie and Buns would like to know how many dogs and how many buns they should produce each week so as to achieve the highest profit. Formulate a linear programming model for this problem and solve it.

SECTION – AThere are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) Write down the final form and restrictions of the basic hydrostatic equation. (5)
- (b) Automobiles suffer power loss with altitude which is proportional to the decrease in air density. Determine the percentage loss in power for an engine at 3000 m elevation, compared to sea level on a standard day [$T = 288 \text{ K}$, $P = 1 \text{ atm}$]. (18)
- (c) Discuss buoyancy and stability of floating bodies with figures. (12)
2. (a) The gate shown is hinged at H. The gate is 2 m wide normal to the plane of the diagram. Calculate the force required at A to hold the gate closed. (18)



- (b) Define and classify turbo machines. (9)
- (c) Briefly explain the working principle of centrifugal pump with diagram. (8)
3. (a) The inner and outer diameters of the impeller of a centrifugal pump are 300 mm and 600 mm respectively. The constant velocity of flow is 2.2 m/s and the vanes are curve backward at an angle of 45° at the exit. If the manometric efficiency is 75%, find the minimum starting speed of the pump. (18)
- (b) A double acting reciprocating pump with a position of 10 cm and stroke of 20 cm runs at a speed of 45 rpm. The total static head is 20 m with 3 m as suction lift. The suction pipe is 4.5 m long, 7.5 cm in dia. The discharge pipe is 24 m long and 7.5 cm in dia. If $f = 0.032$, draw the indicator diagram of the pump and find the power required to drive the pump. [Assume a large air vessel on the delivery side only] (17)

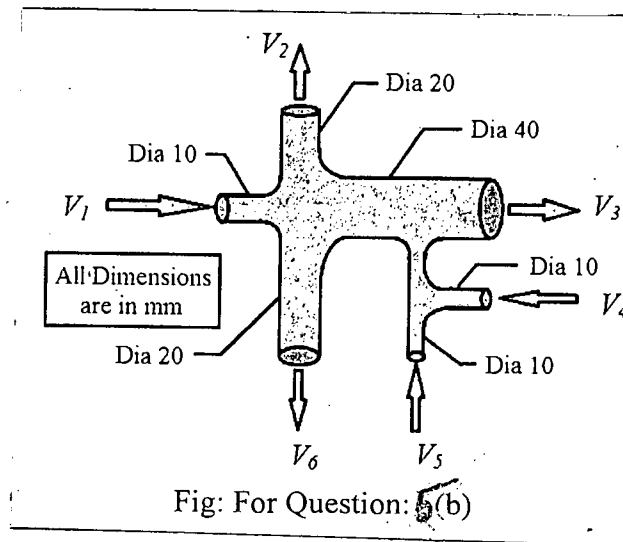
ME 223

- 4. (a) Differentiate between impulse and reaction turbines. (8)
- (b) A Pelton wheel working under a head of 475 m is supplied with 250 lt/s of water. The peripheral velocity of the wheel is 0.45 times the velocity of the jet and the coefficient of velocity is 0.96. If the jet is deflected through an angle of 170°, find the power developed by the turbine and the overall efficiency. (12)
- (c) Briefly discuss draft tube and its benefits. (8)
- (d) Briefly discuss the major components of a gas turbine. (7)

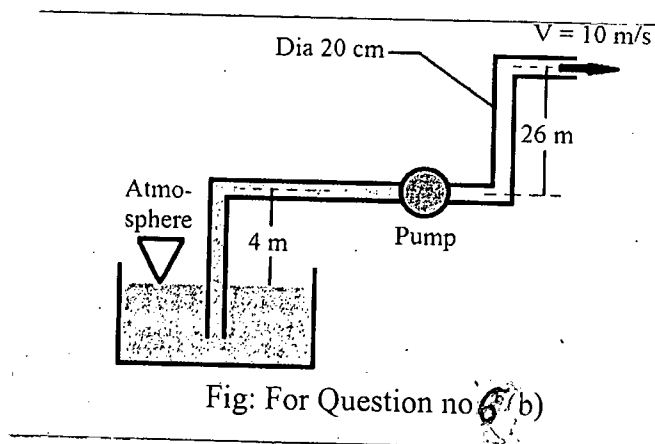
SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

- 5. (a) Write short notes on (i) Stream line (ii) Streak line (iii) Path line (3×5=15)
- (b) Water is flowing through a pipe network as shown in the figure bellow. (15+5=20)
- (i) If the velocity of water V_1, V_2, V_3, V_4 and V_5 are 100 m/s, 10 m/s, 5 m/s, 80 m/s and 60 m/s respectively then find the velocity V_6 .
- (ii) Is V_2 and V_6 are equal? If not than describe the reasons.

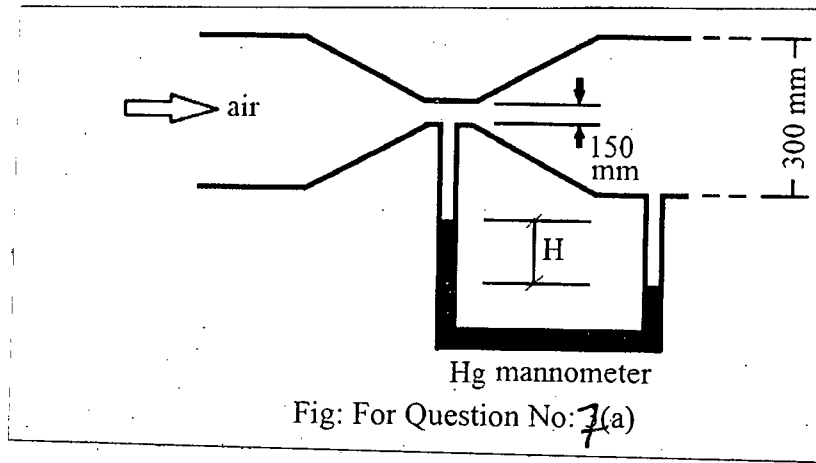


- 6. (a) Derive Bernoulli's equation and give significance of each term. (17)
- (b) A Pump is lifting diesel (s.g. = 0.9) as shown in the figure below. The suction and delivery pipes are of same diameter and the total head loss in the suction and delivery pipe is 1 m and 1.8 m of water. Find out the required power input to the pump. (pump efficiency is 90%) (18)



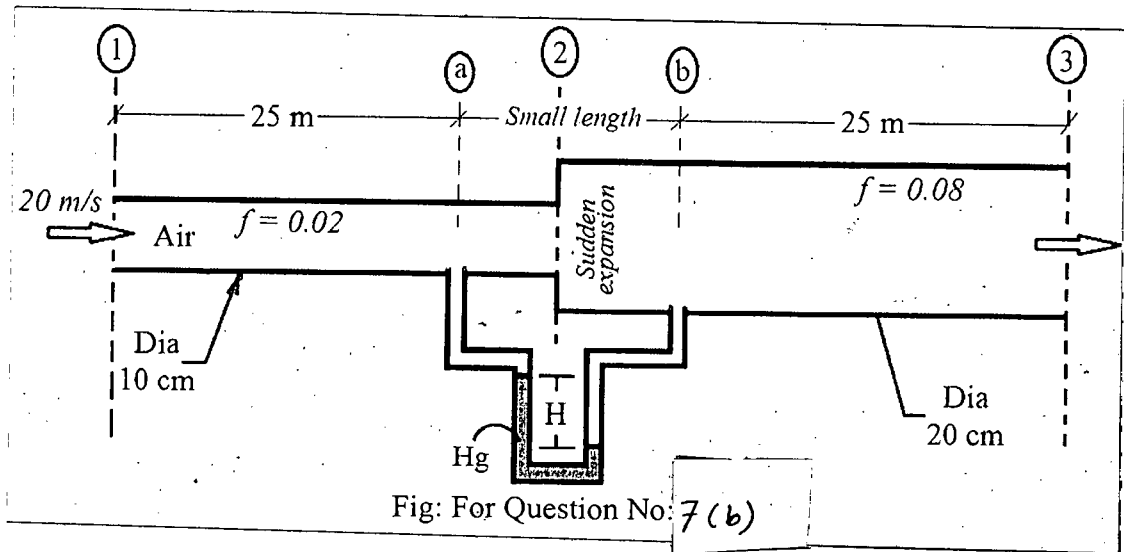
ME 223

7. (a) Air is flowing through the ventury as shown in the figure below. If the reading of the mercury manometer is 10 cm and the C_d of the ventury is 0.9 then find the actual discharge. (15)



- (b) Air is flowing through the pipe as shown in the figure below. The inlet pressure is 2 atm. The manometer is installed just across the sudden expansion (infinitesimal length) so that the major loss within this length [a – b] is negligible.

- (i) Find the pressure at point 'a' and 'b', if $H = 5$ cm.
 (ii) Find minor loss due to the sudden expansion, if $H = 5$ cm.



8. (a) What is compressible and incompressible flow? Give a comparative discussion. (10)
 (b) (i) Write down 2-D Navier Stoke's equation. (17+8=25)
 (ii) Deduce an expression of flow rate for steady, incompressible, inviscid flow for fluid between two infinite stationary parallel plates.
 (iii) Mention all boundary conditions required to solve the problem.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

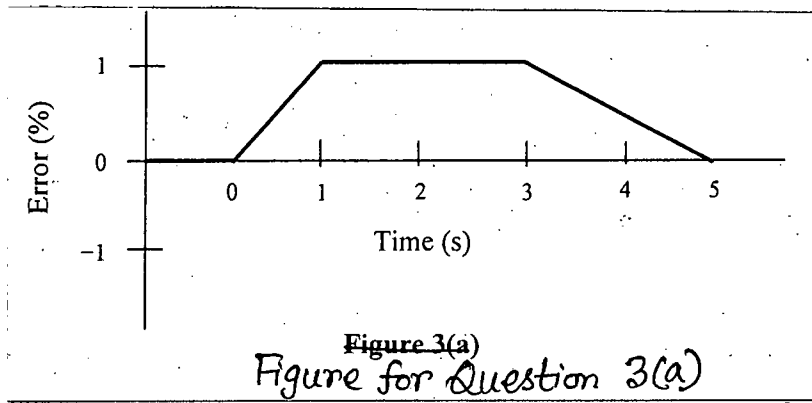
1. (a) Explain multidisciplinary system in brief with a suitable example. (6)
- (b) A temperature sensor has a range of 20°-250°C. A measurement results in a value of 55°C for the temperature. Specify the error if the accuracy is (6)
 - (i) $\pm 0.5\%$ FS
 - (ii) $\pm 0.75\%$ of span
 - (iii) $\pm 0.8\%$ of reading

What is the possible temperature in each case?
- (c) An LVDT has a maximum core motion of ± 1.5 cm with a linearity of $\pm 0.3\%$ over that range. The transfer function is 23.8 mV/mm. (6+5=11)
 - (i) Is used to track work-piece motion from -1.2 cm to $+1.4$ cm, what is the expected output voltage?
 - (ii) If the output voltage is 300 mV, what is the error in position determination due to nonlinearity?
- (d) Explain the working principle of a Bourdon pressure tube with necessary figure(s). (12)

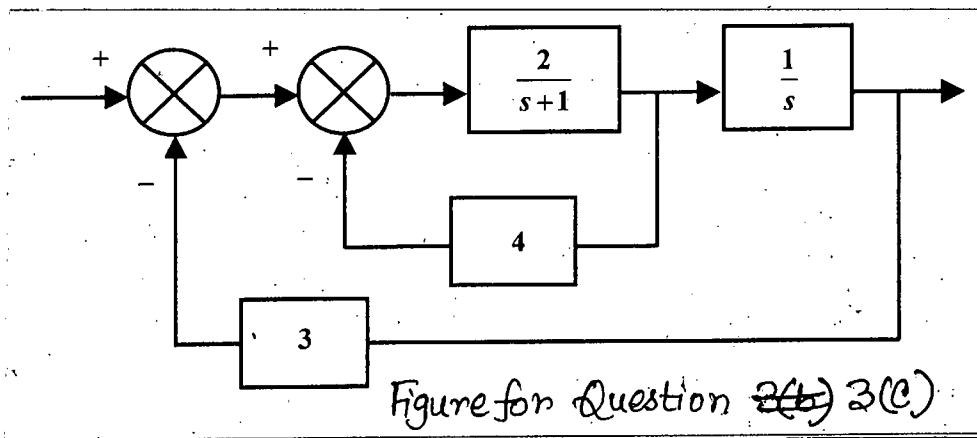
2. (a) A Chromel-Constantan thermocouple has a cold junction at 20°C and is to be used for the measurement of temperatures between 0°C and 300°C. Tables give for this thermocouple: 0°C, e.m.f 0.000 mV; 20°C, e.m.f. 1.192 mV; 200°C, e.m.f. 13.419 mV; 300°C, e.m.f. 21.036 mV. (4+5=9)
 - (i) What will be the thermocouple e.m.f when the hot junction is at 200°C?
 - (ii) What will be the non-linearity error at 200°C, as a percentage of the full-scale reading, if a linear relationship is assumed over the full range?
- (b) Temperature is measured by a sensor with an output of 0.02 V/°C. (4+5=9)
 - (i) Determine the required ADC reference to measure 0-100°C with 0.1°C resolution.
 - (ii) Determine the required word size to measure 0-100°C with 0.1°C resolution.
- (c) Explain discrete-time control system with a suitable example in brief. (7)
- (d) Discuss the relationship between dead time and capacitance of a control system with appropriate examples. (5)
- (e) Explain the limitations of proportional control. (5)

IPE 301

3. (a) Suppose the error in Figure 3(a), is applied to a PID controller with $K_P = 5$, $K_D = 1.0 \text{ s}$ and $K_I = 5 \text{ s}^{-1}$. Initially when the error is 0%, the controller output, P_0 , is 20%. Draw a graph of the resulting controller output. (15)



- (b) Differentiate between static response and dynamic response with examples. (8)
 (c) Determine the overall transfer function for the system shown in Figure 3(c). (12)



4. (a) A pump is to be used for filling two storage tanks. The pump is manually started by the operator from a start/stop station. When the first tank is full, the control logic must automatically stop flow to the first tank and direct flow to the second tank through the use of a level sensor and electric solenoid valves. When the second tank is full, the pump must shut down automatically. Indicator lamps are included to signal when each tank is full. (20)
- (i) Prepare a sketch of the process.
 (ii) Construct the ladder logic diagram for the system.
- (b) A system has output x and input y . Output varies with time t and input y is given by 10 unit step. The system is described by (15)

$$10 \frac{d^2x}{dt^2} + 50 \frac{dx}{dt} + 160x = 160y$$

Initially the input and output are zero.

- (i) What is the state of damping of the system?
 (ii) What is the damped angular frequency?
 (iii) Express the system output as a function of time.

IPE 301

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) What is measurement error? Mention various sources of measurement error. (8)
- (b) What is effective diameter of screw Thread? Explain the two wire method. (12)
- (c) For a screw thread, discuss the relationship between pitch and lead. (5)
- (d) Explain Taylor's principle and its significance with necessary figure. (10)
6. (a) What are the important design considerations in design of metrological instruments. Discuss them. (5)
- (b) The repetitive precision of measurements with a screw micrometer depends on the inherent accuracy of the micrometer caliper and the combined effect of process errors. Elaborate them. (8)
- (c) What are the essential considerations in selection of materials for gauges? (12)
- (d) Define the following terms: (i) Selective Fit (ii) Push Fit (iii) Driving Fit (iv) Pressed Fit (v) Shrinkage Fit. (10)
7. (a) Discuss the different allowances that must be taken into account in the manufacture of gauge. (5)
- (b) What do you understand by geometrical tolerance? (8)
- (c) Explain in brief the method of measuring a taper plug gauge by rollers, slip gauges and micrometers. (10)
- (d) Determine the actual dimensions to be provided for a shaft and a hole of 90 mm size for H₈e₉ type clearance fit. Size 90 mm falls in diameter steps of 80 and 100. Value of tolerance unit $i = 0.45 \sqrt[3]{D} + 0.001D$. Value of tolerance for IT8 and IT9 grades are 25i and 40i. Value of fundamental deviation for 'e' type shaft is $-11D^{0.41}$. Also design the GO and NO GO gauges as per the present British system in which the same workshop and inspection gauges are used. (12)
8. (a) Differentiate between underdamped system, critically damped system and overdamped system. (6)
- (b) An industrial robot performs a machine loading and unloading operation. A PLC is used as the robot cell controller. The cell operates sequentially as follows: (12)

IPE 301

Contd ... Q. No. 8(b)

- (i) A human worker places a work-part into a nest.
- (ii) The robot reaches over and picks up the part and places it into an induction heating coil.
- (iii) A time of 10 seconds is allowed for the heating operation.
- (iv) The robot reaches in and retrieves the part and places it on an outgoing conveyor. A limit switch X1 (normally open) will be used in the nest to indicate part presence in step (i). Output contact Y1 will be used to signal the robot to execute step (ii) of the work cycle. This is an output contact for the PLC, but an input interlock for the robot controller. Timer T1 will be used to provide the 10 seconds delay in step (iii). Output contact Y2 will be used to signal the robot to execute step (iv).

Construct the ladder logic diagram for the system.

- (c) Explain PLC scan cycle in brief. **(7)**
- (d) Convert the hexadecimal number C.82 to its equivalent decimal. Justify your answer by converting the obtained decimal number into its equivalent hexadecimal number. **(10)**

Table: Laplace functions and their corresponding time functions

| <u>Time Functions $f(t)$</u> | <u>Laplace Functions $F(s)$</u> |
|--|---|
| e^{-at} , exponential decay | $\frac{1}{s+a}$ |
| $1 - e^{-at}$, exponential growth | $\frac{a}{s(s+a)}$ |
| te^{-at} | $\frac{1}{(s+a)^2}$ |
| $t - \frac{1 - e^{-at}}{a}$ | $\frac{a}{s^2(s+a)}$ |
| $e^{-at} - e^{-bt}$ | $\frac{b-a}{(s+a)(s+b)}$ |
| $(1-at)e^{-at}$ | $\frac{s}{(s+a)^2}$ |
| $1 - \frac{b}{b-a}e^{-at} + \frac{a}{b-a}e^{-bt}$ | $\frac{ab}{s(s+a)(s+b)}$ |
| $\frac{e^{-at}}{(b-a)(c-a)} + \frac{e^{-bt}}{(c-a)(a-b)} + \frac{e^{-ct}}{(a-c)(b-c)}$ | $\frac{1}{(s+a)(s+b)(s+c)}$ |
| $\sin \omega t$, a sine wave | $\frac{\omega}{s^2 + \omega^2}$ |
| $\cos \omega t$, a cosine wave | $\frac{s}{s^2 + \omega^2}$ |
| $e^{-at} \sin \omega t$, a damped sine wave | $\frac{\omega}{(s+a)^2 + \omega^2}$ |
| $e^{-at} \cos \omega t$, a damped cosine wave | $\frac{s+a}{(s+a)^2 + \omega^2}$ |
| $\frac{\omega}{\sqrt{1-\zeta^2}} e^{-\zeta\omega t} \sin \omega \sqrt{1-\zeta^2} t$ | $\frac{\omega^2}{s^2 + 2\zeta\omega s + \omega^2}$ |
| $1 - \frac{1}{\sqrt{1-\zeta^2}} e^{-\zeta\omega t} \sin(\omega \sqrt{1-\zeta^2} t + \phi)$, $\cos \phi = \zeta$ | $\frac{\omega^2}{s(s^2 + 2\zeta\omega s + \omega^2)}$ |

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2014-2015

Sub : **HUM 277** (Fundamentals of Economics)

Full Marks : 210

Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

Symbols indicate their usual meaning.

1. (a) Clarify the concepts of short-run and long-run in the theory of production. (10)
 (b) Graphically explain the stages of production of a firm. (10)
 (c) Describe the relationship between total physical product (TPP), average physical product (APP) and marginal physical product (MPP). Use diagrams. (15)
2. (a) What are the possible situations that firms experience regarding the returns to scale of production? Describe them. (10)
 (b) Explain the plant economies of scale of production. (10)
 (c) Illustrate the conditions for optimum combination of factors of production. (15)
3. (a) Explain the short run equilibrium of the firm under monopolistic competition. (15)
 (b) show that marginal cost curve of a firm represents the supply curve of the firm in the short run. (10)
 (c) The total revenue function (TRF) and the average cost function (ACF) of a firm are given below (10)

$$\text{TRF} = 4000Q - 33Q^2$$

$$\text{ACF} = 2Q^2 - 3Q + 400 + 5000Q^{-1}, \text{ assuming } Q > 0$$
 Find the maximum profit giving level of output and maximum profit.
4. (a) Define 'Kuznets ratio' and Gini-coefficient'. Using a typical size distribution of personal income, show how these are measured. (15)
 (b) Show that growth rate of gross domestic product (GDP) depends directly on the national net savings rate and inversely on the national capital-output ratio. (10)
 (c) How does a 'project evaluation' differ from a 'cost-benefit analysis'? Give examples in support of your answer. (10)

HUM 277/IPE

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) What is meant by production possibility frontier (PPF)? Explain how resources can be allocated in a society with the help of PPF. (20)
- (b) Discuss three applications of production possibility frontier. (15)
6. (a) Explain the concept of demand function. (5)
- (b) What are the various factors that affect the demand for a commodity? Discuss them. (7)
- (c) Define market equilibrium. Explain the price determination process in an economy under competition. (8)
- (d) (i) Calculate the equilibrium price and quantity from the following demand and supply functions and graphically show the results. (15)
- $QD_x = 50 - 3P_x$
- $QS_x = -30 + 5P_x$
- (ii) What will happen to the equilibrium price and quantity if Government imposes a tax of Tk. 2 per unit?
- (iii) What will happen to the equilibrium price and quantity if Government provides a subsidy of Tk. 3 per unit? Graphically show the result.
7. (a) Explain the concepts of national income (N.I), gross national product (GNP) and gross domestic product (GDP). (5)
- (b) Calculate national income from the following information: (10)
- GNP = Tk. 1,16,000 crore
- Depreciation = Tk. 9,000 crore
- Indirect tax = Tk. 10,500 crore
- Subsidy is 20% of indirect tax
- (c) Briefly discuss the various difficulties in the measurement of national income of a country. (10)
- (d) Define inflation. Briefly discuss the various policies for controlling the prevailing inflation in our country. (10)
8. (a) What is elasticity of demand? Define different types of elasticity of demand. (15)
- (b) Explain the law of diminishing marginal rate of substitution (MRS) between two goods in consumption. (10)
- (c) Show how a consumer attains equilibrium with the help of an indifference curve and a budget line. (10)
-

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Discuss the necessity of change gear box in lathe machine. (5)
- (b) In which methods do you need to swivel the compound rest? Discuss them in brief with necessary sketches. (10)
- (c) Discuss the different work holding devices in lathe machine with necessary sketches. (10)
- (d) Discuss 'internal threading' and 'knurling' operations in detail. (10)
2. (a) Sketch different views of a twist drill and mention different elements and angles. How do you sharpen the dull cutting edges of a twist drill? (15)
- (b) What do you understand by 'strain back effect'? Discuss the necessity of clapper box in shaper machine. (10)
- (c) Discuss 'Up-milling' and 'Down-milling' process with necessary sketches and discuss their relative advantages. (10)
3. (a) What are the importance of dividing head in milling machine? Also discuss the necessity of adjustable sector in dividing head. (12)
- (b) Describe different parameter of grinding wheel. (8)
- (c) Discuss the working principle of EDM. Mention it's advantages and disadvantages. (15)
4. (a) Discuss the principle of Laser Beam Machining. Also discuss Laser Beam drilling and milling process. Mention different advantages and disadvantages of Laser Beam Machining. (18)
- (b) Discuss abrasive water jet cutting with its advantages and limitations. (12)
- (c) Discuss different types of twist drills. (5)

IPE 305/IPE

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Discuss the mechanisms of chip formation and with the help of Merchant Circle Diagram develop an expression for cutting force in order to calculate minimum power consumption. Also discuss briefly the modification done by P.W. Bridgman. (28)
- (b) What do you understand by "built up edge"? How does it form in metal cutting? How does it affect machining process? (7)
6. (a) Discuss the temperature and heat distribution in metal cutting process. In which region, maximum temperature attains in metal cutting? Give reasons. (15)
- (b) Discuss different types of tool wear with necessary sketches. Also mention the type of wear which is mainly responsible for tool life. Explain briefly. (10)
- (c) What do you understand by tool signature? Give an typical example of tool signature and discuss. (10)
7. (a) Derive expression for optimum cutting speeds to minimize cost and to minimize machining time. (15)
- (b) Find the expression for cutting ratio and shear strain in orthogonal chip formation mechanism. (15)
- (c) Discuss different types of chip breakers with necessary sketches. (5)
8. (a) Discuss the blow molding and extrusion process of plastic product manufacturing. (10)
- (b) What do you understand by positive and negative rake angle? (5)
- (c) Discuss the working principle of "Ultrasonic Machining" with neat sketches. (10)
- (d) Discuss the conditions for different types of chip formation in metal cutting. (10)
-