Total No. of Pages: 2   Roll No.....................

SIXTH SEMESTER   B.Tech(MC)

MID SEMESTER EXAMINATION   March-2020

MC 304   THEORY OF COMPUTATION

Time: 1:30 Hours   Max. Marks : 25

Note :Answer all questions. Assume suitable missing data, if any.

Q.1 State True/False with justification.   (5)

i.   A regular grammar can be converted to an equivalent DFA and vice-versa.

ii. Two grammars of different type can generate the same language.

iii. Mealy and Moore machines are equivalent.

iv. An NDFA is a more general machine without being more powerful.

v.   Can we construct an NDFA that accepts {ab, abc}* with fewer than 3 states.

Q.2 Prove that the two state automata (A) and (B) given below are equivalent .   (5)
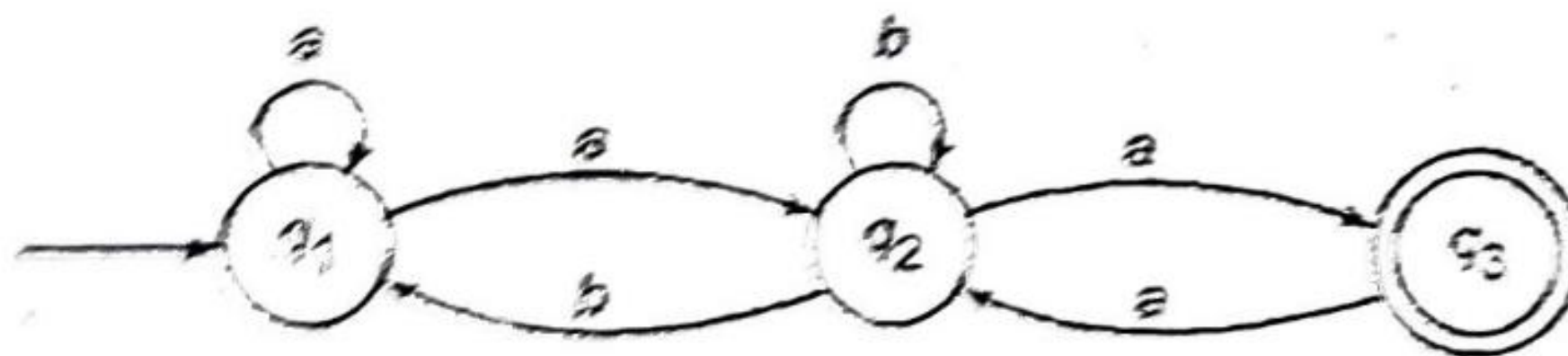
(A)
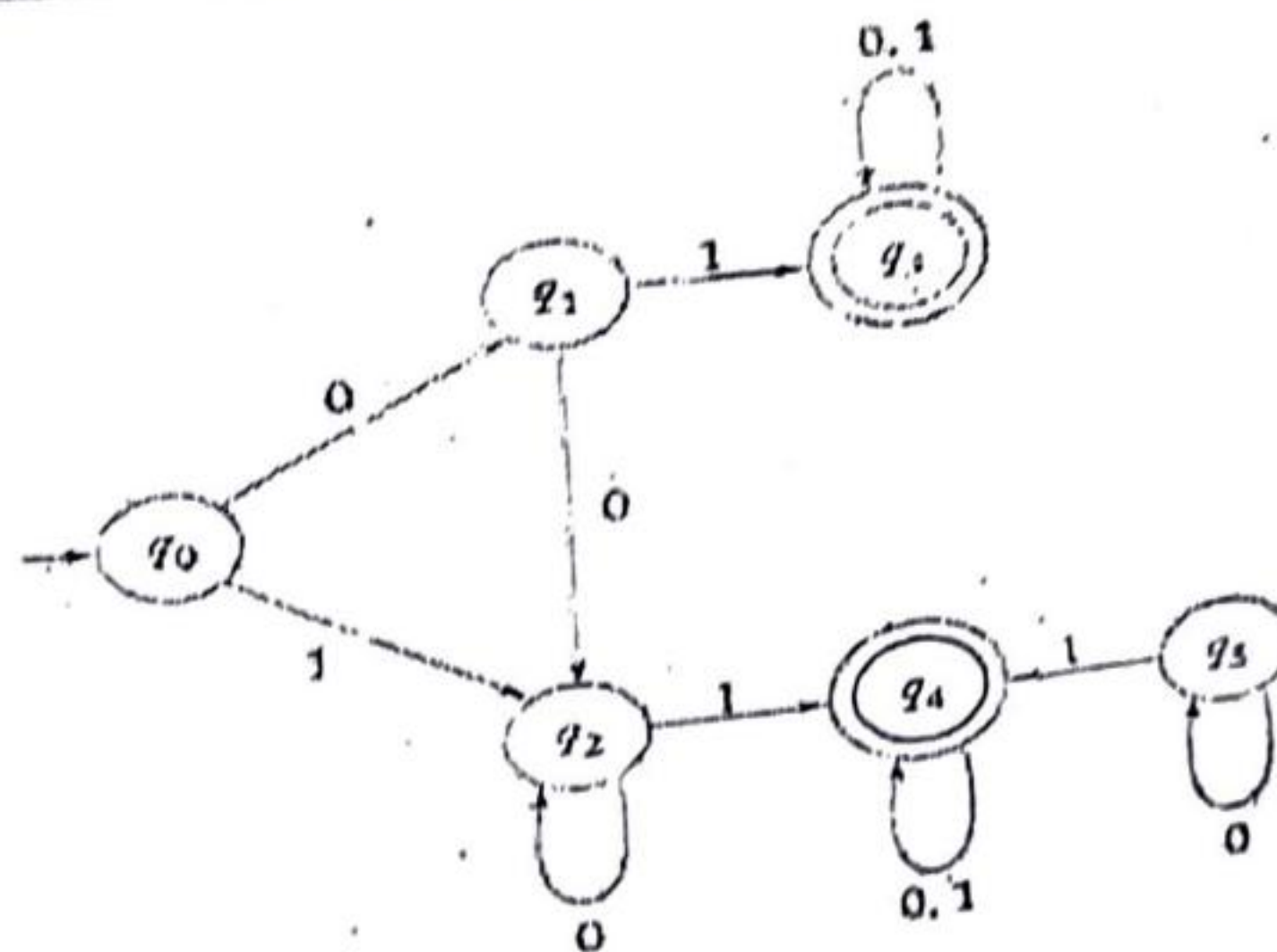
(B)
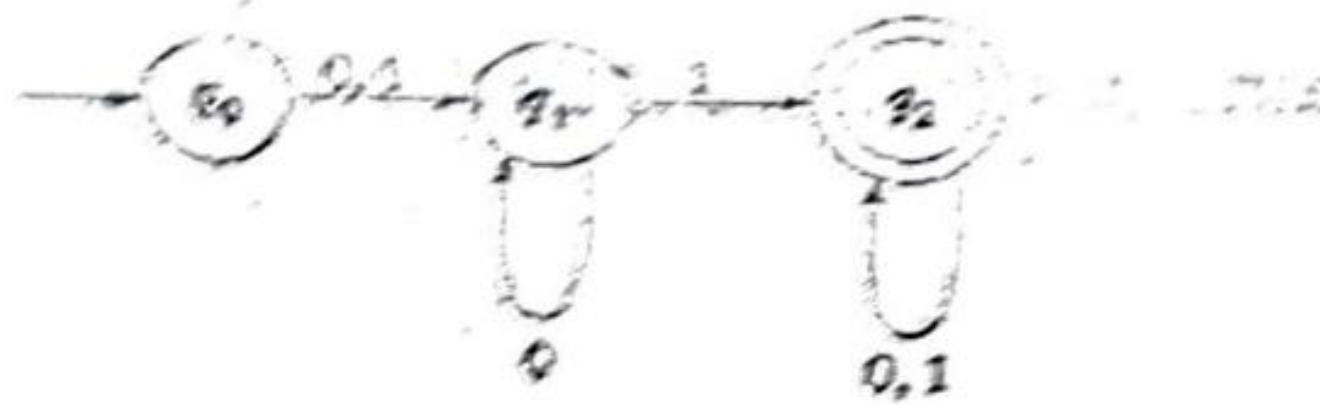
Q.3 Explain Chomsky Classification of languages using suitable examples. (5)

Q.4 Show that Type 1 and Type 3 languages are closed under concatenation operation. (5)

Q.5 State the Arden's Theorem. Using it's algebraic method, construct the regular expression for the state diagram below: (5)

Total no. of pages :1   Roll No._____

6th SEMESTER   B.Tech (MC- Engg.)

MID SEMESTER EXAMINATION   MAR 2020

MC – 306   Financial Engineering

Time : 90 mins   Max. Marks: 25

Note: Attempt all questions. All question carry equal marks. Assume missing data , if any.

1. Let $S(0) = Rs.105, u = 1.09, d = 0.85$ and $r = 5\%$. Consider a call option with strike price $K = Rs.120$ and $T = 1$. Find the option price and the replicating strategy.   **5**

2. Let the risk free continuous compounding interest rate is 7% and current price of a stock is $S(0) = RS.55$. Determine the 6-month forward price F of a forward contract on the given stock.   **5**

3. (a) Define & explain the No-Arbitrage principle of financial market.   **2.5**
   (b) Define risk neutral probability measure and obtain its expression.   **2.5**

4. A non-dividend paying stock is currently selling at $Rs.110$ with annual volatility 15%. Assume the continuously compounded risk free interest rate is 6%. Using a two period CRR binomial option pricing model find the price of one European call option on this stock with a strike price of $Rs.110$ and time to expiration 2 years.   **5**

5. The stock price is $Rs.75$. The annual continuously compounded risk free interest rate is 6.3% and the annual volatility relevant for the Black-Scholes formula is 17%. Call options are written with a strike price of $Rs.85$ and time to expiration of 2 years. Use Black-Scholes formula to find the price of one such call and put option   **5**

Total No. of Pages: 1

6th Semester

Mid Semester Examination

Roll No...............

B. Tech.

(March-2020)

MC 310: Software Engineering

Time: 1:30 Hours

Max. Marks: 25

Note: *All questions are compulsory. Figures in the right margin indicate marks.*

1. Answer the following questions: (1 x 5)
   (a) What is the most important feature of the spiral model?
   (b) Why is it desirable to have a module having low coupling and high cohesion?
   (c) What is the purpose of problem partitioning?
   (d) Define a software metric.
   (e) Write the desirable characteristics of an SRS document.

2. Answer the following questions: (2 x 5)
   (a) Discuss briefly the major areas of applications of a software.
   (b) Contrast between functional and object oriented approaches of system design.
   (c) Give two non-functional requirements and briefly explain their implications to system design?
   (d) What do you think happens when requirement validation reveals an error? Who is involved in correcting the error?
   (e) What do you understand by modularity in software development? Why is it needed?

3. What is requirements engineering? Describe the various steps of requirements engineering process. (5)

4. Describe prototyping model of software development. Under what circumstances this model is suitable over other models? (5)

-End-

B. Tech. [MC]   6th *Semester*
End Semester Examination   *(May-2018)*
MC-302 Database Management System
Time 3h 00 min.   *Max. Marks: 40*

> **NOTE:**   *Attempt any five Questions. Assume suitable missing data if any.*

Q1. A) Consider a university database for the scheduling of classrooms for final exams. This database could be modelled as the single entity set exam, with attributes course-name, section-number, room-number, and time. Alternatively, one or more additional entity sets could be defined, along with relationship sets to replace some of the attributes of the exam entity set, as

• course with attributes: name, department, and c-number

• section with attributes: s-number and enrolment, and dependent as a weak entity set on course

• room with attributes: r-number, capacity, and building

Show an E-R diagram illustrating the use of all three additional entity sets listed.   [5 marks]

B) What is an entity type? What is an entity set? Explain the differences among an entity, an entity type, and an entity set.   [3 marks]

Q2. A) Consider the following Resort, Suite, Reservation and Visitor schemas in a DBMS.   [6 marks]

RESORT (resortNo, resortName, resortType, resortAddress, resortCity, numSuite)

SUITE (suiteNo, resortNo, suitePrice)

RESERVATION (reservationNo, resortNo, visitorNo, checkIn, checkout, totalVisitor, suiteNo)

Visitor (visitorNo, firstName, lastName, visitorAddress)

P.T.O

-37-

B) Consider the transactions T1, T2, and T3 and the schedules S1 and S2 given below. Draw the serializability (precedence) graphs for S1 and S2 and state whether each schedule is serializable or not. If a schedule is serializable, write down the equivalent serial schedule(s). [4 marks]

```
T1: r1(X); r1(Z); w1(X); w1(Z)
T2: r2(Y); r2(Z); w2(Z)
T3: r3(Y); r3(X); w3(Y)
S1: r1(X); r3(Y); r3(X); r2(Y); r2(Z);
    w3(Y); w2(Z); r1(Z); w1(X); w1(Z)
S2: r1(X); r3(Y); r2(Y); r3(X); r1(Z);
    r2(Z); w3(Y); w1(X); w2(Z); w1(Z)
```

Q7. Write short note on any two of the following: [8 marks]

a) Primary Index

b) Secondary index

c) View Serializable Schedule

i) Write the SQL to list full details of all the resorts in Jaipur.
ii) Write the SQL to list full details of all the resorts having number of suites more than 30.
iii) Write the SQL to list visitors in ascending order by first name.

B) How does SQL allow implementation of the entity integrity and referential integrity constraints? [2 marks]

Q3. A) Consider the relation: BOOK (Book_Name, Author, Edition, Year). With the data: [5 marks]

Book_Name	Author	Edition	Copyright_Year
DB_fundamentals	Navathe	4	2004
DB_fundamentals	Elmasri	4	2004
DB_fundamentals	Elmasri	5	2007
DB_fundamentals	Navathe	5	2007

a) Based on the common sense understanding of the above data, what are the possible candidate keys for this relation?
b) Justify that this relation has the MVD {Book_Name} $\twoheadrightarrow$ {Author}| {Edition, Year}.
c) What would be the decomposition of this relation based on the above MVD? Evaluate each resulting relation for the highest normal form it possesses.

B) Consider the universal relation R = {A, B, C, D, E, F, G, H, I, J} and the set of functional dependencies F = {{A, B} -> {C}, {A} -> {D, E}, {B} -> {F}, {F} -> {G, H}, {D} -> {I, J}}. What is the key for R? Decompose R into 2NF, then 3NF relations. [3 marks]

Q4. A) Consider a disk with block size B=512 bytes. A block pointer is P=6 bytes long, and a record pointer is PR =7 bytes long. A file has r=30,000 EMPLOYEE records of fixed-length. Record size R = 115 bytes long.

(a) Calculate the blocking factor bfr and the number of file blocks b assuming an unspanned organization.

(b) Suppose the file is ordered by the key field SSN of size 9 bytes and we want to construct a primary index on SSN. Calculate
(i) the index blocking factor bfr_i (which is also the index fan-out fo);
(ii) the number of first-level index entries and the number of first-level index blocks;
(iii) the number of levels needed if we make it into a multi-level index;
(iv) the total number of blocks required by the multi-level index; and
(v) the number of block accesses needed to search for and retrieve a record from the file--given its SSN value--using the primary index. [6 marks]

B) A STUDENT file with Rollno as the key field includes records with the following Rollno values: 70, 15, 20, 35, 18, 55, 43. Suppose that the search field values are inserted in the given order in a B+ tree of order p=3; show the tree after inserting these values. [2 marks]

Q5. A) List the ACID properties. Explain the usefulness of each. [4 marks]

B) When a transaction is rolled back under timestamp ordering, it is assigned a new timestamp. Why can it not simply keep its old timestamp? [2 marks]

C) Under what conditions is it less expensive to avoid deadlock than to allow deadlocks to occur and then to detect them? [2 marks]

Q6. A) Consider the two tables T1 and T2 shown in figure. Show the results of the following questions: [4 marks]

Table T1

P	Q	R
10	a	5
15	b	8
25	a	6

Table T2

A	B	C
10	b	6
25	c	3
10	b	5

i) $T1 \bowtie_{T1.P=T2.A} T2$

ii) $T1 \cup T2$

iii) $T1 \bowtie_{T1.P=T2.A} T2$

iv) $T1 \bowtie_{T1.P=T2.A \text{ AND } T1.R=T2.C} T2$

END SEMESTER EXAMINATION

MAY 2018

MC 304 THEORY OF COMPUTATION

Time: 3 Hours

Max.Marks: 50

Note:Answer **ALL** by selecting any **TWO** parts from each question.
All questions carry equal marks.

Q1(a). $M = (\{q_1, q_2, q_3\}, \{0,1\}, \delta, q_1, \{q_3\})$ is a nondeterministic finite automaton, where δ is given by

$$\delta(q_1, 0) = \{q_2, q_3\}, \quad \delta(q_2, 0) = \{q_1, q_2\}, \quad \delta(q_3, 0) = \{q_2,\}$$
$$\delta(q_1, 1) = \{q_1\}, \quad \delta(q_2, 1) = \emptyset, \quad \delta(q_3, 1) = \{q_1, q_2\}$$

Construct an equivalent DFA.

(b) Construct a nondeterministic finite automaton accepting the set of all strings over $\{a, b\}$ ending in aba. Use it to construct a DFA accepting the same set of strings.

(c) Construct a Moore machine equivalent to the Mealy machine M defined by Table below:

Present State	Next State			
	$a = 0$		$a = 1$	
	State	output	state	output
$\rightarrow q_1$	q_1	1	q_2	0
q_2	q_4	1	q_4	1
q_3	q_2	1	q_3	1
q_4	q_3	0	q_1	1

Q2(a). State whether the statements are true or false. Give reason for the answer.

i. If a grammar G has three productions $S \to aSa, S \to bSb, S \to c$ then $abcba$, $bacab \in L(G)$.

ii. $\{a^n b^n : n \geq 1\}$ is regular

iii. If $G = (V_n, \Sigma, P, S)$ and $P \neq \emptyset$, then $L(G) \neq \emptyset$

iv. Two grammars of different types can generate the same language.

v. If a grammar G has productions $S \to aS, S \to bS, S \to a$, then $L(G)$ is the set of all strings over $\{a, b\}$ ending in a.

(b) Define equivalent grammars. Show that $G_1 = (\{S\}, \{a, b\}, P_1, S)$, where $P_1 = \{S \to aSb, S \to ab\}$ is equivalent to $G_2 = (\{S, A, B, C\}, \{a, b\}, P_2, S)$, where P_2 consists of $S \to AC$, $S \to AB, C \to SB, A \to a, B \to b$.

(c) Define context-free grammar. Construct CFG to generate the set of all strings over $\{0,1\}$ containing twice as many 0's as 1's.

Q3 (a) State and prove Kleene's theorem.

(b) State Pumping lemma for regular set. Prove that $L = \{0^i 1^i : i \geq 1\}$ is not regular.

(c) By constructing transition system, prove that $(a + b)^* = a^* (ba^*)^*$

Q4 (a) Given the grammar $S \to AB, A \to a, B \to C/b$, $C \to D, D \to E$, $E \to a$, Find an equivalent grammar which is reduced and has no unit productions.

(b) Reduce the following grammar to CNF:
$S \to S+S, \ S \to S * S, \ S \to a, \ S \to b$.

(c) Reduce the following grammar to GNF:
$S \to AB, A \to BSB, A \to BB, B \to aAb, B \to a, A \to b$.

Q5(a) Prove that if a pda $A = (Q, \Sigma, \Gamma, \delta, q_0, Z_0, F)$ accepts L by final state, then we can construct a pda B accepting L by empty store.

(b) Construct a pda A equivalent to the following CFG:
$S \to 0BB, B \to 0S / 1S / 0$. Test whether 010000 is in N(A).

(c) Consider the Turing machine M described by the transition table below. Describe the processing of (i) 011, (ii) 0011, (iii) 001 using ID's. Which of the above are accepted by M.

Present State			Tape Symbol		
	0	1	x	y	b
$\to q_1$	xRq_2				bRq_5
q_2	$0Rq_2$	yLq_3		yRq_2	
q_3	$0Lq_4$		xRq_5	yLq_3	
q_4	$0Lq_4$		xRq_1		
q_5				yRq_5	bRq_6
q_6					

END

Roll No............

B. Tech.
(May-2018)

MC 310: Software Engineering

Time: 3 Hours

Max. Marks: 50

Note: Attemt any five questions. Each question carries equal marks.

1. (a)   What do you understand by a software life cycle model? What problems might occur if a software development organization does not use any specific life cycle model?

    (b) Discuss quality function deployment technique of requirements elicitation. Why an importance or value factor is associated with every requirement?

2. (a)   Discuss the prototype model. What is the effect of designing a prototype on the overall cost of the software project?

    (b)   What are size metrics? How is function point metric is advantageous over LOC metric?

3. Given the following, create a context-level DFD for a university library system.

The system must record the books owned by the library. The library manager will update this list of books on a regular basis. The system must record who has borrowed what books, and which books have been returned. Before someone can borrow a book, they must show a valid ID card that is checked to ensure that it is still valid against the student database maintained by the Registrar's Office (for student borrowers), the faculty/staff database maintained by the Personnel Office (for faculty/staff borrowers), or against the library's own guest database (for individuals issued a "guest" card by the library). The system must also check to ensure the borrower does not have any overdue books or unpaid fines before he or she can borrow another book. Every Monday, the library prints and mails postcards to those

people with overdue books. If a book is overdue by more than two weeks, a fine will be imposed. Sometimes books are lost or are returned in damaged condition. The manager must then remove them from the database and will sometimes impose a fine on the borrower.

4. (a) Explain, with an example, how an intermediate COCOMO provides more accurate estimates as compare to basic COCOMO.

(b) Explain with examples, top down, bottom up and hybrid approaches of software design.

5. (a) Define module cohesion and explain defferent types of cohesion. If a module has logical cohesion, what kind of coupling is this module likely to have with others?

(b) For a program with number of unique operators $\eta_1 = 30$ and number of unique operands $\eta_2 = 50$, compute the program volume, effort and time, program length and program level.

6. (a) Define the terms 'software reliability' and 'software quality'. How can these be measured ?

(b) Differentiate between alpha testing and beta testing and explain black box testing.

7. (a) Explain Boehm software quality model.

(b) Explain equivalence class testing and integration testing.

Total no. of pages :2
6th SEMESTER
END SEMESTER EXAMINATION

Roll No._____

B.Tech (MC- Engg.)
May 2018

MC – 306   Financial Engineering

Time : 3 hrs

Max. Marks: 50

Note: *Q.No.1 is compulsory, answer any other three questions. All questions carry equal mark. Statistical table is allowed. Assume missing data , if any.*

1. (a) The current price of silver is $Rs.\,5000$ per 100gm. The storage cost is $Rs.\,0.60$ per gm per year payable quarterly in advance. Assuming that constant interest rate of 9% compounded quarterly, calculate the forward price of silver for 1kg for delivery in 6 months.

   (b) Consider purchase of 100 units of 3-month Rs.25-strike European call option.   It is given that the stock is currently selling for Rs.20; the continuous compounding risk free interest is 5%; the stocks volatility is 24% per annum. If the stock pays dividends continuously at the rate of 3% per annum, determine the price of block of 100 call options, assuming the Black-Scholes framework.

   (c) Let $X(t) = \mu t + \sigma W(t), -\infty < \mu < \infty, 0 < \sigma < \infty$. Prove that $\{X(t), t \geq 0\}$ is a martingale for $\mu = 0$.

   (d) Prove that if short sales are not allowed then the risk of the portfolio can not exceed the greater of the risks of the individual components of the portfolio.

2. (a) State and prove Put-Call parity formula.

   (b) Consider a stock whose value $S(t)$ follows sde $dS = r.\,Sdt + \sigma.\,SdW$ and has a current price $S(0)$. What is the probability that a call option is in the money based on a strike price $K = 1.25\,S(0)$ at time of expiration T? Given that $T = 0.5, r = 0.04$ and $\sigma = 0.10$.

3. (a) Find the stochastic differential of $W^2(t)$.

(b) Use the first version of Ito-Doeblin formula to evaluate
$\int_0^T 3W^3(t)dW(T)$

4. (a) Let $B(0) = Rs. 100, B(1) = Rs. 110 \ and \ S(0) = Rs. 82$.
$S(1) = \begin{cases} Rs. 95, & with \ probability \ p = 0.80 \\ Rs. 70, & with \ probability \ p = 0.20. \end{cases}$
For K = Rs.90 and T = 1 year, determine P(0).

(b) Derive the expression for line which converts into Capital Market line. Explain the condition of CML with respect to efficient frontier.

5. (a) Find the expression for feasible region of 'n' asset portfolio in (σ, μ) − plane , and describe it.

(b) Suppose the portfolios are constructed using three securities al, a2, a3 with expected returns, $\mu_1 = 20\%, \ \mu_2 = 13\%, \ \mu_3 = 4\%$ standard deviations of returns,
$\sigma_1 = 25\%, \ \sigma_2 = 28\%, \ \sigma_3 = 20\%,$ and the correlation between returns, $\rho_{12} = 0.3, \ \rho_{13,} = 0.15$ and $\rho_{23} = 0.4$. What are the weights of the three securities in this portfolio with minimum risk, While desired expected return is 20%.

OLD

END SEMESTER EXAMINATION   MAY 2018

MC- 314 THEORY OF COMPUTATION

Time: 3 Hours   Max.Marks: 70

Note:Answer **ALL** by selecting any **TWO** parts from each question.
All questions carry equal marks.

Q1(a) Define NDFA. Prove that for every NDFA, there exists a DFA which simulates the behaviour of NDFA.

(b) Define Mealy machine. Construct a Mealy machine which is equivalent to the Moore machine defined below:

Present State	Next State		Output
	a=0	a=1	
q_0	q_1	q_2	1
q_1	q_3	q_2	0
q_2	q_2	q_1	1
q_3	q_0	q_3	1

(c) Write all the steps involved in constructing minimum automaton. Construct a minimum automaton equivalent to a DFA whose transition table is defined below.

State	a	b
→ q_0	q_1	q_2
q_1	q_4	q_3
q_2	q_4	q_3
(q_3)	q_5	q_6
(q_4)	q_7	q_6
q_5	q_3	q_6
q_6	q_6	q_6
q_7	q_4	q_6

Q2(a) Define a Grammar and derivation in a grammar. Find the language generated by the grammar

(i) $S \to 0S1, S \to 0A1, A \to 1A, A \to 1$
(ii) $S \to 0A, S \to 1S, S \to 0, S \to 1, A \to 1A, A \to 1S, A \to 1$

(b) Define equivalent grammars. Show that $G_1 = (\{S\}, \{a, b\}, P_1, S)$, where $P_1 = \{S \to aSb, S \to ab\}$ is equivalent to $G_2 = (\{S, A, B, C\}, \{a, b\}, P_2, S)$, where P_2 consists of $S \to AC, \ S \to AB, C \to SB, A \to a, B \to b$.

(c) Show that the set of context-free languages is closed under concatenation and transpose operation.

Q3. (a) State and prove Pumping Lemma for regular sets. Show that

$\{w \in \{a, b\}^* : w \text{ contains an equal number of } a's \text{ and } b's\}$ is not regular.

(b) Prove the following:

(i) $P + PQ^*Q = a^*bQ^*$, where

$P = b + aa^*b$ and Q is any regular expression.

(ii) $\Lambda + 1^*(011)^*(1^*(011)^*)^* = (1 + 011)^*$

(iii) If $G = (\{ S, C \}, \{ a, b \}, P, S)$, where P consists of $S \to aCa, C \to aCa/b$ then

$$L(G) = \{ a^n b a^n : n \geq 1 \}$$

(c) State and prove Arden's theorem. Describe the algebraic methods using Arden's theorem to find the regular expression recognized by a transition system.

Q4 (a) Let G be the grammar $S \to 0B/1A, \ A \to 0/0S/1AA,$ $B \to 1/1S/0BB$. For the string 00110101, find the left most and the right most derivation. Also find the derivation tree.

(b) Reduce the following grammar into CNF:
$S \to aAbB, A \to aA/a, B \to bB / b.$

(c) Construct a reduced grammar equivalent to the grammar

$S \to aAa, \ A \to Sb/bCC/DaA, \ C \to abb/DD, \ E \to aC, \ D \to aDA.$

Q5(a) Prove that if L is a context-free language, then we can construct a pda 'A' accepting L by null store.

(b) Let A= (Q, Σ, Γ, δ, q_0, Z_0, F) be a PDA. Prove that if $(q, x, \alpha) \vdash^* (q', \Lambda, \gamma)$ then$\forall$ $\beta \in \Gamma^*$, $(q, x, \alpha \beta) \vdash^* (q', \Lambda, \gamma \beta)$. Show by an example that converse need not be true.

(c)) In how many ways a Turing machine can be described? Explain with suitable examples.

END

Total no. of pages :2
5th SEMESTER
END SEMESTER EXAMINATION

Old

Roll No._____

B.Tech (MC- Engg.)
Nov 2018

MC – 303   Financial Engineering
(Old Scheme)

Time : 3 hrs   Max. Marks: 70

Note: Q.No.1 is compulsory, answer any **other three** questions.
Statistical table is allowed. Assume missing data, if any.

1. (a) The current price of silver is $12 per ounce. The storage costs are $0.25   **4**
per ounce per year payable quarterly in advance. Assuming that interest
rates are 10% per annum for all maturities, calculate the futures price of
silver for delivery in nine months.

(b) A stock price is currently $50. Assume that the expected return from the   **6**
stock is 18% per annum and its volatility is 30% per annum. What is the
probability distribution for the stock price in two years? Calculate the
mean and standard deviation of the distribution. Determine the 95%
confidence interval.

(c) Consider a portfolio of two assets a_1 & a_2 with the following statistical   **6**
parameters μ_1 =10%, μ_2 =5% , σ_1=10% , σ_2=20% , ρ_{12} = -0.05 . Find the
value of minimum risk, the expected return and weight of the assets.

(d) The stock price is Rs.260. A 6-month European call option on the stock   **6**
with strike price Rs.256 is priced using Black-Scholes formula. It is given
that the continuously compounding risk free rate is 4%, stock pays no
dividend. The volatility of the stock is 25%. Determine the price of call and
put options.

(e) Evaluate the integral   **6**
$\int_0^T V(t)\, dW(t)$ using the Ito-Doeblin formula.

2. (a) Obtain Cox-Ross-Rubinstein (CRR) formula for European option pricing for   **7**
binomial approximation.

(b) Let S(0) = 100 dollars, u = 0.2, d = −0.1 and r = 0.1. Consider a call option
with strike price X = 120 dollars and exercise time T = 2. Find the option
price and the replicating strategy.

3. (a) Prove that $W^2(t) - t, t \geq 0$ is a Martingale, where {W(t), t≥0} is a Brownian
motion.

(b) Let S(t), stock price at time t, satisfy the stochastic d.e.
dS(t)=μS(t)dt + σS(t)dW(t) , find the strong solution of S(t).

4. (a) If S(0) is the price of asset at t=0, then prove that the forward price will be
$$F(0,T) = \frac{S(0)}{d(0,T)}$$
d(0,T) is the discount factor between t=0 to t=T.

(b) Let A(0) = 100, A(1) = 110, S(0) = $100, strike price Rs.90 and
$$S(1) = \begin{cases} 110 & \text{with probability} \quad .6 \\ 80 & \text{with probability} \quad .4 \end{cases}$$
find call and put option price.

5. (a) Prove that portfolio with minimum risk has weights given by
$$w = \frac{C^{-1}e}{e^T C^{-1}e},$$
where C is variance and covariance matrix, and e^T = (1,1,...1) ∈ R^n.

(b) Using the following data:

Scenario	Probability	Return $K1$	Return $K2$
ω1 (recession)	0.3	−10%	20%
ω2 (stagnation)	0.3	5%	20%
ω3 (boom)	0.4	20%	10%

Find the weights in a portfolio with expected return μ_v =40% and compute
the risk of this portfolio

Total No of Pages 02

SEMESTER- THIRD

END SEMESTER EXAMINATION

Roll. No.....................

B.TECH

Nov-Dec.-2018

— 466 —

HU-201 ENGINEERING ECONOMICS

Time: 03: 00 Hours

Max.Marks: 50

Note: *Answer any five questions. Assume suitable missing data if any.*

1(a) Break-even analysis is a very important analytical technique used to study the relationships   5
between costs, revenues and profits. Explain

1(b) A manufacturer has following option   5

	Purchase from the market (in Rs.)	Manufacture within the company (in Rs.)
Selling price /unit	6000with 18% GST per unit	-
Cost of Machine-1	-	4040440 with 18 % GST
Cost of Machine -2	-	220400 with 12% GST
Cost of raw material/unit		999 with 10% and 08% GST

Annual demand is 1000 units. Suggest to the manufacturer whether he should manufacture or purchase?

2(a) What is the rational for government intervention in the market? In the light of these how would you   5
justify the recent move towards demonetization in the Indian economy?

2(b) A transport company has been looking for a new tyre for its truck and has located the following   5
alternatives:

Brand	Tyre warranty (months)	Price per tyre (in Rs.)
A	12	1,200
B	24	1,800
C	36	2,100
D	48	2,700

If the company feels that the warranty period is a good estimate of the tyre life and that a nominal interest rate (compounded annually) of 12% is appropriate, which tyre should it buy?

3(a) Discuss the nature of soft drink market in India. What incentive may be given by the   5
Government to encourage Indian producers?

3(b) A company must decide whether to buy Machine A or Machine B: 5

|	Machine A	Machine B
Initial Cost	Rs. 4,00,000	8,00,000
Useful life, in years	4	4
Salvage value at the end of machine life	Rs. 2,00,000	Rs. 5,50,000
Annual maintenance cost	Rs. 40,000	0

At 12% interest rate, which machine should be selected? (use future worth method of comparison

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4(a)   Explain the role of risk, uncertainty and innovation in the determination of profit.

4(b)   A Company wants to deposit money to create an R&D reserve. The company will get 15,00,000 every year for next 15 years for R&D. The reserve will grow at the rate of 12 per cent annually. Find out the single payment which should be made now.

5(a)   Environmental problems are macro level problems. Discuss the role of appropriate technology in this regard. Also suggest framework to impose taxes to control environmental hazards.

5(b)   A firm, Prime Manufacturing is planning to expand its production operation. It has identified 5 three machines which are technologically capable to serve the purpose. The initial outlay and annual revenues with each of the machines are given below:

	Initial Outlay (Rs.)	Annual revenue	Life (in years)
Machine I	Rs. 5,45,000	Rs. 2,50,000	15
Machine II	Rs. 6,14,000	Rs. 3,30,000	12
Machine III	Rs. 6,00,900	Rs. 3,50,000	10

If the rate of interest is 12%, which machine the company should opt for? Find out the result by Present Worth method.

6(a)   If you are CEO of an MNC, discuss Business Risk which you will consider while deciding   5 location for your foreign venture.

6(b)   Consider following cash flow diagram. Calculate the total amount at the end of the 10th year at   5 the interest rate of 15%, compounded annually.

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0   1   2   3                        10 yr



                                              4000


  8500  8,000 7500
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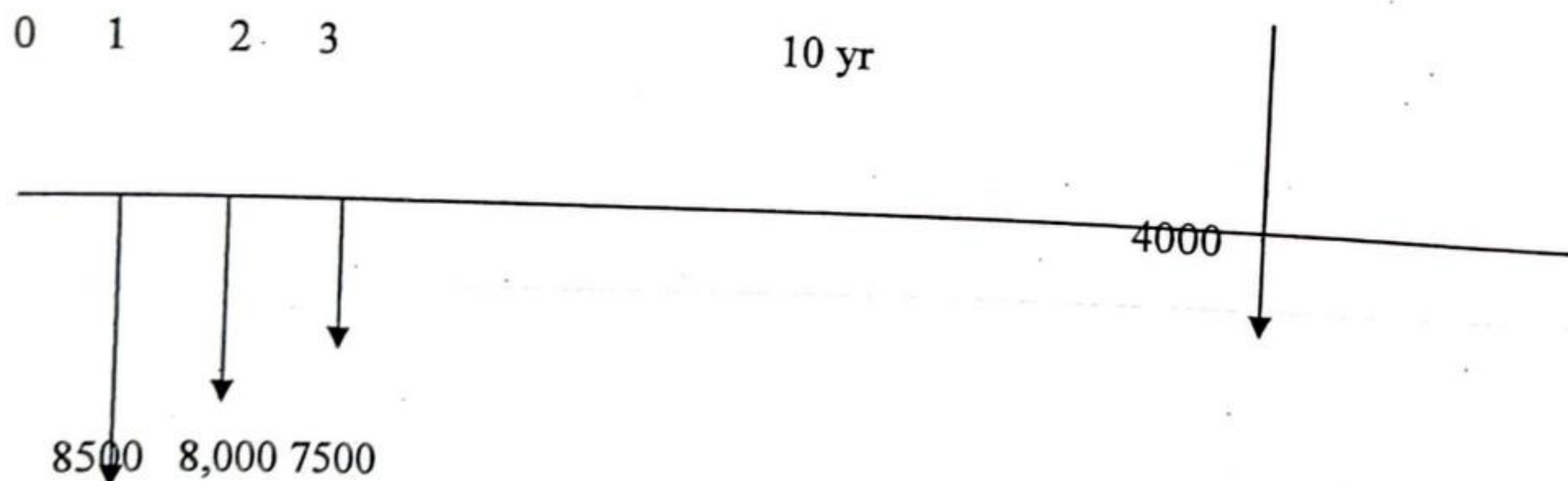
7(a)   Discuss application of Engineering & Technology to improve life at slum.

7(b)   Discuss salient feature of the Indian Economy   5

                                                                                             5

Total no. of pages :2

Roll No._____

5th SEMESTER

END SEMESTER EXAMINATION

B.Tech (MC- Engg.)

Jan 2021

MC – 303   Financial Engineering

Time : 3 hrs

Max. Marks: 70

Note: Q.No.1 is compulsory, answer any other three questions.
Statistical table is allowed. Assume missing data , if any.

1. (a) The current price of gold is Rs.25000 per 10 gm. The storage cost is   4
Rs.200 per gm per year payable quarterly in advance. Assuming that
constant interest rate of 9% compounded quarterly, calculate the
forward price of gold for delivery in nine months.

(b) A non-dividend paying stock is currently selling at Rs. 100 with annual   6
volatility 20%. Assume that the continuously compounded risk-free
interest rate is 5%. Using a two period CRR binomial option pricing model,
find the price of one European *call option* on this stock with a strike price
of Rs. 80 and time to expiration 4 years.

(c) Consider a portfolio of two assets a_1 & a_2 with no short sell, with the   6
following statistical parameters μ_1 =5% , μ_2 =10% , σ_1=10% , σ_2=40% ,
ρ_{12} = -0.05 . Find the value of minimum risk, the expected return and
weight of the assets.

(d) The stock price is Rs.100. The annual continuously compounded risk free   6
interest rate is 5% and the annual volatility relevant for the Black Scholes
formula is 30%. Call options are written with a strike price of Rs.80 and
time to expiration of 5 years. The stock will pay a dividend of Rs.20 In 2
years and another dividend of Rs. 30 in 3 years. Use the Black – Scholes
formula to find the price of one such call option.

(e) Find the stochastic differential equation of $Cos(W(t))$ 6
using Ito – Doeblin formula of version two.

2. (a) Define risk neutral probability, obtain its expression. Prove that under   7
risk neutral probability after nth period
$E(S(n)) = S(0)[1 + r]^n$, where 'r' is risk free interest rate.

(b) Let $S(0)$ = \$50, r = 5%, u = 0.3 and d = -0.1. Find the price of a European   7
call and put with strike price X = 60 dollars to be exercised after $N = 3$
time steps using CRR- formula.

3. (a) Let {S_n , n=0,1,2,....} be a symmetric random walk and F_n be a filtration .   7
Show that
$Y_n = (-1)^n Cos(\pi S_n)$ is a martingale with respect to F_n.

(b) Evaluate $\int_0^T W(t)\, dW(t)$ using quadratic variation .   7

4. (a) A stock being sold for Rs.45 and risk free interest rate is 6%and assume   7
that a dividend of Rs.2 is paid after six months. Find the forward price of
the contract on this stock with a delivery date as one year. Also find its
value after nine months, the stock price at that time happen to be Rs.50.

(b) State and prove the Put – Call parity formula for European call and put   7
option, with current price of stock S(0) and exercise price X and exercise
time T.

5. (a) For two asset portfolio prove that the variance of the portfolio can not   7
exceed the greater of the variances σ_1^2 & σ_2^2 of the component assets, if
there is no short sell.

(b) Using the following data: 7

Scenario	Probability	Return $K1$	Return $K2$
$\omega 1$ (recession)	0.4	−10%	20%
$\omega 2$ (stagnation)	0.2	0%	20%
$\omega 3$ (boom)	0.4	20%	10%

Find the weights in a portfolio with expected return μ_V =26% and
compute the risk of this portfolio