



The LNM Institute of Information Technology

Mid-Term Examination
Optimization TechniquesDuration: $1\frac{1}{2}$ Hrs

25 weightage

Answer all Questions.

1. Solve the following LP Problem by using two-phase simplex method.

$$\text{Minimize } Z = x_1 - 2x_2 - 3x_3$$

subject to the constraints

- $-2x_1 + x_2 + 3x_3 = 2$
- $2x_1 + 3x_2 + 4x_3 = 1$

and $x_1, x_2, x_3 \geq 0$

[4]

2. Formulate the following problem as LP model.

A pharmaceutical company has 50 kg of A, 90 kg of B and 60 kg of C ingredients available per month. The company can use these materials to make three basic pharmaceutical products namely 5 – 10 – 5, 5 – 5 – 10 and 20 – 5 – 10, where the number in each case represent the percentage of weightage of A, B and C, respectively in each of the products. The cost of these materials is as follows:

The selling prices of these products are Rs 40.5, Rs 43 and 45 per kg

Ingredient	Cost per kg
A	80
B	20
C	50
Inert ingredients	20

respectively. There is a capacity restriction of the company for product 5 – 10 – 5, because of which the company cannot produce more than 30 kg per month. Determine how much of each of the products the company should produce in order to maximize its monthly profit. [3]

3. Solve the following LP problem applying penalty (Big-M) method.

$$\text{Maximize } Z = x_1 + 2x_2 + 3x_3 - x_4$$

subject to the following constraints

- $x_1 + 2x_2 + 3x_3 = 5$
- $2x_1 + x_2 + 5x_3 = 20$
- $x_1 + 2x_2 + x_3 + x_4 = 10$

and $x_1, x_2, x_3, x_4 \geq 0$

[4]

- ✓ 4. Apple Company has three major departments for manufacturing two of its model M_1 and M_2 . The monthly capabilities of the departments are given as follows: The marginal profit per unit from model M_1 is Rs 400

Per Unit Time Requirements			Hours Available this month
	Model M_1	Model M_2	
Dept-I	4.0	2.0	1,600
Dept-II	2.5	1.0	1,200
Dept-III	4.5	1.5	1,600

and from model M_2 is Rs 100. Assuming that the company can sell any quantity of either product due to favourable market condition. Determine the optimum output for both the models, the highest possible profit for this month and the slack time in the three departments.

Formulate the above problem as LP model and solve. [3 + 4]

- ✓ 5. Obtain the dual problem of the following LP problem:

Minimize $Z = x_1 + 2x_2$
subject to the constraint

- $2x_1 + 4x_2 \leq 160$
- $x_1 - x_2 = 30$
- $x_1 \geq 10$

and $x_1, x_2 \geq 0$

[3]

- ✓ 6. Use Dual Simplex method solve the following LP problem:

Minimize $Z = x_1 + x_2$
subject to

- $2x_1 + x_2 \geq 2$
- $-x_1 - x_2 \geq 1$

and $x_1, x_2 \geq 0$

[4]

End



The LNM Institute of Information Technology
Jaipur(Raj)-302031

End-Term Examination
Optimization Techniques

Duration:3 Hrs
02.30 PM-05.30 PM

35 weightage

Answer all Questions

1. Use the method of Lagrange multipliers to solve the following NLP problem. Does the solution maximize or minimize the objective function ?

$$\text{Optimize } Z = x_1^2 - 10x_1 + x_2^2 - 6x_2 + x_3^2 - 4x_3$$

subject to the constraints $x_1 + x_2 + x_3 = 7$. and $x_1, x_2, x_3 \geq 0$

[4]

2. Determine x_1 and x_2 so as to Maximize

$$\text{Maximize } Z = 12x_1 + 21x_2 + 2x_1x_2 - 2x_1^2 - 2x_2^2$$

subject to constraints

- (a) $x_2 \leq 8$
(b) $x_1 + x_2 \leq 10$

and $x_1, x_2 \geq 0$.

[4]

3. A company manufactures two products, A and B. It takes 30 minutes to process one unit of product A and 15 minutes to process each unit of B. The maximum machine time available is 35 hours per week. Product A and B require 2 kg and 3 kg of raw material per unit, respectively. The available quantity of raw material is envisaged to be 180 kg per week.

The products A and B, which have unlimited market potential, sell for Rs 200 and 500 per unit, respectively. The manufacturing cost for products A and B are $2x^2$ and $3y^2$ respectively, where x and y represent the quantity of products A and B to produced, respectively. Formulate this problem as NLP model to find how much of each product should be produced per week ? [5]

4. Solve the quadratic programming problem using Wolfe's method.

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

subject to constraints

- (a) $2x_1 + 3x_2 \leq 6$
(b) $2x_1 + x_2 \leq 4$

and $x_1, x_2 \geq 0$

[6]

5. A toy company manufactures two types of toys, A and B. Processing of these two toys is done on two machines X and Y. The toy A requires two hours on machine X and six hours on machine Y. Toy B requires four hours on machine X and five hours on machine Y. There are sixteen hours of time per day available on machine X and thirty hours of machine Y. The profit obtained on both the toys is same, i.e Rs 5 per toy. Formulate this problem as integer LP problem to determine the daily production of each of the two toys. [5]

PTO

6. Use the dual simplex method to solve the following LP problem:

Maximize $Z = -2x_1 - x_3$ subject to the constraints

- (a) $x_1 + x_2 - x_3 \geq 5$
- (b) $x_1 - 2x_2 + 4x_3 \geq 8$

and $x_1, x_2, x_3 \geq 0$

[4]

7. Solve the following integer LP problem using Gomory's cutting plane algorithm: Maximize $Z = x_1 + 2x_2$ subject to

- (a) $2x_2 \leq 7$
- (b) $x_1 + x_2 \leq 7$
- (c) $2x_1 \leq 11$

and $x_1, x_2 \geq 0$ are integers.

[3 + 4]

End



The LNM Institute of Information Technology, Jaipur
Department of Computer Science & Engineering
Final Exam

CSE 331: Theory of Computation

Time: 180 min

Nov 25, 2016

Answer all questions

Wherever proofs are required write clearly what is given, what is to be proved

This is an open notes exam

Sharing of notes is not allowed

No print materials allowed

All the best!

1. **Demonetization Turing machine:** Design a Turing machine that accepts 500 and 2000 and rejects 1000 and all others! (Assume that $\Sigma = \{0, 1, 2, 5\}$. You may use a state q_{reject} for rejecting a string) (2)
2. Any electronic computer has only finite memory size then what is the need for Turing machine model that has infinite memory. Is finite state automata enough for our study? Explain very briefly and crisply. (2)
3. The Traveling Salesman Problem (also called as Hamiltonian circuit problem) is an NP-Complete problem. Suppose a researcher finds that it is solvable by a deterministic Turing machine running in polynomial time what will be the (most appropriate) consequence and why? Explain in one or two sentence(s) only. (2)
 - (a) All NP-Complete problems are solvable in polynomial time
 - (b) $NP = P$
 - (c) $NP \neq P$
 - (d) None of the above
4. Design a Turing machine M that accepts all binary numbers that correspond to a positive even integer. For example: 100 (that correspond to 4) should be accepted but not 1011 (that correspond to 11). Assume that the input alphabet of M as $\{0, 1\}$. (4)
5. Construct a Turing machine M that accepts the language
$$\{a^n b^n c^n \mid n \geq 1\}$$
and rejects any other string given as input. Basically M should not go into an infinite loop in any case, rather it should stop on all inputs (Hint: You may use a state called q_{reject} to reject a string not of the required form/pattern. You may also use some tape alphabets). (4)
6. Construct pushdown automata for the following languages: (10)
 - (a) $\{a^i b^j c^k \mid i, j, k \geq 1, i + j = k\}$
 - (b) $\{a^i b^j c^k \mid i, j, k \geq 1, i + k = j\}$
 - (c) $\{a^n b^m \mid n \leq m \leq 2n\}$
7. Following are problems in context-free grammars

(a) Convert the following Context-Free Grammar into Chomsky Normal Form.

$$S \rightarrow AbA$$

$$A \rightarrow Aa \mid \epsilon$$

Note: Chomsky Normal Form will be consisting of rules of the type $A \rightarrow BC$ and $A \rightarrow a$ (4)

(b) Consider the grammar:

$$S \rightarrow aS \mid Sb \mid a \mid b$$

Describe the language accepted by this grammar. (3)

(c) Consider the grammar:

$$S \rightarrow aSbS \mid bSaS \mid \epsilon$$

Describe the language accepted by this grammar. (3)

8. Using pumping lemma prove that the language $\{ww \mid w \in \{a,b\}^*\}$ is not a context-free language. (4)

9. Three teams: Australia, India and Pakistan are playing for Australasia cup down under. There is a first round where each team play each other team once. Assume that for this tournament only a win or loss is possible – means there are no ties. For every match winning team gets 2 points and the losing team gets no points. At the end of first round, the first two best team (with respect to number of points) will go to the finals (If there are teams with equal number of points then the teams are selected according to the alphabetical order). The finals between the two best teams is a best of three matches where whoever wins two times will be declared as the winner of the Australasia cup.

(a) Design a finite state automata for the different scenarios that can occur in this tournament. The final states of this automata will be q_A , q_I and q_P that denotes the winner as Australia, India and Pakistan, respectively. (6)

(b) If the tie (when the points are same) is broken by tossing a coin how many new states will have to be included in your finite state automata. Discuss it briefly. (2)

Hint: Spend some time to think about what will be the states and the input for this automata. Once you find this designing is very easy.

10. The *min* of a language L is defined as

$$\text{min}(L) = \{w \in L : \text{there is no } u \in L, v \in \Sigma^+, \text{ such that } w = uv\}$$

Show that the family of regular languages is closed under *min*. (4)

The LNM Institute of Information Technology, Jaipur
Department of Computer Science & Engineering
Midterm Exam

Theory of Computation

Time: 90 min

September 15, 2016

Answer all questions

Wherever proofs are required write clearly what is given, what is to be proved

This is an open notes exam

Sharing of notes is not allowed

No print materials allowed

All the best!

1. Are you following any book, either softcopy or print copy, for this course? If yes, give the details of the book. If No, you are a genius and my expectation from you would be very high! (1)
2. Assume that $\Sigma = \{a, b\}$. For the following languages give a deterministic finite state automata
 - (a) Set of all strings over Σ such that no string ends with aa. (3)
 - (b) Set of all strings over Σ that contain number of b's in multiples of 3. (3)
 - (c) Set of all strings over Σ that do not contain the substring ba. (3)
3. Use the pumping lemma for the following:
 - (a) Let L be the language over $\{0, 1\}$ consisting of all strings having equal number of 0's and 1's (not in any particular order). Prove that L is not a regular language. (4)
 - (b) Let L be the language consisting of all balanced parentheses. Here $\Sigma = \{(,)\}$. For example $((())), ()(), ((())()$ are all balanced parentheses. But $(()),)(), ((())()$ are not balanced parentheses. Prove that L is not a regular language. (6)
4. Let the language be the set of all strings x over $\{0, 1\}$ with x having at least one pair of 0's separated by number of positions that is a multiple of 3. Find a nondeterministic finite state automata for this language and convert this nondeterministic to a deterministic finite state automata. (6)
5. Give a finite state automata over $\{0, 1\}$ for the language consisting of strings that has either 01 repeated one or more times or 010 repeated one or more times. You may take advantage of ϵ -transitions and nondeterminism. (4)

Bonus Question: Given an equivalence relation R on a set A explain what do you mean by equivalence class through an example. (3)

Note: This was the first reading homework that you got. Check in Piazza!

2. Answer the following questions. All the bits should be answered sequentially in one place.

- Show the process state transition diagram for non-preemptive processes.
- Consider a multicore system and a multithreaded program written using the many-to-many threading model. Let U, K and P refer to number of user-level threads, number of kernel-level threads and number of processing cores. Assume U>P. Discuss the performance implications of the following scenarios.
 - K<P
 - K > P and K < U
- The arrival time and duration (includes CPU and I/O bursts) for each of three processes P1, P2 and P3 are given in the table below. Each process has a CPU burst followed by an I/O burst followed by another CPU burst. Assume that each process has its own I/O resource. Show process schedule using a Gantt chart if the operating system follows FCFS scheduling.

Process	Arrival time	Burst duration (CPU, I/O, CPU)
P ₁	0	1, 5, 3
P ₂	2	3, 6, 1
P ₃	3	2, 2, 2

3. Consider the following sleeping barber problem.

A barber shop has one barber, one barber chair, and n chairs for waiting customers, if any, to sit on. If there are no customers present, the barber sits down in the barber chair and falls asleep. When a customer arrives, he has to wake up the sleeping barber. If additional customers arrive while the barber is cutting a customer's hair, they either sit down (if there are empty chairs) or leave the shop (if all chairs are full). The problem is to program the barber and the customers without getting into race conditions. Write a solution (pseudo code) for this problem using semaphore.

[10 M]

4. The following processes are being scheduled using a preemptive, round robin scheduling algorithm. Each process is assigned a numerical priority (higher number indicates higher relative priority). In addition to the processes listed below, the system also has an idle task (which consumes no CPU resources and is identified as P_{idle}). This task has priority 0 and is scheduled whenever the system has no other available processes to run. The length of a time quantum is 10 units. If a process is preempted by a higher-priority process, the preempted process is placed at the end of the queue.

[5+3+3+1=12 M]

Process	Burst time	Arrival time	Priority
P ₁	20	0	40
P ₂	25	25	30
P ₃	25	30	30
P ₄	15	60	35
P ₅	10	100	5
P ₆	10	105	10

- Show the scheduling order of the processes using a Gantt chart.
- What is the turnaround time for each process?
- What is the waiting time for each process?
- What is the CPU utilization rate?

✓ Answer the following.

- a. Can running each of the following code segments lead to deadlock of process 0 and process 1? Answer "yes" or "no" with brief explanation.

Code Sample 1		Code Sample 2	
Process 0:	Process 1:	Process 0:	Process 1:
lock1.acquire();	lock1.acquire();	lock1.acquire();	lock2.acquire();
lock2.acquire();	lock2.acquire();	lock2.acquire();	lock2.release();
lock1.release();	lock1.release();	lock1.release();	lock1.acquire();
lock2.release();	lock2.release();	lock2.release();	lock1.release();

- b. What advantage is there in having different time quantum sizes at different levels of a multilevel queueing system?

✓ Consider the following snapshot of a system having four processes and five resources: [2+4 = 6M]

	Allocation						Max						Available				
	A	B	C	D	E		A	B	C	D	E		A	B	C	D	E
P_1	1	0	2	1	1		1	1	2	1	3		0	0	x	1	1
P_2	2	0	1	1	0		2	2	2	1	0						
P_3	1	1	0	1	0		2	1	3	1	0						
P_4	1	1	1	1	0		1	1	2	2	1						

- a. What is the smallest value of x for which this is a safe state?
- b. Assuming the value of x to be 3, if a request from process P_4 arrives for $(0, 0, 1, 1, 1)$, can the request be granted immediately? Illustrate each step of your calculation.

✓ Consider a UNIX file system with 5 direct pointers, 2 indirect pointers, 1 double-indirect pointer, and 1 triple-indirect pointer in the i-node. Assume that disk blocks are 2K bytes and that each pointer to a disk block requires 4 bytes. [4+4 = 8M]

- a. What is the largest possible file that can be supported with this design? Show your work as an expression (i.e., you need not calculate the final numeric answer!).
- b. Assume that the operating system has already read the i-node for your file into main memory (i.e., the file buffer cache). How many disk reads are required to read following data block numbers into memory? Describe each disk read.

- i. 600 ii. 1600

✓ Consider the following sequence of virtual memory references generated by a single program in a pure paging system: [2+6 = 8M]

17, 18, 121, 155, 43, 327, 185, 275, 276, 456, 468, 324

- a. Derive the corresponding reference string, assuming a page size of 80 words.
- b. Determine the number of page faults for LRU and MFU page-replacement strategies, assuming that three frames are available to the program. Show the contents of the page frames after each reference.

5. Answer the following questions.

[2+2+2+3 = 9M]

- Consider a machine with a physical memory of 8 GB, a page size of 8 KB, and a page table entry size of 4 bytes. How many levels of page tables would be required to map a 46 - bit virtual address space if every page table fits into a single page? Be explicit in your explanation.
- List the fields of a Page Table Entry (PTE) in your scheme.
- Without a TLB, how many memory operations are required to read or write a single 32-bit word? Explain briefly.
- How much physical memory is needed for a process with three pages of virtual memory (for example, one code, one data, and one stack page) ?

6. Consider the following segment table:

[5M]

Segment	Base	Length
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	96

What are the physical addresses for the following logical address?

- a. 0,430 b. 1,10 c. 2,500 d. 3,400 e. 4,112

7. Disk requests come into the disk driver for cylinders: 10, 22, 20, 2, 40, 6, and 38, in that order. The disk has 60 total cylinders and the disk head is currently positioned over cylinder 20. A seek takes 6 milliseconds per cylinder moved. What is the sequence of reads and total seek time using each of the following algorithms?

- a. SSTF b. C-SCAN c. LOOK [2*3 = 6M]



Roll No. 14UCSO20

Max. Marks – 35

Date – 17/09/2016

Time – 90 Minutes

PART – I (13 marks)

Instructions – Attempt the paper in sequence and answer new section/sub-section of Part-I on a new page. No partial credits. Marks will be deducted for rewriting or change of response in the answers.

A- Answer True or False (write in capital letters): (5x1=5)

1. The new base year for Indian Economy is 2011-12.
2. Goods market is a part of macroeconomic market.
3. If AD increases at a slower pace than the AS capacity in the economy, slowdown or recession begin.
4. ICOR measure the efficiency of an industrial unit or country as an economic unit.
5. Nifty is calculated for top 30 stock from key sectors.

B- Answer the appropriate answer from the following (write in capital letters): (5x1=5)

1. Recession turns into depression if each quarter of negative growth is more than:
A) 5% B) 10% C) 8% D) 9%
2. Share market is an example ofmarket:
A) Imperfect competitive market C) Perfect market
B) Public offerings D) Perfectly competitive market
3. If depreciations is > gross investment, Net Investment is :
A) Zero C) Negative
B) Positive D) None of the above
4. Which country started the concept of Gross Happiness Index:
A) Nepal C) Maldives
B) Sri Lanka D) Bhutan
5. Production of fixed capital by Households, Firms and Government is added in:
A) Income method C) Expenditure Method
B) Green GDP D) Value Added Method

C- Calculate the following: (Show the calculations in your answer book at the same place) (3x1=3)

1. Robert buys 100 shares of stock in Microsoft and pays a total of \$10,000. The total addition to the GDP is:

Use the following table to answer questions from 2-3:

Year	Nominal GDP (\$)	Real GDP (\$)	GDP Deflator
2003	4500	-----	150
2004	-----	3100	156

2. What is real GDP in 2003?
3. What is nominal GDP in 2004?



PART II (22 marks)

Instructions: Attempt the paper in the sequence and answer all its part at the same place. Give examples and draw diagrams wherever necessary. Write the paper legibly and neatly.

1. Refer the following :

(6)

- a) Assume a Cement industry has an annual capacity to manufacture 100 tons of cement and all is available for sale. But, the industry finds that the actual sale is only 80 tons. What are the micro economics solutions for this problem?
- b) Assume, that the Cement industry capacity is still 100 tons, but the demand is 120 tons? What are the micro economics solutions for this problem?
- c) From a & b, derive macroeconomics characteristics related to a company and entire economy.

2. Explain the relationship between stock market and an economy and how they affect each other. (6)

3. Discuss the changing sectoral composition of India's economy. (6)

4. *Short Note:*

(4)

Circular flow of income in a simple economy

OR

Domestic territory and normal residents of a country.



Roll No. ... 14UCSO20

Max. Marks: 70

Instructions – Attempt the paper in sequence and answer new section/sub-section/question on a new page. No partial credits. No clarifications will be entertained about meaning or interpretation related to any question or about the content/structure of any answer. Apply your own discretion based on the class room discussion.

Date: 30/11/2016

Time: 3 Hrs

PART - I (30 marks)

(5x1=5)

A- Answer True or False (write in capital letters with complete word):

1. Green GDP accounts for all economic goods.
2. A rise (drop) in the interest rate in the economy will shift the demand curves for most stocks to the left (right).
3. India's external debt in proportion to GDP was 23.8% in 2015.
4. If interest rates were lower in the United States than in the rest of the world, the United States would most likely experience a capital outflow.
5. Greece witnessing highest unemployment rate in European Union.

B- Select the appropriate answer from the following (write it in capital letters):

(5x1=5)

1. An economy that doesn't interact economically with the rest of the world is called _____ economy.
a. A closed
b. An open
c. A surplus
d. An authoritarian
2. In the case of stock trades, the secondary market consists of:
a. The trading of a company's stock in a stock market
b. The purchase of a company's stock by an investment bank
c. The first offering of a company's stock to the public
d. All trading that occurs in the initial public offering of the stock
3. If a used car dealer buys a car for \$6,000 and resells it for \$6,500, how much has been added to GDP?
a. Nothing
b. \$500
c. \$6,000
d. \$6,500
4. According to the Purchasing Power Parity theory, the value of a currency should remain constant in terms of what it can buy in different countries of:
a. Bonds
b. Stocks
c. Goods
d. Labor
5. Based on the supply and demand model of the exchange rate, which of the following should cause the Philippine peso to appreciate?
a. Concern abroad over the safety of Philippine toy exports
b. An increase in remittances from Philippine workers abroad to their families at home
c. Repayment by the Philippine government of its debt to the IMF
d. Increased imports by Philippine consumers of electronics made in Taiwan



Calculate the following: (Show the calculations in your answer book at the same place)

(20)

- Statistics Canada reported that in June 2005, the Canadian labor force was 17.1 million, employment was 15.7 million, and the working-age population was 25.1 million. Calculate: (a) Canadian unemployment rate
(b) The labor force participation rate in June 2005. (2+2)
- Assume that labor is the only input in the production of calculators and backpacks in Canada and Japan. The following table gives the output per hour of labor in each country.

Country	Calculators	Backpacks
Canada	4	6
Japan	3	2

- Which country has an absolute advantage in the production of calculators? In backpacks? (2)
- Which country has the comparative advantage in calculators? (2)

- From the following data calculate the Consumer Price Index for 2005 and 2006 and measure the inflation rate in 2006. (3)

Product	2000		2005		2006
	Quantity	Price	Price	Price	Price
Transport	1	\$50	\$80	\$100	
Clothes	5	\$30	\$50	\$60	
Power	10	\$20	\$30	\$40	

- Spot Price = Rs. 100. Call Option Strike Price = Rs. 98. Premium = Rs. 4. An investor buys the Option contract. On Expiry of the Option the Spot price is Rs. 108. Net profit for the Buyer of the Option is _____. (3)
- An investor is bearish about Tata Motors and sells ten one-month futures contracts at Rs.6,06,000. On the last day of the month, Tata Motors closes at Rs.600. He makes a profit/loss of _____. (assume one lot = 100) (3)
- On 1st August, XYZ buys a USD put option for covering its export transactions, at a strike rate of Rs. 45.50. The expiry date is 3 months i.e., 31st Oct. 2010. The premium is 30 paisa on the call. Calculate from the following at what market rate the gain will occur? (3)

Market rate	Premium paid
45.00	0.30
45.50	0.30

PART II (40 marks)

Instructions: Give examples and draw diagrams wherever necessary. Write the paper legibly and neatly.

- The Bahamas is a group of islands whose economy relies heavily on tourism. The majority of the hotels and resorts in the islands are owned by foreign countries. Define GDP and GNP. Which do you think is larger, Bahamas' GDP or GNP? Explain why. (5)

OR

Over the past six years, the exchange rate between Swiss franc and U.S. dollar, SFr/\$, has changed from about 1.30 to about 1.60. Define depreciation and appreciation of currency. Would you agree that over this six-year period, the Swiss goods have become cheaper for buyers in the United States?

- Using a Phillips curve diagram, discuss the possible trade-off between unemployment and inflation. (5)
- Define fiscal deficit. Critically discuss the Fiscal Responsibility and Budget Management Act, 2003. (5)
- Discuss the relationship between sub-prime crisis and global recession. (5)

OR

Explain how the trade balance, the current account balance, and the capital account balance differ.

- Classify and explain revenue receipts and capital receipts as sources of government revenue with examples. (10)
- Discuss the economic effects of inflation on different sections of the society and on economic growth. (10)

Genetic Algorithms & Applications (GAA-2016) Mid Term Exam

Time 1:30 Hours

M. Marks 25

Instructions:

- Attempt all questions
- Make suitable assumptions whenever it is allowed/required (with suitable justifications)

Question 1.

[3+2=5 Marks]

- (a) Given the fitness function $f(x) = x^2$, compute target sampling rates for RWS scheme for the individuals $x=1, x=2$ and $x=3$ and also calculate the target sampling rates for a transposed fitness function $f+10$ and analyze the results after comparing these two rates.
- (b) Differentiate RWS method with SUS method and also compute the time complexity of either one of the methods.

Question 2.

[3+2=5 Marks]

- (a) State the Eight Queens Problem and discuss the various fitness functions associated with this problem while solving it by genetic algorithm. How big the phenotype space for the Eight Queens problem?
- (b) Differentiate Hill climbing approach with simulated annealing and also discuss the role of temperature associated with simulated annealing.

Question 3.

[2+3=5 Marks]

- (a) Discuss the behavior of tournament size k on the parent selection in the tournament method.
- (b) Form a child chromosome from the following parental chromosomes using Edge Recombination Operator
[1 2 3 4 5 6 7 8 9] and [9 3 7 8 2 6 5 1 4].

Question 4.

[3.5+1.5=5]

- (a) Simulate a Genetic Algorithm to minimize a function $f(x) = x^2 + y^2$ where $1 \leq x \leq 15$ and $y \geq 3$ with $x + y = 7$

Note: You will have to mention coding scheme, fitness function, possible crossovers and mutation operators and you will have to generate the next generation only along with fitness values analysis. The following things will have to be considered in this question:

Population size=4, RWS selection mechanism and generational model.

3
4
5
6
7



Use following random numbers with the order

.48, .68, .88, .23

Crossover probability = Mutation Probability = 1.

- (b) Read the problem carefully and design an appropriate fitness function and coding scheme:

We are given a set of n items, each of which has attached to it some value v_i and some cost c_i . The task is to select a subset of those items that maximizes the sum of the values, while keeping the summed cost within some capacity C_{Max} .

[1+1.5+1+1.5=5 Marks]

Question 5

- (a) Discuss the process of windowing in the selection mechanism and also discuss its importance.
- (b) Assume you use k -tournament selection with a population size of 100. What is the probability that the best individual is selected – assume there is a single best individual – and give the general formula for the probability. What is the impact of decreasing k (let us say from 5 to 4) in tournament selections?
- (c) Assume you develop an evolutionary computing system that employs a mutation as well as crossover operators and 5-tournament selection and you observe premature convergence and too much selective pressure. What of the following measures would you take to alleviate the problem? No justification is required!
- Increase the population size
 - Decrease the mutation probability
 - Replace the current fitness function f by a function $g(x) = f(x)^{0.1}$
- (d) Assume 3-tournament selection is used in an EC system with a population size of 100. What is the probability that the worst population member is selected for reproduction (assume, no fitness ties)? What is the probability that the best individual is selected for reproduction? Giving the formula is fine! Consider the case of without replacement in the tournament selection.

END TERM EXAM (GENETIC ALGORITHMS & APPLICATIONS) 2016

M.MARKS 50

M. TIME 3 HOURS

Roll Number

Name Anshul Goyal

Important Instructions:

1. Make suitable assumptions if you require.
2. Questions are not equally difficult.
3. Solve questions in neat & clean manner.

Question 1

Marks 4+2+4=10

(a) Consider three strings A = 11101111, B = 00010100 and C = 01000011 and six schemata S1 = 1******, S2 = 0******, S3 = *****11, S4 = ***0*00*, S5 = 1****1*, S6 = 1110**1*. Which schemata are matched by which strings? What are the order and defining length of each of the schemata? Estimate the probability of survival of each schema under mutation when the mutation probability of a single mutation is 0.001. Estimate the probability of survival of each schema under crossover when the crossover probability is 0.85.

(b) A population contains the following strings and fitness values at generation 0:

Index	Chromosome Strings	Fitness
1	10001	20
2	11100	10
3	00011	5
4	01110	15

The probabilities of mutation and crossover are 0.01 and 1.0 respectively. Compute the expected number of schemata of the form 1*** in generation 1. Estimate the expected number of schemata of the form 0**1* in generation 1.

(c) State and analyze the schema theorem based on selection, mutation and crossover.

Question 2

Marks 6+3+6 = 15

(a) Discuss the implicit & explicit diversity maintenance methods in detail.

(b) Write down the parse tree the following expressions:

(1) If (No. of children = 2) AND (Salary > 80000) Then good else bad (Hint: focus only condition part)

(2) $3*\mu + ((x + 5) - y / (z + d))$

(3) $(x \wedge \text{true}) \rightarrow ((x \vee y) \vee (z \leftrightarrow (x \wedge y)))$

(c) Differentiate genetic programming with genetic algorithms in terms of initialization, selection and variation operators in brief.

Question 3

M. Marks 5

Consider the following expression for computing the output value for any training example d .

$$O(\bar{W}) = \sum_{i=0}^{l=n} w_i x_i, \quad x_0 = 1 \text{ & } i = 1, 2, \dots, n \text{ and } \bar{W} = \{w_i\}$$

Suppose D is the set of training examples for supervised learning i.e each example is associated with its attributes and one target attribute for an example

$d = \{f_1, \dots, f_k, t_d\}$, where f_j represents features & t_d is the target value of example d .

Our objective is to learn these weights optimally for minimizing the training error using gradient descent methods as expressed below

$$E(\bar{W}) = \left(\frac{1}{2} \sum_{d \in D} (t_d - O_d)^2 \right)$$

Deduce the expression for the following training rule of each weight using gradient descent method

$$\Delta w_i = -\rho \frac{\delta E}{\delta w_i}$$

Question 4

M. Marks 10

Design a genetic algorithm to learn conjunctive classification rules for the Play Tennis problem described in the following dataset. Your objective is to find a rule or collection of rules that satisfy the given dataset in which the post condition has the last attribute 'Play Tennis' i.e. If (Outlook = Rain \vee Overcast) \wedge (Wind = Strong) then (Play Tennis = No). Describe precisely the bit string encoding of hypotheses (rules), fitness function and a set of crossovers.

Dataset

Outlook	Temperature	Humidity	Wind	Play Tennis
Sunny	Hot	High	Weak	No
Sunny	Hot	High	Strong	No
Overcast	Hot	High	Weak	Yes
Rain	Mild	High	Weak	Yes
Rain	Cool	Normal	Weak	Yes
Rain	Cool	Normal	Strong	No
Overcast	Cool	Normal	Strong	Yes
Sunny	Mild	High	Weak	No
Sunny	Cool	Normal	Weak	Yes
Rain	Mild	Normal	Weak	Yes
Sunny	Mild	Normal	Strong	Yes
Overcast	Mild	High	Strong	Yes
Overcast	Hot	Normal	Weak	Yes



Rain	Mild	High	Strong	No
------	------	------	--------	----

Question 5 (Objective) [Each wrong answer carries -1 Marks]

M. Marks 2

- A. Assume you evolve binary strings of length 100 and you use the binary string mutation operator with $pm=0.02$. How many bit-flips do you expect on average, if you use this operator to evolve binary strings of length 100? (a) 2 (b) 3 (c) 4 (d) None of these
- B. Assume you use a randomized hill climbing approach to solve an optimization problem and you observe that that randomized hill climbing frequently gets stuck in plateaus before reaching good solutions. What could be done to alleviate the problem? (a) By increasing the neighborhood size (b) decreasing the neighborhood size (c) adding penalty function in objective function (d) None of these

Question 6

M. Marks 2+1+5 = 8

(a) How many schemata exist within strings of length $L = 10, 20$ and 30 when the underlying English alphabet (If some assumptions require then you can make). Also estimate the upper bound on the number of schemata processed using strings of length $L = 10, 20$ and 30 when population size is 50 under the same alphabet.

(b) Discuss the NO Free Lunch Theorem

(c) Suppose there is equality $a + 2b + 3c + 4d = 30$ and genetic algorithm will be used to find the value of a, b, c , and d that satisfy the above equation. It is given that all the variables are in the range of 0 to 30. Design a genetic algorithm framework for solving this problem based on your assumptions. You will have to start with initial population and will have to compute the next generation with the following restrictions:

1. Population Size is 4
2. Crossover Probability = Mutation Probability = 1.
3. Generational Model
4. Linear ranking selection probability method with RWS scheme

1 Generation



Software Case Study

Ques.

CompJournals Case Study

SmallBytes is a software journal published by the CompJournals company. This company is planning to publish four new journals in the field of computer science and technology. CompJournals has asked you to build a web-based software system for efficiently managing the subscriptions, reviews, and publications of various journals. The web-based system to be developed should be made accessible by the editors, editorial assistants, authors, reviewers and subscribers of different journals according to their role. Analyze the existing business operations (given below for SmallBytes journal) and then prepare a list of user stories with prioritization for the proposed web-based system for CompJournals that can be used for the current and future journals.

SmallBytes is published on a monthly basis. A typical monthly issue consists of 5-10 articles, each written by one or more authors in the software engineering field. Though the authors receive no payment for their articles, they do receive a year's free subscription as a token of appreciation for their efforts. If they already have a subscription, then a new subscription (free) is made with the start date as day after the last date of current subscription.

SmallBytes has an editorial board of advisors. Each advisor on the editorial board normally serves for a one-year or two-year term, for which they receive a complimentary subscription to the magazine. As with most magazines, issues are scheduled and planned months in advance.

The editor does a quick review of the submissions to ensure that they fit with the magazine before assigning three or four advisors for detailed reviews and comments. Upon receiving replies from the advisors by email, the assistant records the review comments into the system. From time to time, upon receiving instructions from the editor, the assistant updates the list of advisors and their subject areas.

An editor manages SmallBytes with the support of an assistant who is responsible for keeping track of subscriptions and submissions using an in-house computerized system. The assistant receives subscription orders (new and renewal) from subscribers, and new article submissions by authors via mail or email, and registers those orders and article submissions into the system.

SmallBytes is sold on a subscription basis to its subscribers. Most subscriptions are for a one-year period, but the publisher accepts subscriptions for periods longer, or shorter than a year by simply pro-rating the annual subscription price. Payments for new subscriptions are normally received by cheque. Some subscribers pay by credit card, using a prescribed form that includes a signature, as the bank insists. This means that credit card orders are typically sent by fax or mail.

Q. Write User Stories?



Mid-Semester Examination Introduction to Artificial Intelligence

Wednesday, September 14, 2016

Time Duration: 90 minutes

Maximum Marks: 30

1. Explain the Turing test for artificial intelligence. Mention at least two required properties of an AI agent to be able to pass the Turing test.

2+1 Marks

2. What is meant by an environment that is fully observable, single agent, deterministic, episodic and discrete?

1+1+1+1+1 Marks

3. In state space searching, completeness is defined as a property of a search algorithm such that if a solution exists it is guaranteed to find it. Optimality is defined as the guarantee to find the least cost path. Show the applicability of the two properties for DFS and BFS.

2+2 Marks

4. Explain what is the Uniform Cost Search (UCS) and best first (or greedy) search. We get A^* if we combine the both. Given Figure 1, run A^* to find the shortest path from Oradea to Bucharest showing the search in the tree. Give the details of which part are you using as UCS and which part for best first (greedy). Using this heuristic, are you always guaranteed to find the optimal solution? Justify.

2+3+1+1 Marks

5. Suppose you are given to apply A^* to the problem given in Figure 2. Start state and goal states are given to you. Provide any three admissible heuristics (prove). Show the cost of reaching the goal state from the start state under the admissible heuristic that you are using.

3+2 Marks

6. Consider n queens problem. Recall the formulation of it in which Variables were given as $X_{ij} \in \{0, 1\}$. To be precise, i represents the row number and j represents the column. Write the set of constraints. Solve the following independent instances of 4 queens problem.

- (a) Consider the start state given to you is $\{X_{31}, X_{22}, X_{33}, X_{42}\} = 1$. Apply hill climbing using min-conflicts heuristic to reach to the final state. Draw all the steps and reason for transition to next state at each step.
(b) Consider empty state as the start state. Make use of the three heuristics, namely, (a). Minimum Remaining Values, (b) Degree Heuristic and (c) Least Constraining Value to start assigning values to the variables X_{ij} such that you reach a goal state of the 4 queens problem.

2+2+2 Marks

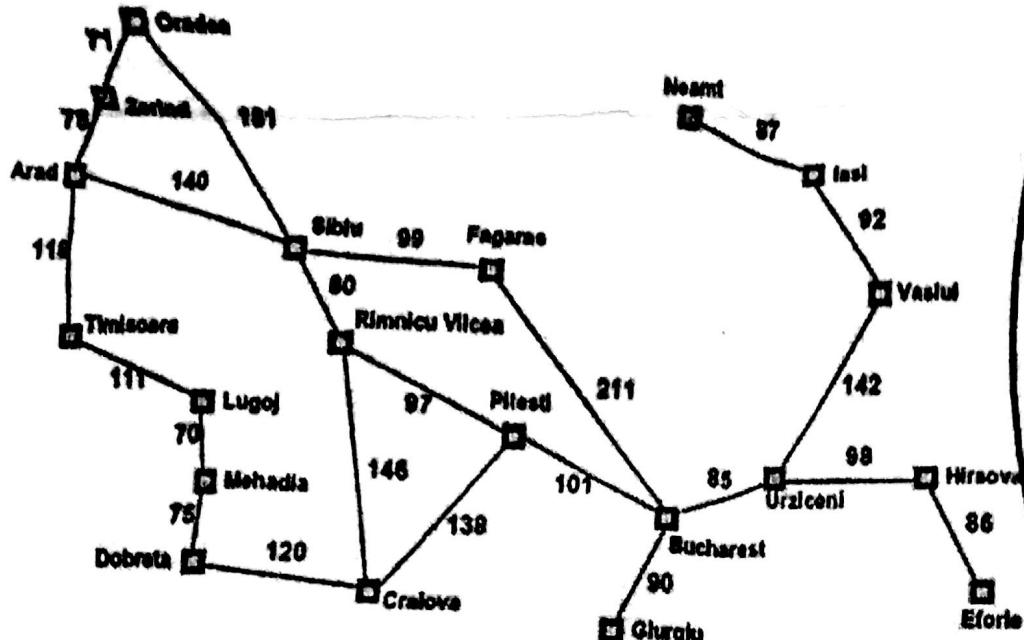
MTB

WON

DEZI<PSU

DAD
DAD

①



Straight-line distance to Bucharest

Arad	366
Bucharest	0
Craiova	160
Dobretei	242
Eforie	161
Fagaras	178
Glurghiu	77
Hirsova	151
Iasi	226
Lugoj	244
Mehadia	241
Neamt	234
Oradea	380
Pitesti	98
Rimnicu Vilcea	193
Sibiu	253
Timisoara	329
Urziceni	80
Vaslui	199
Zerind	374

Figure 1: Map of Romania.

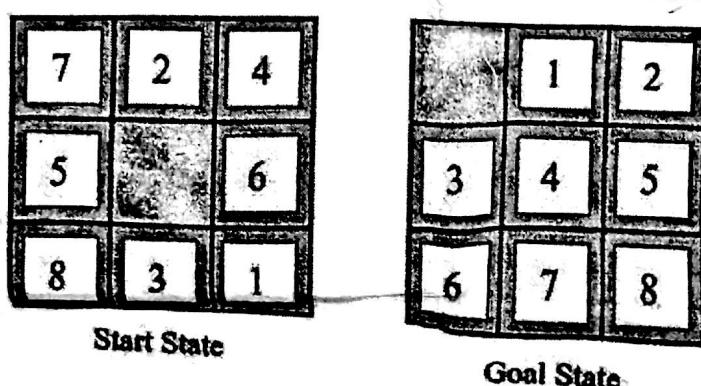


Figure 2: Tiles Problem.



End-Semester Examination

Introduction to Artificial Intelligence

Wednesday, November 23, 2016

Time Duration: 3:00 hours

Maximum Marks: 50

Please read the following instructions carefully.

- The paper has 7 questions printed on two pages.
- In case of any doubt in questions, make your assumption(s), write it(them) clearly and continue.
- Draw diagrams wherever you can.

=====XXXXX=====

1. Prove that with a positive linear transformation of leaf values (i.e., transforming a value x to $ax + b$ where $a > 0$), the choice of move remains unchanged in a deterministic min-max game tree.

4 Marks

2. Define X_n as the number of rows, columns, or diagonals with exactly n X's and no O's. Similarly, O_n is the number of rows, columns or diagonals with just n O's. Assuming $n = 3$, the utility function assigns +1 to any position with $X_3 = 1$ and -1 to any position with $O_3 = 1$. All other terminal positions have utility 0. For nonterminal positions, we use a linear evaluation function defined as $Eval(s) = 3X_2(s) + X_1(s) - 3(O_2(s) + O_1(s))$.

- (a) Approximately how many possible games of tic-tac-toe are there?
- (b) Show the whole game tree starting from an empty board down to depth 2 (i.e., one X and one O on the board), taking symmetry into account.
- (c) Mark on your tree the evaluations of all the positions at depth 2.
- (d) Using the minimax algorithm, mark on your tree the backed-up values for the positions at depths 1 and 0, and use those values to choose the best starting move.
- (e) Circle the nodes at depth 2 that would not be evaluated if alpha-beta pruning were applied, assuming the nodes are generated in the optimal order for alpha-beta pruning.

1+2+2+2+1 Marks

3. (a) Explain what is wrong with the following proposed definition of adjacent squares in the wumpus world:

$$\forall x, y \text{ Adjacent}([x, y], [x + 1, y]) \wedge \text{Adjacent}([x, y], [x, y + 1]).$$

3 Marks

(b) Consider a knowledge base containing just two sentences: $P(a)$ and $P(b)$. Does this knowledge base entail $\forall x P(x)$? Explain. 1+2 Marks

(c) Represent the sentence "All Germans speak the same languages" in first order logic. Use $Speaks(x, l)$, meaning that person x speaks language l . 3 Marks

4. Define rectilinear floor planning as finding non-overlapping places in a large rectangle for a number of smaller rectangles. Give precise formulation for rectilinear floor planning problem as CSP. 4 Marks

5. (a) Prove using natural deduction.

- i. $L \wedge M \Rightarrow \neg P, I \Rightarrow P, M, I \vdash \neg L$
- ii. $A \vee B, A \Rightarrow C, \neg D \Rightarrow \neg B \vdash C \vee D$

(b) Using the intuition behind natural deduction. Discuss how forward and backward chaining work.

Note: You must provide the precise intuition. Formal algorithms are not solicited but you are free to write it in algorithmic form.

2+4+3 Marks

6. (a) With the help of a figure, explain how a stochastic two player game can be visualized. How is it different from deterministic two player games? 2 Marks

(b) What is the approach to find out admissible heuristics in A* search? Explain with the help of an example. 2+2 Marks

(c) Write a note on hill climbing. Discuss the reasons for its efficiency on n -queens problem. Use figures to illustrate your ideas. 1+2 Marks

7. Write short notes on the following:

- (a) Soundness in logic
- (b) Completeness in logic
- (c) Resolution in logic
- (d) Conjunctive Normal Form (CNF)
- (e) Environment that is fully observable, discrete and deterministic.
- (f) Arc consistency for constraint propagation
- (g) Uniform Cost Search (UCS)

7x1 Marks



CSE :: Principles of Programming Languages:: Mid-Term Exam :: Sept 2016

Time: 90 mins

Marks: 90

Note: (i) Marks are proportional to time

(ii) Make and State Assumptions as and where required

[Q1]. Discuss,

- (iv) Objectives (motivation), [marks 3]
- (v) Common Characteristics, [marks 7]
- (vi) Execution Model, and [marks 5]

for the following Programming Paradigms:

- (d) Procedure-Oriented
- (e) Object-Oriented
- (f) Logic Oriented

[Marks: $15 * 3 = 45$ marks]

[Q2]. Write any 8 related rules from your own group's project work (not any other rules) and draw the corresponding "AND-OR-Net" indicating clearly the Observable Facts, Rule Numbers, Intermediate and Final Deductions in the net; [Marks $15 + 15 = 30$]

[Q3]. For each of the above mentioned 3 Programming Paradigms (consider C, Java and Propositional Logic as candidate languages respectively), give 2 examples possible of semantic errors; [Marks $5 * 3 = 15$]

**The LNM Institute of Information Technology,
 Jaipur, Rajasthan
 Mid Term Exam
 ECE326, Digital Signal Processing**

Roll No:

Time : 1:30 Hours

Date: September 14, 2016
 Maximum Marks : 50

Instructions

- All questions are compulsory.
- Show all your work. Justify your answers. Partial credit is possible for an answer, but only if you show the intermediate steps in obtaining the answer.

- 1) Fill in the blanks $(2 \times 10 = 20 \text{ marks})$
 - i) Monochromatic picture is a-channel and-dimensional signal
 - ii) All memoryless systems are
 - iii) A function of one or more variables which conveys information in the nature of physical phenomenon is called
 - iv) Given $x[n] = (0.25)^n u[n]$, where $u[\cdot]$ denotes the discrete-time unit step function, $P_\infty = \dots$ and $E_\infty = \dots$
 - v) The analysis of light into colors is actually a form of analysis.
 - vi) If $x[n] \longleftrightarrow a_k$, N is period of the discrete-time signal $x[n]$
then $a_k = \dots$ (analysis equation).
 - vii) There are no convergence issues for periodic signals due to the presence of only a finite number of terms in their Fourier series representation.
 - viii) The region of convergence of the discrete-time Fourier transform is $|z| \dots$
 - ix) If $H(z)$ and $H_{\text{inv}}(z)$ are the system functions of a discrete-time LTI system and its inverse system, respectively, then $H(z)H_{\text{inv}}(z) = \dots$
 - x) A discrete-time LTI is stable if and only if the region of convergence of its system function $H(z)$ includes the
- 2) (4 marks) Apply the final value theorem to determine $x[\infty]$ for the signal

$$x[n] = \begin{cases} 2; & \text{if } n \text{ is even} \\ 0; & \text{otherwise} \end{cases}$$

- 3) (4 + 2 + 4 + 2 = 12 marks) A digital communication link carries binary-coded words representing samples of an input signal

$$x_a(t) = 3 \cos(600\pi t) + 7 \cos(1800\pi t).$$

The link is operated at 20,000 bits/s and each input sample is quantized into 1024 different voltage levels.

- a) What are the sampling frequency and the folding frequency?
- b) What is the Nyquist rate for the signal $x_a(t)$?
- c) What are the frequencies in the resulting discrete-time signal $x[n]$?
- d) What is the resolution?

- 4) (2 + 2 + 2 = 6 marks) An audio signal $s(t)$ generated by a loudspeaker is reflected at one wall with reflection coefficient γ . The signal $x(t)$ recorded by a microphone close to the loudspeaker, after sampling is

$$x[n] = s[n] + \gamma s[n - k],$$

where k is the delay of the echo.

- a) Determine the autocorrelation $r_{xx}[l]$ of the signal $x[n]$ in terms of the autocorrelation $r_{ss}[l]$ of the signal $s[n]$.
- b) Let $s[n]$ be the 2-point sequence

$$s[n] = \delta[n] + \delta[n - 1].$$

Determine the autocorrelation $r_{ss}[l]$ of the given $s[n]$.

- c) Plot the autocorrelation $r_{xx}[l]$ for the given $s[n]$.
- 5) (2 + 2 + 4 = 8 marks) Consider a three-point moving average system

$$y[n] = \frac{1}{3} \sum_{k=-1}^1 x[n - k]$$

- a) Determine the impulse response $h[n]$ of the system.
- b) Determine the frequency response $H(\omega)$ of the system.
- c) Plot the magnitude spectra and phase spectra of $H(\omega)$ for $0 \leq \omega \leq \pi$.



The LNM Institute of Information Technology, Jaipur
Electronics and Communication Engineering Department
Subject: Digital Communication (ECE 325)
Full Marks: 50

Time: 90 Minutes

Date: 15.09.2016

Instruction: Answers must be brief and to the point

[10×1=10]

1. Choose the correct alternative:
 - (a) Which probability distribution the incoming traffic in a Gateway will follow?
 i) Gaussian ii) Exponential iii) Rayleigh iv) Poisson
 - (b) If the generator polynomial of m -sequence is given by $P(x) = 1 + x^4 + x^9$ then:
 i) $B_n = B_1 \oplus B_0$ ii) $B_n = B_1 \oplus B_0$ iii) $B_n = B_4 \oplus B_0$ iv) $B_n = B_2 \oplus B_0$
 - (c) A binary source generates digits 1 and 0 randomly with probabilities $P(1) = 0.8$ and $P(0) = 0.2$. The probability that at least three 1's will occur in a five-digit sequence is:
 i) 0.2048 ii) 0.9421 iii) 0.4096 iv) 0.3277
 - (d) A signal carrying data in which one data element is encoded as two signal element; if the bit-rate is 100 kbps, what is the average value of the baud rate if c is between 0 and 1? [Given $S = c \times N \times \frac{1}{r}$]:
 i) 100 kbaud ii) 50 kbps iii) 50 kbaud iv) 25 kbaud
 - (e) The discrete time random variable(s) having memory-less property:
 i) Exponential ii) Geometric iii) both (i) and (ii) iv) None
 - (f) A video transmission system transmits 625 picture frames per second. Each frame consists of 400×400 pixel grid with 64 intensity levels per pixel. The data rate of the system is:
 i) 16 Mbps ii) 100 Mbps iii) 600 Mbps iv) 6.4 Gbps
 - (g) The Nyquist sampling interval for the signal, $\text{Sinc}(800t) + \text{Sinc}(600t)$ is:
 i) $1/400$ sec. ii) $\pi/400$ sec. iii) $1/800$ sec. iv) $\pi/200$ sec.
 - (h) If the sampling frequency in a voice-coding PCM systems is increased from 40 kHz to 80 kHz, the SQNR for this PCM system will increase by an amount:
 i) 30 dB ii) 40 dB iii) 60 dB iv) None of these
 - (i) Source coding technique in a digital communication system is used for:
 i) Bandwidth compression ii) To remove redundancies in the source
 iii) To help correct channel errors iv) To convert analog signal to a digital signal format
 - (j) Decreasing the quantum step-size in a PCM encoder ensures:
 i) Increase of signal-to-quantum noise ratio ii) Increase of PCM transmission rate
 iii) Decrease of destination SNR iv) Increase of the system BER

2. (a) Draw the block diagram of Digital Communication System.
 (b) What are the considerations of choosing a particular line coding technique? Which property is not satisfied by the Manchester or differential Manchester encoding?
 (c) Give example of an uniform random number generation procedure using multiplication algorithm with prime modulus.

[2+(2+2)+4=10]

3. (a) Derive PSD of uni-polar RZ and draw it's spectrum.
(b) What do you mean by bandwidth of a signal? Explain with the help of PSD of NRZ signal, the **possible definitions** of bandwidth.
(c) Draw the transmitted waveforms (label the amplitude and time frame) corresponding to the binary sequence 10110000101, using the following line codes i) uni-polar RZ, ii) uni-polar NRZ, iii) Manchester code, and iv) AMI-NRZ.

[(4+1)+(1+2)+2=10]

4. (a) Draw the block diagram of PCM generator and explain function of each block briefly.
(b) A TV signal band-limited to 5.5MHz, is sampled at a rate 60% above the Nyquist rate, quantized to 1024 levels, and binary coded to form a PCM signal. What would be the minimum bandwidth requirement for transmitting the above PCM signal?
(c) A monochrome video signal that ranges from 0 to 8V, is digitized using an 8-bit ADC. Determine the resolution of the ADC and calculate the mean squared quantization error.

[4+4+2=10]

5. (a) What will be the problem if the signal is under-sampled? Can you suggest a method to partially rectify this problem? Explain.
(b) A waveform, $x(t) = 10\cos(1000t + \pi/3) + 20\cos(2000t + \pi/6)$ is to be uniformly sampled for digital transmission. (i) What is the maximum allowable time interval between sample values that will ensure perfect signal reproduction? (ii) If we want to reproduce 1 hour of this waveform, how many sample values need to be stored?
(c) Briefly explain analog pulse modulation techniques.

[(2+2)+(1.5+1.5)+3=10]



The LNM Institute of Information Technology

Electronics and Communication Engineering Department

Digital Communication: ECE 325

End Sem-2016

Time: 3 Hours

Date: 25/11/2016

Full Marks: 100

Instruction: I. Answer must be brief and to the point. II. All parts of the question should be in same place

Q1. a) What are the advantages of Digital Modulation schemes?

- b) Is there any loss of information due to sampling? In case of aliasing effect due to sampling, indicate a method to resolve it.
- c) Explain briefly different pulse modulation techniques like PAM, PPM, and PWM with appropriate signaling diagram.
- d) What are the advantages of DM over DPCM?
- e) Indicate the major problems in DM. How will you resolve these problems?

[2 + (1+2) + 4 + 2 + (2+2) = 15]

Q2. a) Why ASK is not preferred among the shift keying modulation schemes?

- b) Write down the signal representation for QPSK technique. Draw the block schematic diagram for modulator and demodulator scheme for the same.
- c) Draw the constellation diagram for 16 QAM.
- d) Why synchronization is required in digital communication? Draw the clock recovery circuit for the BPSK modulation scheme.

[1 + (1+3) + 2 + (1+2) = 10]

Q3. Five telemetry signals, $m_i(t)$, $i = 1, 2, \dots, 5$, each of bandwidth 4 kHz, are to be transmitted simultaneously by PCM. The maximum tolerable error in the sample amplitude of the first signal $m_1(t)$ is 0.1% of the peak amplitude. For other signals, it is 0.2% of the peak amplitude. The first signal is sampled at 50% over the Nyquist rate and the others at 25% over the Nyquist rate. Framing and synchronization requires an additional 1% extra bits. The signal required to transmit the composite signal by 4-ary signaling. Determine

- a) Minimum possible data rate (bits/s).
- b) Minimum bandwidth in Hz.

[6+4 = 10]

Q4. a) Assume that in an encoding operation - the encoded symbol has n bits, the maximum number of quantizing levels is L , and maximum peak-to-peak dynamic range of the quantizer is $2^n \Delta$. P is the power of the message signal. $m_p = \max|m(t)|$ is the maximum absolute value of the message signal. Consider that the message signal fully loads the quantizer. Given $m_p = \frac{1}{2} 2^n \Delta$. Prove that the SNR at the quantizer output in dB is expressed as:

$$SNR_Q = 6n + 10 \log_{10} \left(\frac{3P}{m_p^2} \right)$$

- b) What is spectral efficiency? Arrange the given modulation schemes in terms of BW efficiency in ascending order – BASK, BPSK, QPSK, BFSK, 8-PSK, GMSK, 8-QAM, and 16-QAM.

[6+4 = 10]

Q5. a) For any digital communication system, the relationship between received S/N_0 and received bit-energy to noise-power spectral density, E_b/N_0 is given by:

$$\frac{E_b}{N_0} (\text{dB}) = \frac{S}{N_0} (\text{dB-Hz}) - 10 \log_{10} R (\text{dB-bit/s})$$

Suppose, you are given a bandwidth-limited AWGN radio channel with an available bandwidth of $W = 4000$ Hz. Also, consider that the link constraints (transmitter power, antenna gains, path loss, etc.) result in the received average signal-power to noise-power spectral density, $\frac{S}{N_0}$ being equal to 53 dB-Hz. Let the required data rate, R be equal to 9600 bit/s, and the required bit-error performance is $p_e = 10^{-5}$. Whether the channel is bandwidth limited or not? Based on the table below, which Modulation scheme should be selected.

M	m	R (bps)	R_s symbols/s	MPSK Minimum BW (kHz)	MPSK R/W	MPSK E_b/N_0 (dB)	MFSK Minimum BW(kHz)	MFSK R/W	MFSK E_b/N_0 (dB)
2	1	9600	9600	9.6	1	9.6	19.2	1/2	13.4
4	2	4800	4800	4.8	2	9.6	19.2	1/2	10.6
8	3	3200	3200	3.2	3	13.0	25.6	1/3	9.1
16	4	2400	2400	2.4	4	17.5	38.4	1/4	8.1
32	5	1920	1920	1.92	5	22.4	61.4	1/8	7.4

b) Now let the demodulator symbol error probability is given by:

$$P_E(M) \cong 2Q\left[\sqrt{\frac{2E_s}{N_0}} \sin\left(\frac{\pi}{M}\right)\right] \text{ for } M > 2$$

$$\frac{E_s}{N_0} = (\log_2 M) \frac{E_b}{N_0}$$

where,

$$Q(x) \cong \frac{1}{x\sqrt{2\pi}} \exp\left(-\frac{x^2}{2}\right)$$

Check whether the selected modulation scheme satisfies the $p_e = 10^{-5}$ or not.

[(6+2+2) + 5 = 15]

Q6. a) Write the MSK signal equations both $s(t)$ and $\theta(t)$.

- b) Suppose a data sequence '111010000' is sent using MSK modulation scheme. Draw the phase variation as a function of time.
- c) Find the 3dB bandwidth of 0.25 BT GMSK with a channel data rate of 270 kbps.
- d) What is the 90% power bandwidth in the RF channel?

**Occupied RF Bandwidth (for GMSK and MSK as a fraction of R_b)
Containing a Given Percentage of Power [Mur81]**

BT	90%	99%	99.9%	99.99%
0.2 GMSK	0.52	0.79	0.99	1.22
0.25 GMSK	0.57	0.86	1.09	1.37
0.5 GMSK	0.69	1.04	1.33	2.08
MSK	0.78	1.20	2.76	6.00

[(2+2) + 2 + 2 + 2 = 10]

Q7. a) What is Information? What is entropy?

b) Construct a Huffman code for 5 letters A, B, C, D, E with probabilities 0.25, 0.25, 0.25, 0.125, 0.125 respectively. Is this code uniquely decodable?

c) Find the entropy of the code.

$$[(1+2) + (3+1) + 3 = 10]$$

Q8. a) Define mutual Information between two ensemble X and Y .

b) Show that the capacity of the channel with probability transition matrix given below is achieved by a distribution that places zero probability on one of input symbols. What is the capacity of this channel?

$$\begin{bmatrix} \frac{2}{3} & 0 & \frac{1}{3} \\ \frac{1}{3} & 1 & \frac{1}{3} \\ \frac{1}{3} & \frac{2}{3} & \frac{1}{3} \\ 0 & \frac{1}{3} & \frac{2}{3} \end{bmatrix}$$

$$[2 + (5+3) = 10]$$

Q9. A linear block code is represented by (n, k, t) .

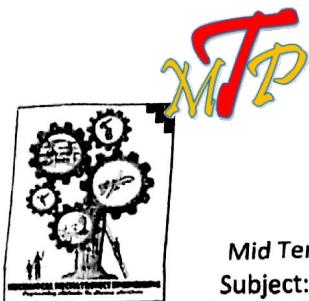
a) What is the code rate? How many errors can be corrected using such code?

b) What should be the minimum distance of separation between two code words? Draw the Hamming sphere to illustrate.

c) Write the equation for the generator polynomial $g(x)$ of the t -error-correcting BCH code and indicate all the relevant terms used in the expression explicitly.

d) Find the Hamming distance between the bit strings 01110 and 11011 and the Hamming distance between the bit strings 00000 and 11111.

$$[(1+1) + (1+1) + 3 + 3 = 10]$$



Note: Attempt any three (10 X 3)

Q.1 (a) what do you mean by factor of safety? List the important factors that influence the magnitude of factor of safety.

(b) A cantilever beam is subjected to different load as shown in Fig.1. Calculate the stresses at point A and B.

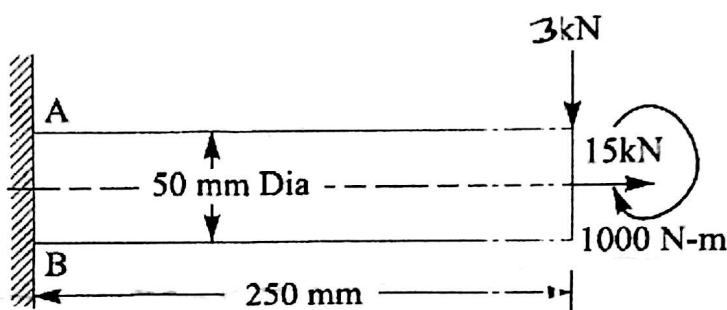


Fig.1

Sypt 2 Q.2 (a) A mild steel shaft of 50 mm diameter is subjected to a bending moment of 2000 N-m and a torque T. If the yield point of steel in tension is 200 MPa, find the maximum value of this torque without causing yielding of the shaft according to 1. Maximum principal stress 2. Maximum shear stress and 3. Maximum distortion energy theories of failure.

Sypt 2 (b) What is the necessity of having different theories of failure? Explain the graphical representation of Maximum shear stress theory.

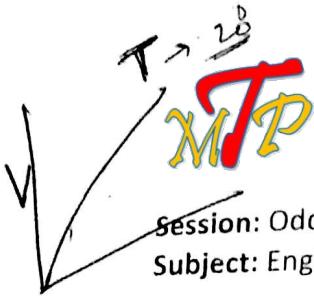
Q.3 (a) Explain in brief:

(i) Stress concentration (ii) Endurance limit (iii) S-N curve (iv) Notch sensitivity

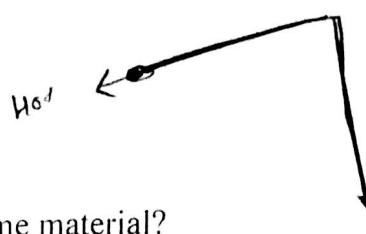
Se 1 (b) A 40mm diameter shaft is made of steel 50-C4 ($S_{ut} = 660 \text{ MPa}$) and has a machined surface. The expected reliability is 99%. The theoretical stress concentration factor for the shape of the shaft is 1.6 and the notch sensitivity factor is 0.9 Determine the endurance limit of the shaft.

Sut = 580 MPa Q.4 (a) A part made of 40 C8 steel is subjected to fatigue loading where 15 % of its life is spent at an alternating stress level 298 MPa, 30% is spent at a stress level of 325 MPa and the remaining at a stress level of 376 MPa. Determine the total number of cycles that the part can endure before final failure.

Sse - 0.5 (b) Explain the modified Goodman diagram for bending stresses.



Note: (i) Assume suitable data, if any missing
(ii) All dimensions are in mm in all three figures.



100

[10 X 1 = 10]

Q.1 Short- Answer Questions

- (a) Why is the pinion weaker than the gear made of same material?
- (b) What is Miner's equation?
- (c) What are the three basic modes of failure of mechanical component?
- (d) State maximum shear stress theory.
- (e) What is the difference between failure due to static load and fatigue failure?
- (f) How leak-proof joint can be ensured in riveted joint.
- (g) If the three principal stresses are 11 MPa, 1 MPa, and -1 MPa. Calculate the maximum shear stress.
- (h) What is herringbone gear?
- (i) Determine the diameter of the rivets those re used to joins 20 mm thick plates.
- (j) Why the radial component of gear tooth force is called 'separating' component?

Attempt any six

[6 X 10 = 60]

Q. 2 (a) A machine component is subjected to a flexural stress which fluctuates between $+300 \text{ MN/m}^2$ and -150 MN/m^2 . Determine the value of minimum ultimate strength according to (i). Gerber relation; (ii). Goodman relation; and (iii). Soderberg relation. Take yield strength = 0.55 Ultimate strength; Endurance strength = 0.5 Ultimate strength; and factor of safety = 2. [6 marks]

(b) A rod of a linkage mechanism made of steel 40 Cr1 ($S_{ut} = 550 \text{ N/mm}^2$) is subjected to a completely reversed axial load of 100 kN. The rod is machined on a lathe and the expected reliability is 95%. There is no stress concentration. Determine the diameter of the rod using a factor of safety of 2 for an infinite life condition. [4 marks]

Q. 3 (a) Define formative or virtual number of teeth on a helical gear. Derive the expression used to obtain its value. [6 marks]

(b) A pair of helical gears consists of a 25 teeth pinion meshing with a 50 teeth gear. The normal module is 4 mm. find the required value of the helix angle, if the center distance is exactly 165 mm. [4 marks]

Q. 4 (a) What do you understand by the term 'efficiency of a riveted joint'? [4 marks]

(b) Find the efficiency of the following riveted Joint:

A Double riveted lap joint of 6 mm plates with 20 mm diameter rivets having a pitch of 65 mm. Assume Permissible tensile stress in plate = 120 MPa; Permissible shearing stress in rivets = 90 MPa; Permissible crushing stress in rivets = 180 MPa [6 marks]

Q. 5 The shaft of an overhang crank subjected to a force P of 1 kN is shown in Fig.1. The shaft is made of plain carbon steel 45C8 and the tensile yield strength is 380 MPa. The factor of safety is 2. Determine the diameter of the shaft using (i) maximum principal stress theory (ii) maximum shear stress theory and (iii) maximum distortion energy theory. [10 marks]

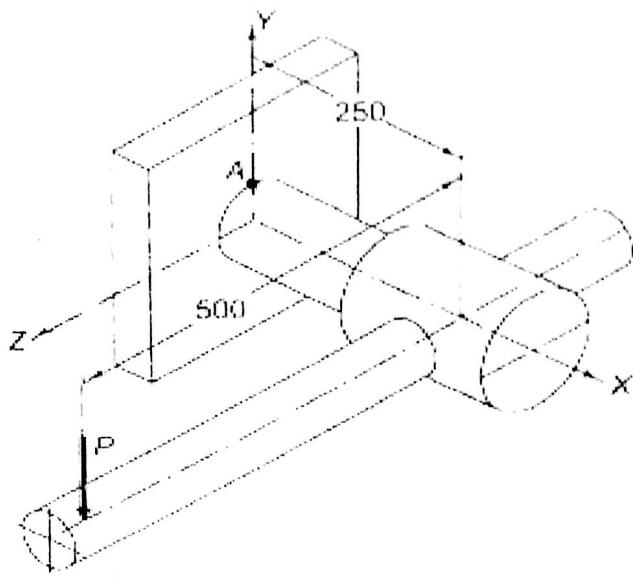


Fig. 1

Q. 6 (a) The pitch circle diameters of the pinion and gear are 100 and 300 mm respectively. The pinion is made of plain carbon steel 40 C8 ($S_{ut} = 600 \text{ N/mm}^2$) While the gear is made of grey cast iron FG 300 ($S_{ut} = 300 \text{ N/mm}^2$). The pinion receives 5 kW power at 500 rpm through its shaft. The service factor and factor of safety can be taken as 1.5 each. The face width of gear can be taken 10 times that of the module. Assume that the velocity factor accounts for the dynamic load. Calculate (i) Module (ii) Number of teeth on the pinion and gear. [6 marks]

(b) A pair of straight bevel gears consists of a 30 teeth pinion meshing with a 45 teeth gear. The module is 6 mm, while the face width of the tooth is 50 mm. The gears are made of steel ($S_{ut} = 600 \text{ N/mm}^2$). Calculate the beam strength of the tooth. [4 marks]

Q. 7(a) A pair of helical gears consists of a 26 teeth pinion driving a 104 teeth gear. The gears have a normal module of 2 mm. The pressure angle is 20° and the helix angle is 25° . The pinion receives 100 kW power through its shaft and rotates at 3600 rpm. The face width is 35mm. The gears made of alloy steel 30 Ni 4 Cr1 ($S_{ut} = 1500 \text{ N/mm}^2$) and heat treated to a surface hardness of 450 BHN. The service factor is 1.25. Determine the factor of safety against bending and against pitting failure. [6 marks]

(b) A pair of straight bevel gears is mounted on shaft, which are intersecting at right angles. The gears are made of steel and surface hardness is 300 BHN. The number of teeth on the pinion and gear are 40 and 65 respectively. The module is 3mm, while the face width of the tooth is 35 mm. Calculate the wear strength of the tooth. [4 marks]

Compulsory questions

[12 + 10 + 8 = 30]

Q. 8 It is required to design a spur gear speed reducer for a compressor running at 250 rpm. Driven by a 7.5 kW, 1000 rpm electric motor. The centre distance between axes of the gear shafts should be exactly 250 mm. The starting torque of the motor can be assumed to be 150% of the rated torque. The pressure angle is 20° . The gears made of alloy steel ($S_{ut} = 700 \text{ N/mm}^2$). The factor of safety is 2 for preliminary design based on the use of velocity factor. (i) Design the gears and specify their dimensions. (ii) If the gears are manufactured to meet the requirements of Grade 6, calculate the effective load. (For Grade 6 take $e = 8 + 0.63\epsilon$, here $\epsilon = m + \sqrt{d}$) [12 marks]

Q.9 The bracket as shown in Fig. 2, is to carry a load of 45 kN. Determine the size of the rivet if the shear stress is not to exceed 40 MPa. Assume all rivets of the same size. [10 marks]

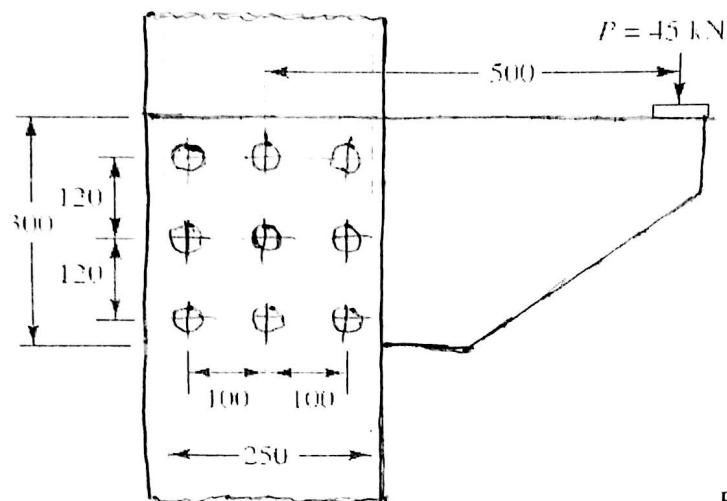


Fig. 2

Q.10 Find the value of P for the joint shown in Fig. 3 based on a working shear stress of 100 MPa for the rivets. The four rivets are equal, each of 20 mm diameter. [8 marks]

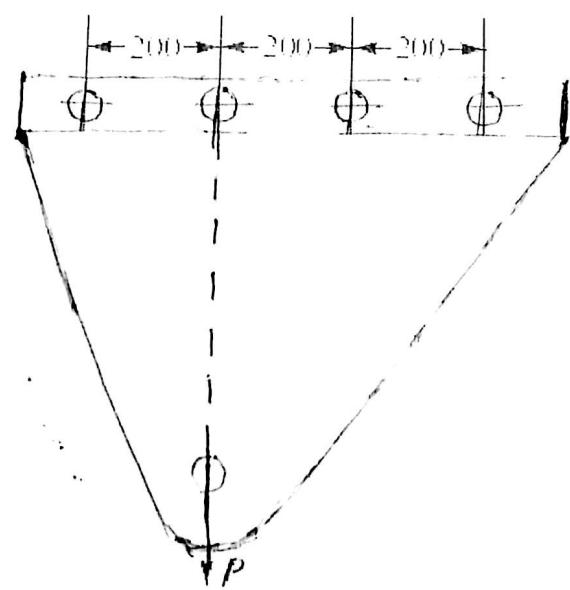


Fig. 3





The LNM Institute of Information technology Jaipur

Department of Mechanical-Mechatronics Engineering

Mid Term Examination, Odd Semester 2016
B.Tech. (MME III Year, V semester)

Course Name: Fluid Mechanics and Machinery (MME 303)

Max. Mark: 30

Time: 1.5 Hr

Day and Date: Friday, September 16, 2016

Note: (a) All questions are compulsory, (b) All questions carry equal marks, (c) Suitable assumptions can be taken for any missing data, (d) Write all steps while answering the problems.

[1] Differentiate between the Newtonian fluid and Non-Newtonian fluid? Explain the phenomena of capillary action ~~and~~ surface tension. [5 Marks]

[2] The diameter of a cylindrical water tank is D_0 and its height is H . The tank is filled with water, which is open to the atmosphere. An orifice of diameter D with a smooth entrance is open at the bottom. Develop a relation for the time required for the tank (a) to empty halfway and (b) to empty completely. [8 Marks]

[3] Water is pumped from a lake to storage tank 18 m above at a rate of 70 L/s while consuming 20.4 kW of electric power. Disregarding any frictional losses in the pipes and any changes in the kinetic energy, determine (a) the overall efficiency of the pump-motor unit and (b) the pressure difference between the inlet and the exit of the pump. [5 Marks]

[4] The velocity field for an incompressible flow is given as $\vec{V}_P = 5x^2\hat{i} - 20xy\hat{j} + 100t\hat{k}$

Determine if the flow is steady. Also determine the velocity and acceleration of at (1, 3, 3) at $t = 0.2$ s. [3 Marks]

[5] A pressure cooker cooks a lot faster than an ordinary pan by maintaining a higher pressure and temperature inside. The lid of pressure cooker is well sealed and steam can escape only through an opening in the middle of the lid. A separate metal piece, the petcock, sits on the top of this opening and prevents steam from escaping until the pressure force overcomes the weight of the petcock. The periodic escape of the steam in this manner prevents any potentially dangerous pressure build-up and keeps the pressure inside at a constant value. Determine the mass of the petcock of pressure cooker whose operation pressure is 120 kPa and has an opening cross-sectional area of 3 mm^2 . Assume an atmospheric pressure of 101 kPa and draw the free body diagram of the petcock. [8 Marks]



The LNM Institute of Information Technology, Jaipur
First Semester, 2016-2017
END SEMESTER EXAMINATION (Closed Book)

Course title: Fluid Mechanics and Machinery
Date: 28/11/2016
Time: 02.30 PM to 05.30 PM

Course code: MME303
Duration: 03 hour
Maximum marks: 70

- Each question must start on a new page and answer all parts of a question together.
- All standard notations have usual meaning unless specifically stated.
- Assume suitable data wherever necessary.
- Write all steps while answering the problems.

- Q.1. (a)** Obtain an expression for the work done per second by water on the runner of [10] Pelton wheel. Hence derive an expression for maximum efficiency of the Pelton wheel giving relationship between the jet speed to bucket speed. Draw inlet and outlet velocity triangles for a Pelton turbine and indicate the direction of various velocities.
- (b)** Describe briefly the function of various main components of Pelton wheel [10] turbine with neat sketches.
- Q.2. (a)** A Pelton wheel is working under a gross head of 400 m. The water is supplied [10] through penstock of a diameter 1 m and length 4 km from reservoir to the Pelton wheel. The co-efficient of friction for penstock is given as 0.008. The jet of water of diameter 150 mm strikes the bucket of the wheel and gets deflected through an angle of 165° . The relative velocity at outlet is reduced by 15% due to friction between inside surface of the bucket and water. If the velocity of buckets is 0.45 times jet velocity at inlet and mechanical efficiency is 85%. Determine: (i) Power given by the runner, (ii) Shaft Power and (iii) Hydraulic efficiency and overall efficiency.
- (b)** An inward flow reaction turbine has external and internal diameters as 1.0 m [10] and 0.6 m respectively. The hydraulic efficiency of turbine is 90% when the head on turbine is 36 m. The velocity of flow at outlet is 2.5 m/s and discharge at outlet is radial. If the vane angle at outlet is 15° and width of wheel is 100 mm at inlet and outlet, determine: (i) The guide blade angle, (ii) Speed of the turbine, (iii) Vane angle of the runner at inlet, (iv) Volume flow rate of turbine

- Q.3. (a)** A Kaplan turbine develops 24647.6kW power at an average head of 39 m. [05]
 Assuming a speed ratio of 2, flow ratio of 0.6, diameter of the boss is equal to 0.35 times the diameter of the runner and an overall efficiency of 90%. Calculate the diameter, speed and specific speed of the turbine.
- (b)** Show that the hydraulic efficiency for a Francis turbine having constant velocity of flow through runner is given by, [05]

$$n_h = \frac{1}{1 + \frac{\frac{1}{2} \tan^2 \alpha}{\left(1 - \frac{\tan \alpha}{\tan \theta}\right)}}$$

Where α = Guide blade angle and θ = Runner vane angle at inlet. The turbine is having radial discharge at outlet.

- Q.4. (a)** Define the term 'Governing of turbine'. Describe with a neat sketch the working of an oil pressure governor. [05]
- (b)** A straight conical draft tube attached to a Francis turbine has an inlet of diameter 3 m and its outlet area is 20 m^2 . The velocity of water at inlet 5 m/s. The inlet is set 5 m above to tail race level. Assuming the loss of head in the draft tube equals to half of velocity head at its outlet. Determine: (i) pressure head at the top of the draft tube, (ii) the total head at the top of tail race level as datum, (iii) power of water at outlet of runner, (iv) power of water at end of the draft tube and (iv) the power lost in the draft tube. [08]
- (c)** Define Specific speed of a turbine and derive an expression for it. Give brief classifications of Fluid Machines. [07]

**** END ****



The LNM Institute of Information Technology, Jaipur
Department of Mechanical-Mechatronics Engineering
End-term Examination

14/11/2016

Session : Odd Semester (2016-17) **Semester : III**
Branch : MME **Subject code : MME-204**
Subject : Manufacturing and Materials **Time : 180 mins**
Max. Marks : 50

(Date: 28/11/2016: 9.30 AM to 12.30 PM)

Instructions :

- i. All questions are compulsory.
- ii. Figures to right indicate full marks.
- iii. Draw neat sketches whenever required.
- iv. Use of Non-Programmable calculators is allowed.
- v. Clearly mention assumptions wherever required in numerical problems.

Q.1 Multiple Choice Questions. One mark each. (10)

- i. In foundry work, a runner is which one of the following: (a) channel in the mold leading from the downspurc to the main mold cavity, (b) foundryman who moves the molten metal to the mold, or (c) vertical channel into which molten metal is poured into the mold?
- ii. Which of the following rolling mill types are associated with relatively small diameter rolls in contact with the work (*two correct answers*): (a) cluster mill, (b) continuous rolling mill, (c) four-high mill, (d) reversing mill, and (e) three-high configuration?
- iii. Johnson's formula is associated with which one of the four bulk deformation processes: (a) bar and wire drawing, (b) extrusion, (c) forging, and (d) rolling?
- iv. The maximum possible draft in a rolling operation depends on which of the following parameters (*two correct answers*): (a) coefficient of friction between roll and work, (b) roll diameter, (c) roll velocity, (d) stock thickness, (e) strain, and (f) strength coefficient of the work metal?
- v. Which of the following manufacturing processes are classified as material removal processes (*two correct answers*): (a) casting, (b) drawing, (c) extrusion, (d) forging, (e) grinding, (f) machining, (g)

Page Turn Over

Session	: Odd Semester (2016-17)	Semester	: III
Branch	: MME	Subject code	: MME-204
Subject	: Manufacturing and Materials	Time	: 180 mins
Max. Marks	: 50		

molding, (h) pressworking, and (i) spinning?

- vi. Which one of the four types of chip would be expected in a turning operation conducted at low cutting speed on a brittle work material: (a) continuous, (b) continuous with built-up edge, (c) discontinuous, or (d) serrated?
- vii. Welding can only be performed on metals that have the same melting point; otherwise, the metal with the lower melting temperature always melts while the other metal remains solid: (a) true, (b) false?
- viii. Which one of the following arc-welding processes uses a nonconsumable electrode: (a) FCAW (Flux-cored arc welding), (b) GMAW (Gas metal arc welding), (c) GTAW (Gas tungsten arc welding), or (d) SMAW (Shielded metal arc welding)?
- ix. Metals that are easiest to weld in resistance welding are ones that have low resistivities since low resistivity assists in the flow of electrical current: (a) true or (b) false?
- x. A misrun is which one of the following defects in casting: (a) globules of metal becoming entrapped in the casting, (b) metal is not properly poured into the downspurce, (c) metal solidifies before filling the cavity, (d) microporosity, and (e) "pipe" formation?

- Q.2** In an orthogonal cutting operation, the rake angle = -5° , chip thickness before the cut = 0.2 mm and width of cut = 4.0 mm. The chip ratio = 0.4. Determine (a) the chip thickness after the cut, (b) shear angle, (c) friction angle, (d) coefficient of friction, and (e) shear strain. (4)
- Q.3** A cylindrical part is warm upset forged in an open die. The initial diameter is 45 mm and the initial height is 40 mm. The height after forging is 25 mm. The coefficient of friction at the die-work interface is 0.20. The yield strength of the work material is 285 MPa, and its flow curve is defined by a strength coefficient

End-term Examination

Session	: Odd Semester (2016-17)	Semester	: III
Branch	: MME	Subject code	: MME-204
Subject	: Manufacturing and Materials	Time	: 180 mins
Max. Marks	: 50		

of 600 MPa and a strain-hardening exponent of 0.12. Determine the force in the operation (a) just as the yield point is reached (yield at strain = 0.002), (b) at a height of 35 mm, (c) at a height of 30 mm, and (d) at a height of 25 mm.

- Q.4** A cylindrical billet that is 100 mm long and 50 mm in diameter is reduced by indirect (backward) extrusion to a 20 mm diameter. The die angle is 90° . The Johnson equation has $a = 0.8$ and $b = 1.4$, and the flow curve for the work metal has a strength coefficient of 800 MPa and strain-hardening exponent of 0.13. Determine (a) extrusion ratio, (b) true strain (homogeneous deformation), (c) extrusion strain, (d) ram pressure, and (e) ram force. (5)
- Q.5** A riser in the shape of a sphere is to be designed for a sand casting mold. The casting is a rectangular plate, with length = 200 mm, width = 100 mm, and thickness = 18 mm. If the total solidification time of the casting itself is known to be 3.5 min, determine the diameter of the riser so that it will take 25% longer for the riser to solidify. (3)
- Q.6** Explain in brief **any two** bulk deformation processes with neat sketch of each. (4)
- Q.7** Briefly explain with neat sketch about **SMAW** (Shielded metal arc welding), **GMAW** (Gas metal arc welding), **SAW** (Submerged arc welding), and **GTAW** (Gas tungsten arc welding) processes. (8)
- Q.8** Compare hot working and cold working processes indicating advantages and disadvantages of each. (4)
- Q.9** Write the limitation of following processes: **SMAW**, **GMAW**, **SAW**, **GTAW** and **FSW** (Friction stir welding)? (5)
- Q.10** Explain in brief about: **PESMAW**, **dual consumable arc welding & wear plate manufacturing process**. (3)

===== END =====



The LNMIIT

Microprocessor and Interface

End Semester Exam

- Note: 1. Manage the time.
2. Use the keywords rather than giving general descriptions.
3. Draw D/A, flowcharts, etc. where ever required.

Marks: 100
Time: 3 Hours
Date: 02/12/2016

Q1. Explain SIM and RIM Instruction. WAP assuming the microprocessor is completing a RST 7.5 interrupt request, check to see if RST 5.5 is pending. If it is pending, Enable RST 5.5 without affecting any other interrupts; otherwise, return to the main program. 10

Q2. Draw state transition diagram, with the help of the diagram explain the following: 15

1. Three states of HALT
2. Why DMA request has high priority, then TRAP?
3. The BIMC, ready and wait states

Q3. Draw the timing diagram of (any three among) the following instructions; 15

- a) RC
- b) MVI A, 32
- c) OUT P8
- d) RET
- e) CALL 2500

Also calculate the execution time of each instruction.

Q4. Design and interface 8 Switches and 8 LED's to 8085 using buffer and latch as input and output devices. Also write a program to take input data from switches and display it on LED connected such that S4 switch is pressed, D4 led should be on. 15

Address of input port - FF
Address of output port - FE

Q5 Design and interface 8Kx8 memory to 8085 using 2K*8 memory chips with both fully decoded and partially decoded addressing. (The starting address is 8000). 15

Q6. Explain the following in detail (including all modes, application, block dia etc.) 30

- a) PIT
- b) Data Transfer Modes
- c) KDI
- d) PPI



CLASS TEST 2

Mechatronics Systems Interface

Duration 1 Hour

Max Marks: 50

Q1. Explain how the circuit shown in figure below can be used to debounce a switch?

(10)

Q2. Describe how the displacement of the cam follower shown in figure below will vary with the angle of rotation.

(10)

Q3. Describe the basic details of poppet valve? (5)

Q4. Explain in brief about various data presentation systems? (10)

Q5. Explain what logic gates might be used to control the following situations:

- a. The issue of tickets at an automatic ticket machine at a railway station.
- b. A safety lock system for the operation of a machine tool. (5+5)

Q6. A differential amplifier is to have a voltage gain of 100. What will be the feedback resistance required if the input resistances are both 1 K ohm. (5)



LNM Institute of Information Technology, Jaipur

Department of Mechanical-Mechatronics Engineering

Mid Term Examination: 2016-17

Subject: Mechatronics System Interface

Subject Code: MME302

Total Time: 90 Minutes

Maximum Marks: 100

No. of Page/s : 02

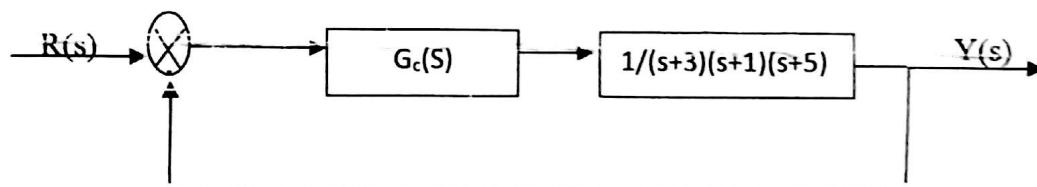
Note:

- a. The answers to be written in order of the section in the main Answer booklet.
- b. Sketch figures where necessary.
- c. All Questions are compulsory.
- d. Use separate answer sheets for Q1.
- e. Assume suitable data if required.

SECTION A [50 Marks]

Note: Answer all Questions

Q1. Design the transfer function of following plant, which is having PID controller using Ziegler-Nicholas second method. [10]



Q2. Describe the working of RVDT with a neat sketch. List the applications of potentiometer sensor in/around your home and office/university. [10]

Q3. Describe an optical fibre sensor for liquid level measurement. Comment on its range, accuracy, and resolution. [10]

Q4. How did temperature scale evolve? What are the important primary temperature sensors? Are they all useful in industrial practice?

Q5. Develop a conceptual design of a Light sensors based control system for counting the number of milk packets being packed for discharge. [10]



SECTION B [50 Marks]

Note: Answer all Questions

Q6. Explain Hall Effect. [5]

Q7. Derive the expression for the transfer function of Armature Controlled DC Motor? [5]

Q8. State Mason's Gain Formula? [5]

Q9. What is meant by Relative stability? [5]

Q10. What are the properties of State Transition Matrix? [5]

Q11. Obtain the state model of the system described by the following transfer function:

$$\frac{y(s)}{u(s)} = \frac{5}{s^3 + 6s + 7} \quad [5]$$

Q12. Check the controllability of the following state space system:

$$\dot{x}_1 = x_2 + u_2$$

$$\dot{x}_2 = x_3$$

$$\dot{x}_3 = -2x_2 - 3x_3 + u_1 + u_2 \quad [5]$$

Q13. State various principles on which a sensor can be based for the mechanical output, Electrical Output and Radian output if the input is Magnetic? [5]

Q14. What are the different measurands in mechanical, thermal and electrical sensors? Give some examples explaining their practical use? [5]

Q15. Explain sensitivity and resolution of a sensor? [5]

Quiz-I [B]

Monday, May 30, 2016

Time: 45 Minutes

Maximum Marks: 10

Name: S. A. N.Roll No.: 14UCS0001

Instructions: Tick or encircle all the correct answer/s. Any cutting/overwriting will be considered as wrong answer. Do not write anything here except the answer. No justification is required. Some questions have more than one correct options. There is no negative marking for wrong answer/s.

1. The sequence $\left\{ n^2 \sin \left(\frac{\pi}{2n^2} \right) \right\}_{n \geq 1}$ is

- (a) convergent.
- (b) bounded but not convergent.
- (c) diverges to $+\infty$.
- (d) None of these

2. The statement

$$\lim_{x \rightarrow +\infty} f(x) \neq L$$

is equivalent to

1. (a) $\exists \epsilon > 0$ such that $\forall n \in \mathbb{N}, \exists x \geq n$ such that $|f(x) - L| \geq \epsilon$.
- (b) $\forall \epsilon > 0, \exists n \in \mathbb{N}$ such that $\forall x \geq n, |f(x) - L| \geq \epsilon$.
- (c) $\forall \epsilon > 0, \forall n \in \mathbb{N}, \exists x \geq n$, such that $|f(x) - L| \geq \epsilon$.
- (d) None of these

3. The function $f : [0, 1] \rightarrow \mathbb{R}$ defined by $f(x) = \begin{cases} x & \text{if } x \text{ is rational,} \\ 1-x & \text{if } x \text{ is irrational,} \end{cases}$ is

- (a) nowhere continuous
- (b) continuous only at $x = 0, 1$
- (c) continuous everywhere
- (d) continuous only at $x = 1/2$

4. There exists a real number which is 1 more than its 7th power. True/False

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5. Let $a, b \in \mathbb{R}, a < b$ and $I_n = \left(a - \frac{1}{n}, b - \frac{1}{n} \right)$. Then $\bigcap_{n=1}^{\infty} I_n = \underline{\hspace{1cm}}$

6. Let $A, B \subset \mathbb{R}$ be bounded above. Then which of following statement/s is/are true?

- (a) $\sup A \leq \sup B$
- (b) $\sup(A \cup B) \geq \sup B$
- (c) $\inf(A \cup B) \leq \inf B$
- (d) $\max\{\sup A, \sup B\} = \sup(A \cup B)$

7. Let $\{a_n\}_{n \geq 1}$ be such that $\lim_{n \rightarrow \infty} (-1)^n a_n = L \in \mathbb{R}$. Then $\{a_n\}_{n \geq 1}$ is bounded.

True/False

8. Which of the following statement(s) is/are correct?

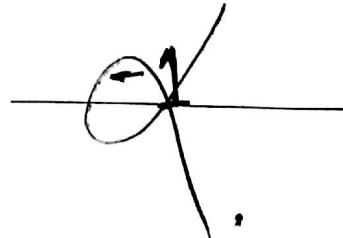
- (a) $\{a_n b_n\}_{n \geq 1}$ is convergent if $\{a_n\}_{n \geq 1}$ is convergent.
- (b) $\{a_n b_n\}_{n \geq 1}$ is convergent if $\{a_n\}_{n \geq 1}$ is convergent and $\{b_n\}_{n \geq 1}$ is bounded.
- (c) $\{a_n b_n\}_{n \geq 1}$ is convergent if $\{a_n\}_{n \geq 1}$ is convergent, $\{b_n\}_{n \geq 1}$ is bounded and monotonic.
- (d) $\{a_n b_n\}_{n \geq 1}$ is convergent if $\{a_n\}_{n \geq 1}$ is bounded, $\{b_n\}_{n \geq 1}$ is bounded and monotonic.

9. You know that $\lim_{n \rightarrow \infty} \left(\frac{n}{n+1} - \frac{n+1}{n} \right) = 0$. Now, let $\epsilon > 0$ be given. Choose the N 's which will work for the $\epsilon - N$ definition.

- (a) $N > \frac{1}{3\epsilon}$
- (b) $N > \frac{1}{2\epsilon}$
- (c) $N > \frac{1}{\epsilon}$
- (d) $N > \frac{2}{\epsilon}$
- (e) $N > \frac{3}{\epsilon}$



10. Let $A = [-1, 2]$ Then $\inf(A + \mathbb{N})$ is





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THE LNM INSTITUTE OF INFORMATION TECHNOLOGY
JAIPUR, RAJASTHAN
Mid Semester Exam

Time: 90 Minutes
Mathematics-1

12th September 2016
Maximum Marks: 50

Note: You should attempt all questions. Your writing should be legible and neat. Marks awarded are shown next to the question. Please make an index showing the question number and page number on the front page of your answer sheet in the following format, otherwise you may be penalized by the deduction of **2 marks**.

Question No.				
Page No.				

1. Show that between any two distinct real numbers there is a rational number. [6]

2. Using Sandwich theorem, discuss the convergence of the following sequence: [6]

$$x_n = \left(\sqrt{2} - 2^{\frac{1}{3}} \right) \left(\sqrt{2} - 2^{\frac{1}{5}} \right) \cdots \left(\sqrt{2} - 2^{\frac{1}{2n+1}} \right), n \in \mathbb{N}.$$

3. Using Ratio test for sequences, discuss the convergence/divergence of the following sequence: [6]

$$x_n = \frac{n^n}{(n+1)(n+2)\dots(n+n)}, n \in \mathbb{N}.$$

4. Using Root test, find whether the series [6]

$$\left(\frac{2^2}{1^2} - \frac{2}{1} \right)^{-1} + \left(\frac{3^3}{2^3} - \frac{3}{2} \right)^{-2} + \left(\frac{4^4}{3^4} - \frac{4}{3} \right)^{-3} + \dots$$

is convergent or divergent.

5. Investigate the convergence of the alternating series $\sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{n - \log n}$. [6]

6. Check the continuity of $f(x) = \sin x, x \in \mathbb{R}$ by using $\epsilon - \delta$ definition. [6]

7. Find the local extremum of the function $f(x) = \frac{1}{x^4 - 2x^2 + 7}$. [7]

8. Show that a polynomial of odd degree has at least one real root. [7]