RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
2nd Year Even Semester Examination 2018
COURSE NO: CSE 2201 COURSE TITLE: Computer Algorithms
FULL MARKS: 72 TIME: 3 HRS

N.B. (i) Answer any SIX questions taking any THREE from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

50

## SECTION : A

17

Q.1 (a) What is an algorithm? Briefly describe about the characteristics of an algorithm. 3 1

(b) Find out the big 'O', big 'θ' and big 'Ω' notation of the following equations: 6 2

(i). $2n^2 2^n + nlogn$

6 (ii). $\frac{6n^3}{(logn+1)}$

(iii). $n^{2n} + 6 * 2^n$

(c) What do you mean by average case, worst case and best case of an algorithm? 3 3

Q.2 (a) Consider the recurrence relation: 4
T(1)=7; T(n)=T(n-1)+n
Prove by induction that, $T(n) = \frac{n(n+1)}{2}$.

5 (b) What does happen if deterministic quick sort is used to sort the following array of integers: 4 4
A[]={10, 20, 30, 40, 50, 60};
Also explain the complexity of the algorithm.

(c) What is amortized analysis? 2

(d) How can you find the median of a list of numbers in a complexity less than $O(n^2)$. 2 1

Q.3 (a) Discuss the local minima problem of greedy search techniques. Explain with necessary example. 4 4

(b) Given N pair of vertices $(v_i, v_j)$ where $i \neq j$ and $v_i$ and $v_j$ are members of same set. By examining all the N pairs we need to find which elements are in same set. Write an algorithm that can perform this task in 6
(i) $O(n^2)$ (ii) $O(\log_2 n)$

6

(c) What is prefix code? How Huffman tree can be used to generate prefix code. Discuss with example. 2 2

Q.4. (a) Explain Quick Hull algorithm to find Convex Hull from a set of points. Clarify each step with necessary diagram. 05

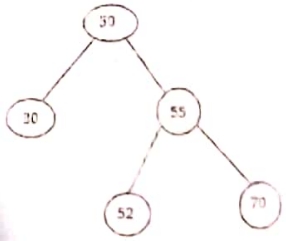
(b) What are the drawbacks of using divide and conquer approach? Explain with an example. 03

(c) Define backtracking. Solve the 8-queen problem using backtracking. How many steps are required to obtain a solution? 4

## SECTION : B

33

Q.5 (a) Given the AVL tree below, what happens if you insert a new node with value 85 in the tree 5 5

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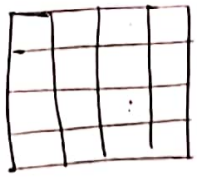
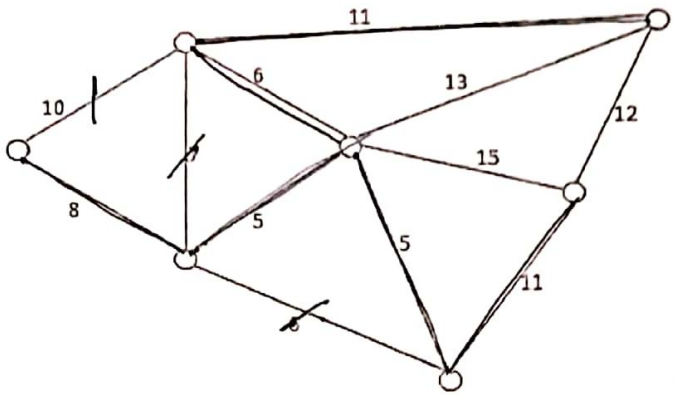


(b) Draw the state space tree generated by backtracking approach while solving 4 Queens problem. Terminate branches on nodes, that is sufficient to check and say that no solutions can be found from the leaves of that branch. 4 4

(c) Given following set of numbers S, show the dynamic programming strategy to find any subset from S that adds upto 12. 3 3

S=[2, 3, 8, 10, 7]

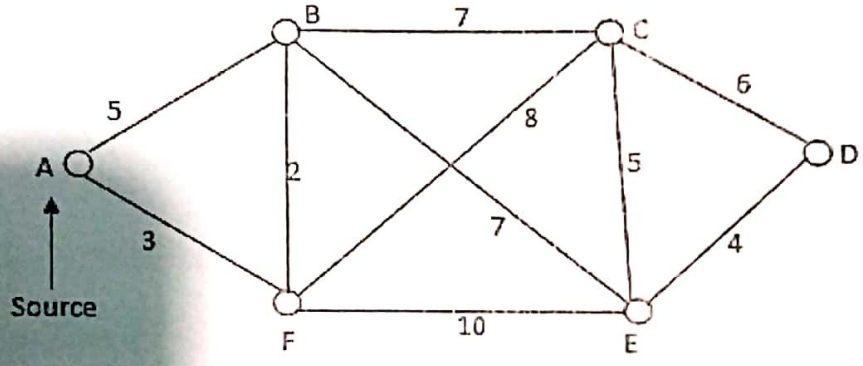
Q.6. (a) Define minimum spanning tree. Show the different stages of building the minimum spanning tree from the following graph using Prim's algorithm. 5




(b) Solve the max-min problem and draw the recursion tree for a sample dataset where divide and conquer approach is used. 4

(c) Define deterministic algorithm. What are the differences between NP-hard and NP-complete problem. 3

Q.7. (a) Define single source shortest path algorithm. Find out the shortest paths of the following graph using Dijkstra's algorithm. 5

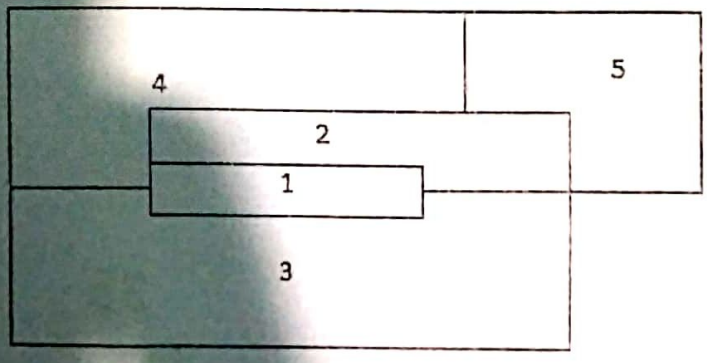



(b) Using dynamic programming strategy, find the longest common subsequence between the following two strings, string 1: ACABE, string 2: ABE. 5

(c) What are local and global optima? 2

Q.8. (a) Describe the best-fit, worst-fit and average-fit algorithm using a suitable example. 4

(b) Define chromatic number. From the following map deduce the corresponding graph and color it. 4




(c) Discuss the complexity of Graham's scan algorithm. Your discussion must include the impact of different data structures on the complexity. 4

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Heaven's Light Is Our Guide

# RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
## DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
### 2nd Year Even Semester Examination 2018

COURSE NO: CSE 2205 COURSE TITLE: Finite Automata Theory

FULL MARKS: 72 TIME: 3 HRS

N.B. (i) Answer any **SIX** questions taking any **THREE** from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

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## SECTION : A

34

Q.1. (a) What is meant by finite automata? 03

(b) Write short note on the following terms: 03×2=06
i. Deduction proof
ii. Proof by contradiction
iii. Induction proof

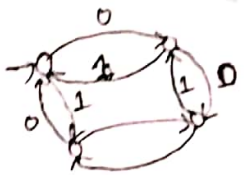
(c) What are the differences between transition function and extended transition function? Explain with example. 03

Q.2 (a) Describe the pigeonhole principle. 02 1

(b) Design a DFA that will accept odd number of 0's and odd number of 1's. 03 3

10 (c) Convert the following NFA to DFA. 05 5

| | 0 | 1 |
|---|---|---|
| →a | {a,b} | {a} |
| b | {c,d} | {e} |
| c | {a,c} | {e} |
| *d | Ø | Ø |
| *e | Ø | Ø |




(d) What is epsilon-closure and what is the purpose of using it? 02 1

Q.3 (a) Consider the grammar G with start symbol S: 04 4

S→ bS | aA | b
A→ bA | aB
B→ bB | aS | a

bS → baA → baaB → baaa
aA → abA → abaB → abab

12

i) What are the variables of G?
ii) What are the terminals of G?
iii) Give three strings in L(G).
iv) Give three strings not in L(G).

(b) Considers the grammar described in Q.3(a). Now, for each of the strings you've given in Q.3(a) (iii), 03×02=06 6
i) Show leftmost derivation.
ii) Show rightmost derivation.
iii) Draw parse tree (any derivation).

(c) What is ambiguous grammar? Give an example. 02 2

Q.4. (a) Convert the following DFA to a Regular Expression. 06 6

12

| | 0 | 1 |
|---|---|---|
| →*a | d | a |
| b | a | d |
| c | c | b |
| d | b | c |

ad → 1 + 0((0+10*1)1)* 0
ab → 0((0+10*1))*
ba → 0·1(1(0+10*1))* 0
bb → ((0+10*1))*

(b) Consider the following DFA. Find the equivalent states. Also draw the table of distinguishabilities for this automaton. 06 6

| | 0 | 1 |
|---|---|---|
| →P | Q | T |
| Q | R | U |
| *R | S | W |
| S | T | W |
| T | U | X |
| *U | V | Q |
| V | W | Q |
| W | X | R |
| *X | P | T |

(P,S) → (Q,T) (W,T)
(Q,T) → (U,R) (U,X)
(R,U) → (S,V) (Q,W)
(P,V) → (Q,W) (Q,T)
(S,V) → (T,W) (Q,W)
(Q,W) → (R,X) (U,R)
(T,W) → (U,X) (R,X)
(R,X) → (S,P) (W,T) (U,X) → (V,P) (Q,T) (R,X)

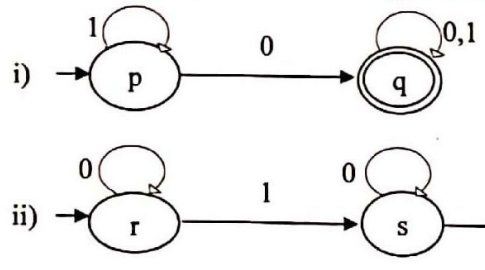
(R,U) → (S,V)
(W,Q)
(S,V) → (T,W)
~~(W,Q)~~
(Q,W) → (R,X)
(U,R)

## SECTION : B

Q.5. (a) Prove that "If L is a regular language, so is $L^R$." 04

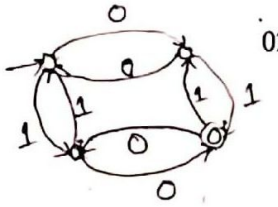
(b) Write the steps to find the complement of a Regular Language. 02

(c) What are the language of the following automatons? 02










(d) Suppose, L= language described by Q.5(c)(i), M= language described by Q.5(c)(ii). Now, i) find the automaton for $L \cap M$ ii) describe the language of $L \cap M$ 04

Q.6. (a) What is push down automata? How does it differ from ε-NFA? 02

(b) Begin with the grammar: 06

$S \rightarrow pPp \mid qQq \mid \varepsilon$
$P \rightarrow R \mid p$
$Q \rightarrow R \mid q$
$R \rightarrow RST \mid \varepsilon$
$S \rightarrow P \mid Q \mid pq$

Eliminate ε-production, unit production, useless symbol and put the resulting grammar into Chomsky Normal Form.

(c) Suppose the PDA, $P=(\{q,p\},\{0,1\},\{z_0,x\},\delta,q,z_0,\{p\})$ has the following transition function: 04

i) $\delta(q,0,z_0)=\{(q,xz_0)\}$
ii) $\delta(q,0,x)=\{(q,xx)\}$
iii) $\delta(q,1,x)=\{(q,x)\}$
iv) $\delta(q,\varepsilon,x)=\{(p,\varepsilon)\}$
v) $\delta(p,\varepsilon,x)=\{(p,\varepsilon)\}$
vi) $\delta(p,1,x)=\{(p,xx)\}$
vii) $\delta(p,1,z_0)=\{(p,\varepsilon)\}$

Draw the transition diagram for this PDA.

Q.7. (a) Verify the following identities involving regular expressions 06
i) $(R^*S^*)^*=(R+S)^*$ ii) $(RS+R)^*RS=(RR^*S)^*$ iii) $(R+S)^*=R^*+S^*$

(b) Consider an automaton that accepts all those strings that have a 0, while the other automaton accepts all those strings that have a 1. Now find the product of these two automatons. 03

(c) What is undecidable problem? How can we solve it? 03

Q.8. (a) Describe the "7-tuple' notation of turing machine. 04

(b) A turing machine is describe as $M=(\{q_0, q_1, q_2, q_3, q_4\},\{0,1\},\{0,1,X,Y,B\},\delta, q_0,B,\{q_4\})$ where δ is given by the following table: 02

| State | 0 | 1 | X | Y | B |
|---|---|---|---|---|---|
| $\rightarrow q_0$ | $(q_1,X,R)$ | - | - | $(q_3,Y,R)$ | - |
| $q_1$ | $(q_1,0,R)$ | $(q_2,X,L)$ | - | $(q_1,Y,R)$ | - |
| $q_2$ | $(q_2,0,L)$ | - | $(q_0,X,R)$ | $(q_2,Y,L)$ | - |
| $q_3$ | - | - | - | $(q_3,Y,R)$ | $(q_4,B,R)$ |
| $*q_4$ | - | - | - | - | - |

Draw the transition diagram.

(c) For the turing machine describe in Q.8(b), what will be sequence of moves of M for initial ID $q_0w$, where w is 06

i) 0001
ii) 0011
iii) 1010

Also comment if the sequence is accepted or not.

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Heaven's Light Is Our Guide

**RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY**

**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING**

**2nd Year Even Semester Examination 2018**

COURSE NO: **EEE 2251** COURSE TITLE: **Electrical, Machines and Instrumentations**

FULL MARKS: 72 TIME: 3 HRS

N.B. (i) Answer any **SIX** questions taking any **THREE** from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

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## SECTION : A 20

| | | | |
|---|---|---|---|
| Q.1. | (a) | Explain the external characteristics of d.c. shunt generator. | 4 |
| | (b) | What is commutator? Explain the commutator action of a d.c. generator. | 4 |
| | (c) | What is armature reaction? Explain the voltage build up process of a d.c. generator with necessary diagram. | 4 |
| Q.2. | (a) | Explain the dynamic breaking of a d.c. shunt motor. | 2 |
| | (b) | Draw the phasor diagram of a single phase transformer. Also draw the phasor diagram when load is applied to the transformer. | 4 |
| | (c) | A 30 kVA, 2400/120V, 50Hz transformer has a high voltage winding resistance of 0.1 Ω and a leakage reactance of 0.22 Ω. The low voltage winding resistance is 0.035 Ω and the leakage reactance is 0.012 Ω. Find the equivalent winding resistance reactance and impedance referred to (i) the high voltage side and (ii) the low voltage side. | 4 |
| | (d) | What are the conditions for connecting alternators in parallel? | 2 |
| Q.3. | (a) | Prove the condition for maximum starting torque in an induction motor under running condition and hence, derive the expression for $T_{max}$. | 4 |
| | (b) | What is stepper motor? Explain the operation of a two phase 4/2 pole permanent magnet stepper motor. | 4 |
| | (c) | A 500V d.c. shunt motor has armature and field resistances of 1.2Ω and 500Ω respectively. When running on no load, the current taken is 4A and the speed is 1000 r.p.m. Calculate the speed when motor is fully loaded and the total current drawn from the supply is 26A. Estimate the speed at this load if (i) a resistance of 2.6Ω is connected in series with the armature and (ii) the shunt field current is reduced by 15%. | 4 |
| Q.4. | (a) | Explain double field revolving theory. Also explain why single phase induction motor isn't self-starting. | 4 |
| | (b) | Explain the operation of steeper motor. What are the features of servomorots? | 4 |
| | (c) | What is synchronous condenser? A 25-hp, 220V 60Hz four pole Y-connected synchronous motor is rotating with a light load. The angle between the rotor and stator fields is 3°. The excitation is adjusted for a generated armature voltage per phase of 110V. (i) What is the resultant armature voltage per phase (ii) what is the angle between $E_R$ and $V_T$. | 4 |

## SECTION : B 21

| | | | |
|---|---|---|---|
| Q.5. | (a) | What is hunting? Explain how you can improve the p.f. from 0.6 lagging to 0.9 lagging using condenser with necessary power triangle. | 4 |
| | (b) | What are the advantages of a stationary armature in an alternator? | 4 |
| | (c) | Why parallel operation is done in alternators? Also mention its requirements. | 4 |
| Q.6. | (a) | Explain how you can use unidirectional torque in a synchronous motor. | 3 |
| | (b) | Prove the force equation of an electrostatic instrument. | 3 |
| | (c) | Prove that the sensitivity of a full wave rectifier type instrument with a.c. is 0.90 time than its sensitivity with d.c. | 3 |
| | (d) | A moving coil instrument gives a full scale deflection of 10mA when the potential difference across its terminal is 100mV. Calculate<br>(i) the shunt resistance for a full scale deflection corresponding to 100A<br>(ii) the series resistance for full scale reading with 1000V. | 3 |
| Q.7. | (a) | What is transducer? How can transducers be classified? | 2 |
| | (b) | Explain how POT can be used to measure displacement? Also write the advantages and disadvantages of POT. | 6 |
| | (c) | Draw and explain the construction and operating principle of LVDT. | 4 |
| Q.8. | (a) | How does an electronic multi-meter act as an ohmmeter? | 3 |
| | (b) | A moving coil instrument whose resistance is 25Ω gives a full scale deflection with a current of 1mA. This instrument is to be used with a manganin shunt to extend its range to 100mA. Calculate error caused by a 10°C rise in temperature when:<br>(i) Copper moving coil is connected directly across the manganin shunt.<br>(ii) A 75Ω manganin resistance is used in series with instrument moving coil.<br>The temperature co-efficient of copper is 0.004/°C and that of manganin is 0.00015/°C. | 6 |
| | (c) | How flow velocity can be measured by an ultrasonic transducer? | 3 |

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RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
2nd Year Even Semester Examination 2018
COURSE NO: CSE 2203 COURSE TITLE: Digital Techniques
FULL MARKS: 70 TIME: 3 HRS

N.B. (i) Answer any SIX questions taking any THREE from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

## SECTION : A

Q.1. (a) Concisely describe the major difference between analog and digital systems with examples. 2
(b) What is the largest decimal values that can be represented using 12 bits? 2
(c) In many cases binary subtraction is done in a special way by binary addition, why? 2
(d) Convert $(10100011)_{BCD} = (?)_{10} = (?)_5 = (?)_8$ 6

Q.2. (a) Convert the following POS expression to truth table. 4

$$(\overline{A}+B+\overline{C})(A+\overline{B})(A+B+C)$$

(b) Simplify the following expression 3

$$\overline{Y}\,\overline{Z}+\overline{W}\,\overline{X}\,\overline{Z}+\overline{W}XY\overline{Z}+WY\overline{Z}$$

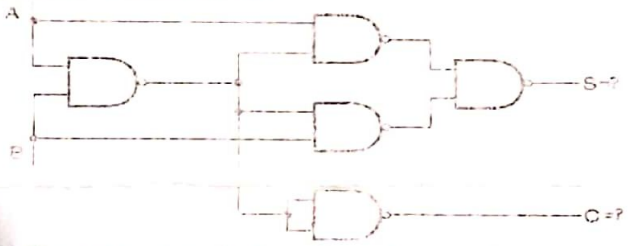
(c) Simplify the following function using K-map and draw its equivalent circuit. 5

$$Y(A,B,C,D)=\Pi(1,3,5,7,9,11,13,15)$$

Q.3. (a) Obtain the canonical product of the sum form of the following function. 4

$$F(A,B,C)=(A+\overline{B})(B+C)(A+\overline{C})$$

(b) Design a three input logic circuit whose output will be HIGH when all inputs are in the same state only. 4
(c) Simplify the logic circuit shown below: 4

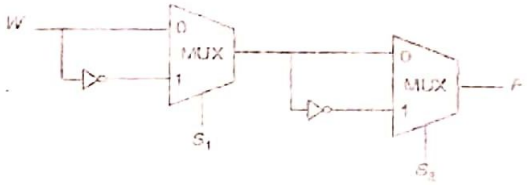



Q.4. (a) Implement the following function by decoder and external gates: 4

$$Y=\sum(0,1,3,5)$$

$$Y_2=AB+C$$

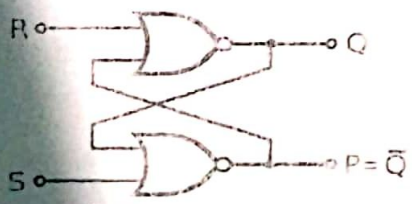
(b) Design a 5:32 decoder with 2:4 decoders only. 4
(c) Consider the multiplexer based logic circuit shown below: 4



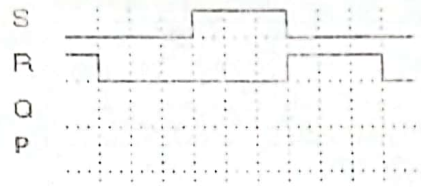

Express the function F in terms of $W, S_1$ and $S_2$

## SECTION : B

Q.5. A flip-flop can be constructed from two NOR gates connected as follows:




Now answer the following questions:
(a) What are the differences between latch and flip-flop? 2
(b) What restriction must be placed on S and R so that P always equal to $\overline{Q}$? 2
(c) Construct a next state table and derive the next-state equation for the flip-flop. 3
(d) Complete the following timing diagram for the flip-flop. 5




Q.6 (a) Design a synchronous counter which counts the following sequences: 6

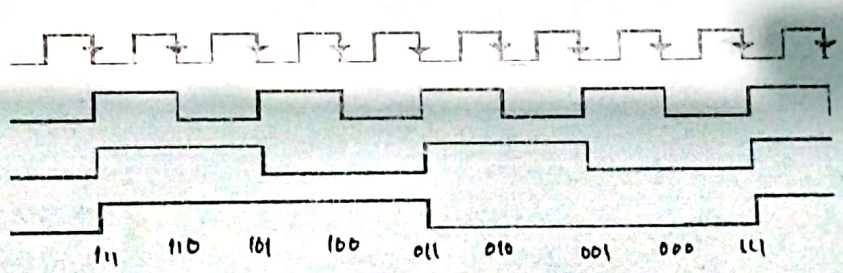
$$0 \rightarrow 1 \rightarrow 3 \rightarrow 5 \rightarrow 0$$

(b) Draw the block diagram of a 4-bit ring counter. Describe its working principle with timing diagram. 4

(c) What is modulus of a counter? How to determine the number of flip-flops for a MOD-10 counter. 2

Q.7 (a) Distinguish between asynchronous and synchronous counter. 3

(b) The following timing diagram represents the clock signal and output of a counter.




Now answer the following questions:

(i) Draw the block diagram of that counter 3

(ii) The counter in above figure starts off in the 111 state and then clock pulses are applied sometimes later the clock pulse are removed and the counter read 100. How many clock pulse have occurred? 3

(iii) Convert it to MOD4 counter. 3

Q.8. (a) Define the following terms: (i) Fan-in (ii) Fan-out. 4

(b) Draw and explain the operation of a two input TTL NAND gate. 4

(c) Implement a 2-input NOR gate using CMOS logic. 4

| | | | |
|---|---|---|---|
| 0 | 0 | 0 | X |
| 0 | 1 | 1 | X |
| 1 | 0 | X | 1 |
| 1 | 1 | X | 0 |

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Heaven's Light is Our Guide

# Rajshahi University of Engineering & Technology

## Department of Electrical and Electronic Engineering

**B.Sc. Engineering 2nd Year Even Semester, Examination 2018**

Course No: **Math 2201** Course Title: **Engg. Mathematics IV**

Full marks: **72** Time: **3 Hours**

N. B: (i) Answer any six questions taking three from each section.
(ii) Use separate answer script for each section
(iii) Figures in the margin indicate full marks

### SECTION-A

Q. 1(a) What is representing $\left|\frac{z-3}{z+3}\right| = 2$ graphically? Explain. 04

(b) State and prove Deroivres theorem. 04

(c) Find the indicated roots and locate them graphically $Z = (-1+i)^{1/3}$ 04

Q. 2(a) State and prove the necessary and sufficient condition for $f(z)$ to be analytic. 06

(b) What are the harmonic functions? Show that $u = 3x^2y + 2x^2 - y^3 - 2y^2$ is a harmonic function. Find $v(x, y)$ such that $u + iv$ is analytic function. Express $u + iv$ in $z = x + iy$ form. 06

Q. 3(a) State and prove Cauchys Integral theorem. 04

(b) Evaluate $\frac{1}{2\pi i}\oint_c \frac{e^{zt}}{z^2+1}dz$ if t>0 and C is the circle $|z| = 3$. 04

(c) Evaluate $\oint_c \frac{z^3 dz}{(9-z^2)(z+i)}$ where C in the circle $|z| = 2$ 04

Q. 4(a) Define conformal mapping. Prove that the bilinear transformation can be considered as a combination of the transformation of translation, rotation, stretching and inversion. 03

(b) Evaluate any two by Contour integration: 09

(i) $\int_0^\infty \frac{Sinx}{x}dx$ (ii) $\int_0^{2\pi} \frac{Cos3\theta}{5-4Cos\theta}d\theta$ (iii) $\int_0^\infty \frac{\log(x^2+1)}{x^2+1}dx$.

### SECTION-B

Q. 5(a) The median and mode of the following distribution are known to be 33.50 and 34 respectively. Find the values of missing frequencies. 06

| Class interval : | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | |
|---|---|---|---|---|---|---|---|---|
| Frequency : | 4 | 16 | ? | ? | ? | 6 | 4 | = Total 230 |

(b) Goals scored by two teams A and B in a football season were as follows: 06

| No. of goals scored in a match | | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|
| No. of matches | A | 27 | 9 | 8 | 5 | 4 |
| | B | 17 | 9 | 6 | 5 | 3 |

Find out which team is more consistent.

Q. 6(a) If A and B are any two events and are not disjoint then show that 04

$$P(A \cup B) = P(A) + P(B) - P(A \cap B).$$

(b) The diameter of a electric cable is assumed to continuous random variable with probability density function $f(x) = x(5-x^2)$, $0 \le x \le 2$ find the mean and variance of it. 04

(c) A problem of physics is given to three students A, B and C whose chances of solving it are $1/2, 3/4$ and $1/4$ respectively. What is the probability that the problem will be solved by at least two students? 04

Q. 7(a) The elementary probability law of a continuous random variable x is $f(x) = y_0 e^{b(x-a)}$, $a \le x \le \infty, b > 0$ Where a, b and $y_0$ are constants. Show that $y_0 = b = \frac{1}{\sigma}$ and $a = m - \sigma$, where m and $\sigma$ are mean and standard deviation respectively, also find $\beta_1$ and $\beta_2$. 05

(b) Establish Poisson distribution from Binomial distribution. 04

(c) The mean yield for one-acre plot is 662 kilos with standard deviation 32 kilos. Assuming normal distribution, how many one-acre plots in a batch of 1000 plots would you expect to have yield (i) Over 700 kilos (ii) below 650 kilos? 03

Q. 8(a) What is the best fitting curve? Derive the normal equation for the least square line. 06

(b) Find the rank correlation coefficient from the following data: 06

| x | 65 | 63 | 67 | 64 | 68 | 62 | 70 | 66 | 68 | 67 | 69 | 72 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| y | 68 | 66 | 68 | 65 | 69 | 66 | 68 | 65 | 71 | 69 | 68 | 70 |

***END***

Heaven's Light Is Our Guide

# RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
## DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
### 2nd Year Even Semester Examination 2018

COURSE NO: Math 2213 COURSE TITLE: Complex Variable, Differential Equations and Harmonic Analysis

FULL MARKS: 72 TIME: 3 HRS

N.B. (i) Answer any **SIX** questions taking any **THREE** from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

31/29

## SECTION : A

15/10

Q.1 (a) Find the roots of $Z^3 = -1 + i$ and locate these values of $Z$ in the complex plane 4
(b) Find an equation for a circle of radius 4 with centre at $(-2, 1)$ in terms of $Z$. 4
(c) Is the function $f(z) = \begin{cases} z^2 ; z \neq i \\ 0; \ z = i \end{cases}$ continuous at $z = i$ ? If it is not true, redefine the function to be continuous. 4

Q.2. (a) Define analytic function. Prove that the necessary condition for $f(z)$ to be analytic. 4
(b) If $Im\{f'(z)\} = 6x(2y - 1)$ and $f(0) = 3 - 2i$, $f(1) = 6 - 5i$, find $f(z)$ and $f(1 + i)$. 5
(c) Prove that the real and imaginary parts of an analytic function $f(z)$ satisfy Laplace's equation. 3

Q.3 (a) State and prove Cauchy's Integral theorem. 4
(b) Evaluate $\oint_c \frac{e^{2z}}{z-2} dz$ if c is
(i) the circle $|z| = 3$ , (ii) the circle $|z| = 1$ 4
(c) Evaluate $\oint_c \frac{z^3 \, dz}{(9-z^2)(z+i)}$ where c is the circle $|z| = 2$. 4

Q.4. (a) State Residue's theorem. Determine the poles of the following function and residue at each pole: 06

$$f(z) = \frac{z^2}{(z-1)^2(z+2)}$$

and hence evaluate $\int_c f(z)dz$ where $c_i|z| = 3$.
(b) Evaluate the following by contour integration: 06

$$\int_0^\infty \frac{dx}{1 + x^6}$$

## SECTION : B

16 18

Q.5 (a) Obtain a series solution of the following differential equation (DE) using Frobenius method: 9

$$3x\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 0$$

(b) Express $f(x) = 1 + x - x^2$ in terms of Legendre Polynomial. 3

Q.6 (a) Find the solution of the wave equation $\frac{\partial u^2}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ such that $u = P_0 cospt$, ($P_0$ is a constant) when $x = l$ and $u = 0$ when $x = 0$ 5
(b) State and prove Rodrigue's formula. 7

Q.7 (a) Obtain a Fourier expansion for $f(x) = x^3$ when $-\pi < x < \pi$ . 4
(b) Find the Fourier sine and cosine transforms of $(x) = e^{-ax}$ . 4
(c) Evaluate $J_{-1/2}$ where $J_n(x)$ is the solution of Bessel's DE. 4

Q.8 (a) Solve $y'' - 9y = cos2t$ if $y(0) = 1$ and $y\left(\frac{\pi}{2}\right) = -1$ by Laplace transform. 6
(b) Using Charpit's method find the solution of $p^2 - y^2q = y^2 - x^2$. 6

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