Heaven's Light is Our Guide

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

COURSE NO: CSE 2101 COURSE TITLE: Discrete Mathematics

FULL MARKS: 72 TIME: 3 HRS

52

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

23

Q.1. (a) Show that $(p \rightarrow q) \wedge (p \rightarrow r)$ and $p \rightarrow (q \wedge r)$ are logically equivalent by developing a series of logical equivalences (Don't use truth table). 3

(b) Consider the following program, designed to interchange the values of two variables x and y. 3

```
Temp:=x
x:=y
y:=temp
```

Find predicates that we can use as the pre-condition and the post-condition to verify the correctness of this program. Then explain how to use them to verify that for all valid input the program does what is intended.

(c) Let $Q(x, y)$ denote, "$x + y = z$". What are the truth values of the quantifications $\exists_z \forall_y Q(x, y)$ and $\forall_y \exists_z Q(x, y)$, where the domain for all variables consists of all real numbers? 3

(d) Show that the premises "A student in this class has not read the book" and "Everyone in the class passed the first exam" imply the conclusion "Someone who passed the first exam has not read the book". 3

Q.2. (a) Define: (i) theorem (ii) corollary and (iii) conjecture. 3 1

(b) Give a contraposition proof that if $n=ab$, where a and b are positive integers, then $a \leq \sqrt{n}$ or $b \leq \sqrt{n}$. 3 3

10

(c) Prove that if n is an integer, then $n^3 \geq n$ by giving proof by cases. 3 3

(d) Verify the $3x + 1$ conjecture for 131 3 3

Q.3. (a) When do we use proof by contraposition instead of direct proof? Suppose that a statement of the form $\forall_x P(x)$ is false. How can it be proved? 3 3

(b) What is the difference between empty set and singleton set? What is the output of the followings: 4 4

9

(i) $|\{\emptyset\}|$ (ii) $|\{\{a\}, a, \{a, \{a\}\}\}|$ (iii) $|\{1,2,2,3,3,3,4\}|$

(c) How is a predicate different from a proposition? When they are similar? 3

(d) Show that the set of odd integers is countable. 2 2

Q.4. (a) What are the advantages of big-O notation? Show that 2^n is $O(3^n)$ but that 3^n is not $O(2^n)$. 3 1

0 (b) Show that if a|b and b|a, where a and b are integers, then a=b or a=-b. 4

(c) How can you find a linear combination (with integers coefficients) of two integers that equals their GCD? Express GCD(84,119) as a linear combination of 84 and 119. 5 3

SECTION : B

29

Q.5. (a) State BEZOUT's theorem. Express gcd(252,198) = 18 as a linear combination of 252 and 198. 4 3

(b) Find an inverse of 101 modulo 4620. 2 2

11 (c) Let m be a positive integer and let a, b and c be integers. If $ac \equiv bc \pmod{m}$ and gcd(c,m)=1, then prove that $a \equiv b \pmod{m}$. 3 3

(d) Show that 1729 is a Carmichael number. 3 3

Q.6. (a) State the Chinese remainder theorem and prove it. 6

(b) Use the method of back substitution to find all integers x such that $x \equiv 1 \pmod 5$, $x \equiv 2 \pmod 6$ and $x \equiv 3 \pmod 7$. 4

(c) Use Fermat's little theorem to compute $3^{307} \bmod 5$. 2

Q.7. (a) What do you mean by mixed graph and multi-graph? Is there any difference between them? Explain. 3 3

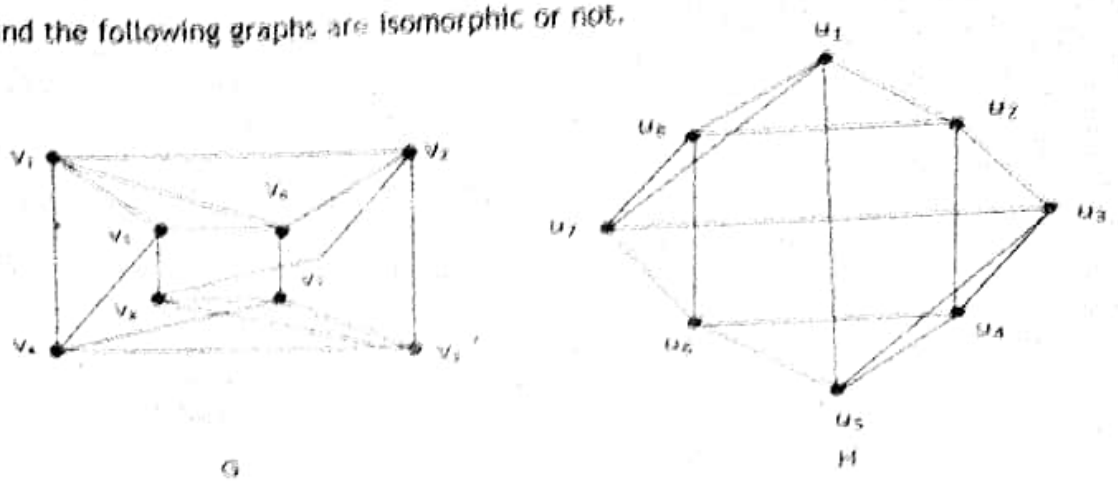
10 (b) Describe a graph model that represents whether each person at a party knows the name of each other person at the party. Should the edges be directed or undirected? Should multiple edges be allowed? Should loops are allowed? 3 3

(c) Can a simple graph exist with 15 vertices each of degree five? Explain. 3

(d) Draw the following graph. Find out these graphs are bipartite or not. 3 3

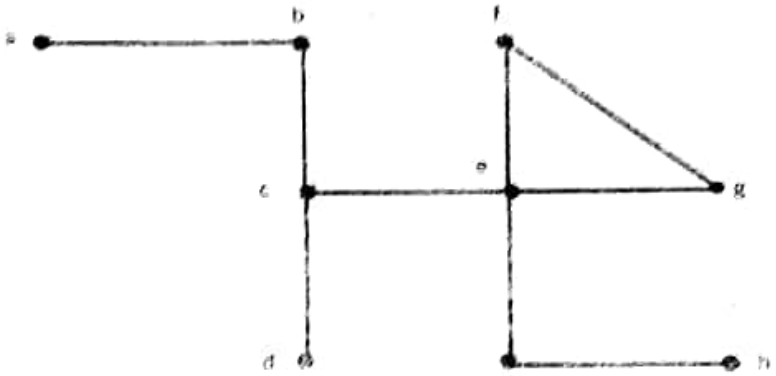
(i) K_7 (ii) $K_{1,8}$ (iii) Q_4

Q.8. (a) Find the following graphs are isomorphic or not.



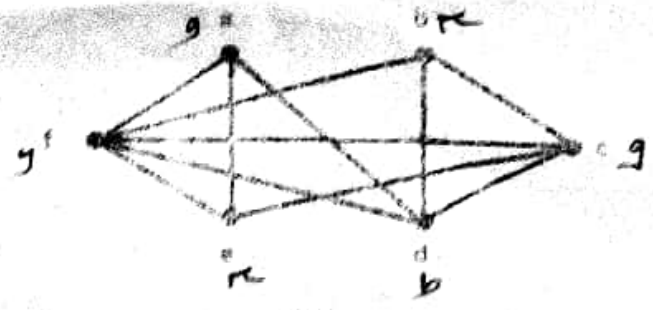
G H

(b) What are the connected components of a graph? Find all the cut edges in the following graph: 3



(c) Construct a graph with five vertices where both Euler and Hamilton circuit exist. 3 3

(d) Is the following graph is planar? If so, then find out the number of regions and identify them. 3 2



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RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
2nd Year Odd Semester Examination 2018
COURSE NO: CSE 2103 COURSE TITLE: Numerical Methods
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.

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SECTION : A 27

Q.1 (a) What are transcendental and algebraic equations? Give one example of each. 4

(b) Determine the real root of, $f(x) = 5x^3 - 5x^2 + 6x - 2$ (i) Graphically (ii) Using Bisection to locate the root to $\varepsilon_s = 10\%$. Employ initial guesses of $x_l = 0.5$ and $x_u = 1.0$. 8

Q.2 (a) On what type of equations Newton's method can be applicable? Using Newton's method, find the root of the equation, $x^3 - 6x - 4$. 4 9

10 (b) State and prove Lagrange's interpolation formula for unequal intervals. 4 2

(c) Using Ramanujan's method, obtain the first eight convergent of the equation $x + e^x = 1$ 4 4

Q.3 (a) Solve the following systems of non-linear equations by any suitable method $x^2 - 3xy = -7$, $y - 2xy = 1$. 6 6

6 (b) Use the Gauss-Seidal method to obtain the solution of the system 6

$3x_1 - 0.1x_2 - 0.2x_3 = 7.85$ $0.1x_1 + 7x_2 - 0.3x_3 = -19.3$ $0.3x_1 - 0.2x_2 + 10x_3 = 71.4$

Q.4 (a) From the following table of values of x and $y = e^x$, interpolate the value of y when x=1.91 6 6

11

x	1.7	1.8	1.9	2.0	2.1	2.2
$y = e^x$	5.4739	6.0496	6.6859	7.3891	8.1662	9.0250

(b) What is the significance of least square curve fitting? The curve $Z = ue^{vy}$ is fitted to the data: 6 5

y	1	2	3	4	5	6
z	1.5	4.6	13.9	40.1	125.1	299.5

Find the best values of u and v.

SECTION : B 27

Q.5 (a) Prove that $\left[\frac{d^2y}{dx^2}\right]_{x=x_0} = \frac{1}{h^2}\left[\Delta^2 y_0 - \Delta^3 y_0 + \frac{11}{12}\Delta^4 y_0 + \cdots\right]$ and $\left[\frac{d^2y}{dx^2}\right]_{x=x_n} = \frac{1}{h^2}\left[\nabla^2 y_n + \nabla^3 y_n + \frac{11}{12}\nabla^4 y_n + \cdots\right]$ 5 5

12 (b) Integrate the following function using Trapezoidal and Simpson's 1/3 rules with n=4. $\int_0^2 x^2 e^x dx$ and compare your result with true value. 7 7

Q.6 (a) What are the differences between initial and boundary value problem? 3

(b) Using Euler's method, find the approximate value of y when $x = 0.3$; $\frac{dy}{dx} = x + y^2$; $y(0) = 1$ and $h = 0.1$ 4 4

9

(c) Use Runge-Kutta method of fourth order to find $y(0.2)$, given $\frac{dy}{dx} = \frac{y^2 - x}{y^2 + x^2}$, $y(0) = 1$ taking h=0.2. 5 5

Q.7 (a) Evaluate the following double integral: $\int_0^1\int_0^1 (x^2 + 3y^2 + xy^3)dxdy$ by using Trapezoidal rule and Simpson's 1/3 rule with h=k=0.5 6

6 (b) Consider the following system: 6 6

$3x_1 + x_2 - 4x_3 + x_4 = 7$ $2x_1 - 2x_2 - x_3 + 2x_4 = 1$

$5x_1 + 7x_2 - 14x_3 - 8x_4 = 20$ $x_1 + 3x_2 - 2x_3 + 4x_4 = -4$

Solve it by using Gauss elimination method.

Q.8. (a) From the following table, find x, correct to two decimal places, for which y is maximum and find this value of y. 4

x	1.2	1.3	1.4	1.5	1.6
y	0.9320	0.9636	0.9855	0.9975	0.9996

(b) A solid revolution is formed by rotating about the x axis, the area between the x axis, the lines x=0 and x=1 and a curve through the points with the following coordinates: 6

x	0.00	0.25	0.50	0.75	1.00
y	1.0000	0.9896	0.9589	0.9089	0.8415

Estimate the volume of the solid formed give the answer to three decimal places.

(c) Define round-off error and truncation error with example. 2

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2nd Year Odd Semester Examination 2018

COURSE NO: Math 2113 COURSE TITLE: Vector Analysis and Linear Algebra

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.

SECTION : A

Q.1 (a) In each case determine whether the vectors are linearly independent or linearly dependent — 6

(i) $\vec{A} = 2\hat{i} + \hat{j} - 3\hat{k}$, $\vec{B} = \hat{i} - 4\hat{k}$, $\vec{C} = 4\hat{i} + 3\hat{j} - \hat{k}$

(ii) $\vec{A} = \hat{i} - 3\hat{j} + 2\hat{k}$, $\vec{B} = 2\hat{i} - 4\hat{j} - \hat{k}$, $\vec{C} = 3\hat{i} + 2\hat{j} - \hat{k}$

If linearly dependent then determine a relation between them.

(b) Find the projection of the vector $\vec{A} = \hat{i} - 2\hat{j} + \hat{k}$ on the vector $\vec{B} = 4\hat{i} - 4\hat{j} + 7\hat{k}$ — 3

(c) Find the acute angles which the line joining the points $(1, -3, 2)$ and $(3, -5, 1)$ makes with the coordinate axes. — 3

Q.2 (a) Given the space curve $x = t, y = t^2, z = \frac{2}{3}t^3$. Find (i) curvature κ (ii) torsion τ — 6

(b) Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point $(2, -1, 2)$. — 3

(c) Find the directional derivative of $\varphi = x^2yz + 4xz^2$ at $(1, -2, -1)$ in the direction $2\hat{i} - \hat{j} - 2\hat{k}$. — 3

Q.3 (a) Determine the constant a so that the vector $\vec{v} = (x + 3y)\hat{i} + (y - 2z)\hat{j} + (x + az)\hat{k}$ is solenoidal. — 3

(b) The acceleration of a particle at any time $t \geq 0$ is given by $\vec{a} = \frac{d\vec{v}}{dt} = 12\cos 2t\,\hat{i} - 8\sin 2t\,\hat{j} + 16t\hat{k}$. If the velocity $\vec{v}$ and displacement $\vec{r}$ are zero at $t = 0$, find $\vec{v}$ and $\vec{r}$ at any time. — 3

(c) Find the volume of the region common to the intersecting cylinders $x^2 + y^2 = a^2$ and $x^2 + z^2 = a^2$. — 3

(d) Evaluate $\int_2^3 \vec{A} \cdot \frac{d\vec{A}}{dt}\,dt$, if $\vec{A}(2) = 2\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{A}(3) = 4\hat{i} - 2\hat{j} + 3\hat{k}$. — 3

Q.4. (a) Let $\vec{F} = 2xz\hat{i} - x\hat{j} + y^2\hat{k}$. Evaluate $\iiint_V \vec{F}\,dV$ where V is the region bounded by the surfaces $x = 0, y = 0, y = 6, z = x^2, z = 4$ — 6

(b) State and prove Green's theorem in the plane. — 6

SECTION : B

Q.5 (a) Find the rank of the following matrix — 6

$$A = \begin{pmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & 7 \end{pmatrix}$$

(b) Determine the characteristic roots and the corresponding characteristic vectors for the following matrix — 6

$$A = \begin{pmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{pmatrix}$$

Q.6. (a) Solve the system — 6

$2x + 4y - z = 9$

$3x - y + 5z = 5$

$8x + 2y + 9z = 19$

(b) Find all the eigen values and any one eigen vector of the following matrix: — 6

$$A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$$

Q.7. (a) Define basis and dimension of a vector space. Determine whether or not the following set of vectors form a basis of $\Re^3$: {(1,1,1), (1,2,3), (2,-1,1)} — 6

(b) Find conditions on a, b and c so that $(a, b, c) \in \Re^3$ belongs to the space generated by $u = (2,1,0), v = (1,-1,2)$ and $w = (0,3,-4)$ — 6

Q.8. (a) Define linear mapping. Suppose the mapping $F: \mathfrak{R}^2 \to \mathfrak{R}^2$ is defined by $F(x, y) = (x + y, x)$. Show that F is linear. 6

(b) Consider the matrix $A = \begin{bmatrix} 2 & 2 \\ 1 & 3 \end{bmatrix}$. Find a nonsingular matrix P such that $D = P^{-1}AP$ is diagonal. 6

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
2nd Year Odd Semester Examination 2018

COURSE NO: EEE 2151 COURSE TITLE: Analog Electronics

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.

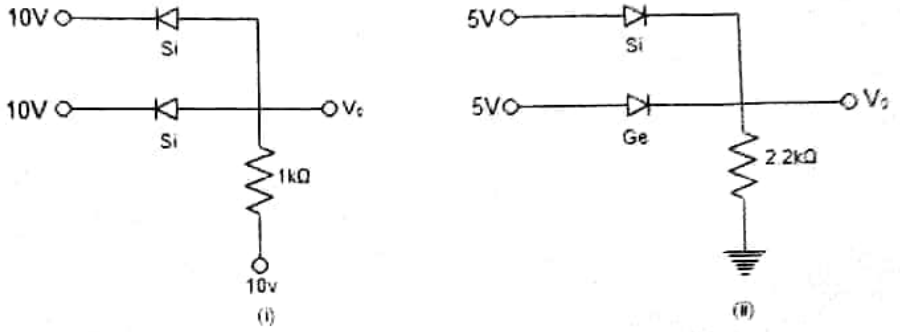
SECTION : A

Q.1. (a) "Silicon is preferred to germanium in the manufacture of semiconductor devices"-do you agree with this statement? Comment on your answer. 2

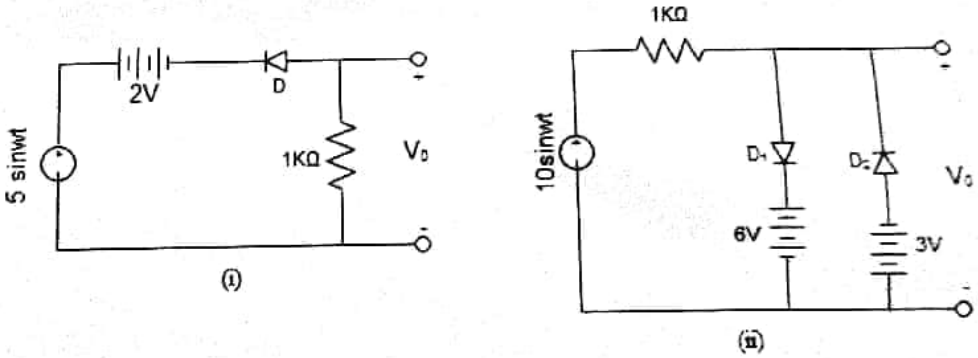
(b) Why is PIV the most important consideration in rectifier diodes? 2

(c) Explain the operation of full wave bridge rectifier and find the average value, V_{dc} for a full-wave rectifier. 4

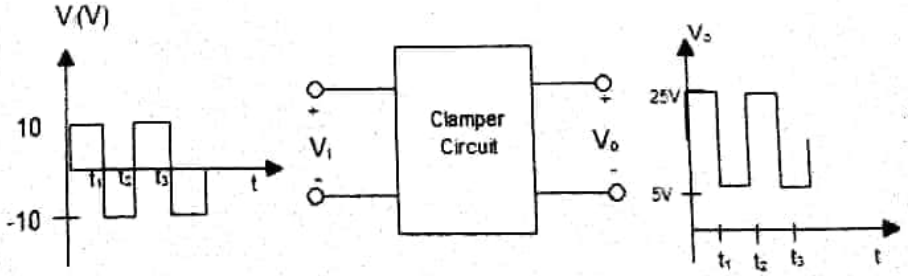
(d) Determine V_o for the configuration of the following figure. 4



Q.2 (a) For the following two clippers, draw the input-output voltage waveform. 5



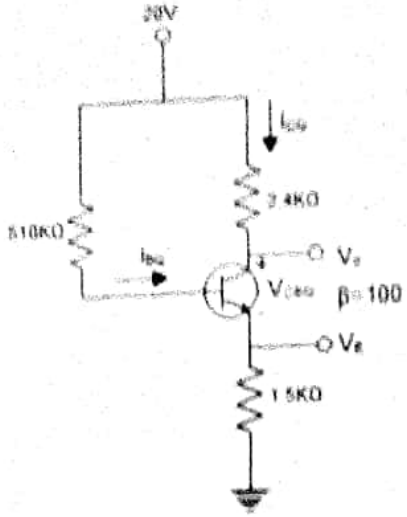
(b) Design a clamper to obtain the following output for the given input. 3



(c) Draw the AC equivalent circuit of a CE emitter bias (unbypassed) configuration and derive the expression of voltage gain for this circuit. 4

Q.3 (a) For a transistor prove that $\beta = \frac{\alpha}{1-\alpha}$, where the symbols have their usual meaning. 4

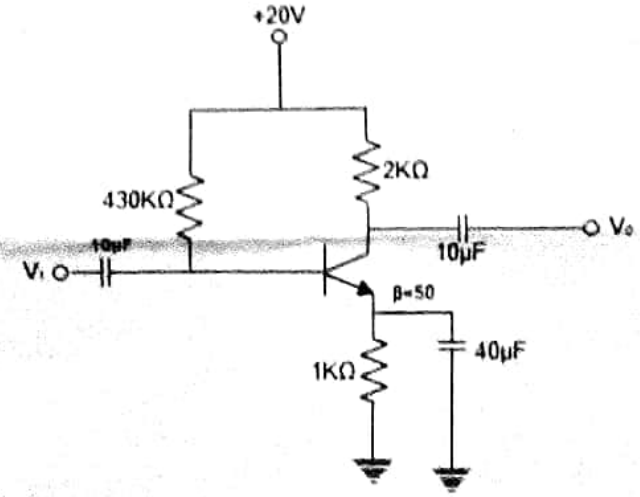
(b) For the following emitter bias circuit, determine (i) I_{BQ}, (ii) I_{CQ}, (iii) V_{CEQ}, (iv) V_C, (v) V_E, and (vi) V_B



(c) What are the basic differences between fixed bias and emitter bias circuits? 3

Q.4. (a) Sketch the output characteristics of a CB configuration and indicate the tree regions. How must junctions of a BJT be biased to operate as an amplifier and as a switch? 4

(b) For the emitter bias network of the following circuit determine: I_B, I_C, V_{CE}, V_C, V_E, V_B, V_{BC}. 4



(c) What is the basic difference between semiconductor diode and zener diode? Draw the I-V characteristics curve of a zener diode. 4

SECTION : B

Q.5 (a) Define and draw the frequency responses of (i) low pass filter, (ii) high pass filter, (iii) band-pass filter and (iv) band-reject filter. 4

(b) Explain the operation of a band-pass filter. 4

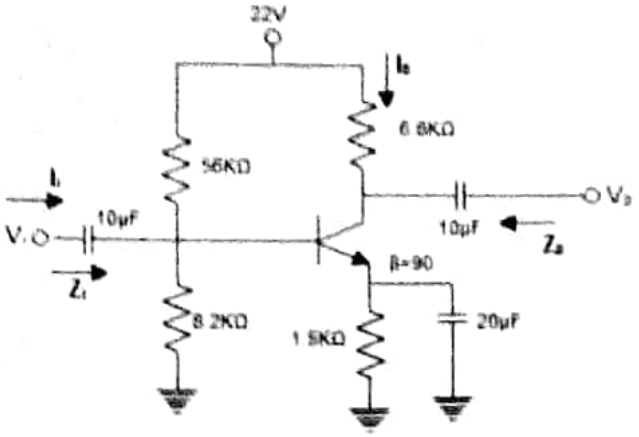
(c) Design a high-pass active filter with cut-off frequency $f_c = 2kHz$. 4

Q.6 (a) The output power of a transistor amplifier is more than the input signal power. Is the law of conservation of energy applicable? 2

(b) Why is it desirable to have high input impedance for a transistor amplifier? 2

(c) Draw the equivalent r_e model for a common-emitter fixed-bias configuration and show that "voltage gain, A_V reveals 180^0 phase shift between input and output signals". 4

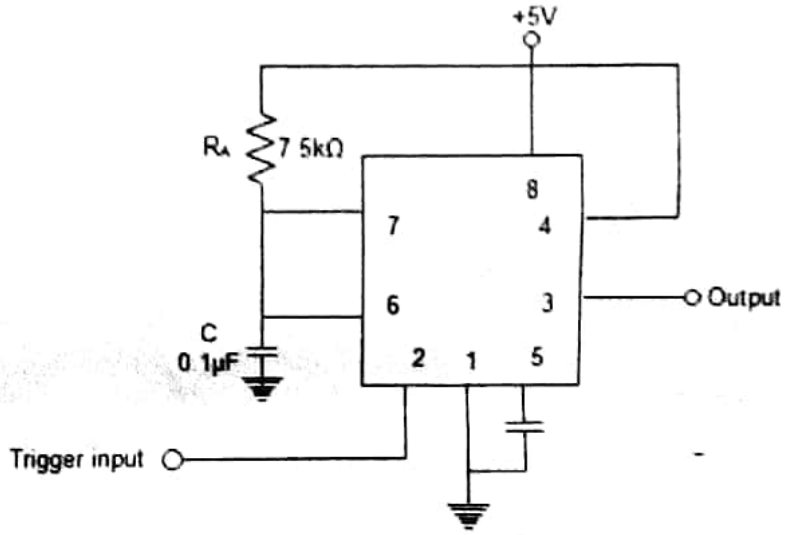
(a) For the network of the following circuit, determine: (i) r_e, (ii) Z_i, (iii) $Z_o(r_o = \infty\Omega)$, (iv) $A_V(r_o = \infty\Omega)$. 4



Q.7. (a) Explain the operation of astable multivibrator using 555 timer. 4

(b) How can an astable multivibrator be used as a square wave oscillator? Explain. 4

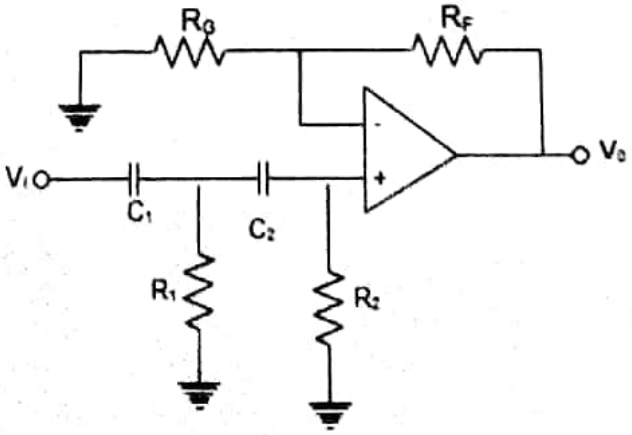
(c) Determine the period of the output waveform for the circuit of the following circuit when triggered by a negative pulse. 4



Q.8. (a) Why Op-amp is called operation amplifier? What do you mean by virtual ground? 4

(b) Explain the operation of an op-amp as an integrator. 4

(c) Calculate the cutoff frequency of a second order high pass filter as in the following circuit for $R_1 = R_2 = 2.1\ K\Omega$, $C_1 = C_2 = 0.05\mu F$, $R_G = 10K\Omega$, and $R_F = 50K\Omega$. 4



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Heaven's Light is Our Guide

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

COURSE NO: HUM 2113 COURSE TITLE: Industrial Management & Accountancy

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.

SECTION : A

Q.1. (a) Define: Management, Efficiency and Effectiveness. 3
(b) State the basic functions of a typical manager. 5
(c) Discuss the following Administrative Management principles: Division of labor, Unity of Command, Unity of Direction, Centralization, Authority and Accountability. 4

Q.2. (a) What is employee motivation? Why is it important? 3
(b) Mention financial and non-financial sources of employee motivation. 3
(c) Briefly state the "Need Hierarchy Theory" of Motivation showing its criticisms and potential application. 6

Q.3. (a) What is inventory control? State the costs associated with holding high level inventory. 3
(b) What is EOQ? Mention its assumptions. 2
(c) A firm uses a continuous review system and operates 52 weeks per year. One of the items handled had the following characteristics: 7
Annual Demand=20,000 units
Ordering cost= Tk. 40/order
Holding cost= Tk. 2/unit/year
Lead time= 2 weeks
Cycle service Level= 95 percent
Demand is normally distributed, with a standard deviation of weekly demand of 100 units. Current on hand inventory is 1040 units, with no scheduled receipts and no backorders.
(i) Calculate the item's EOQ. What is the average time, in weeks, between orders?
(ii) Find the safety stock and reorder point (assume z-value at 95% cycle service level is 1.42)
(iii) For these policies, what are the annual costs of holding the cycle inventory and placing ordered?
(iv) A withdrawal of 15 units just occurred. Is it time to re-order? If so how much should be ordered?

Q.4. (a) What is training? Discuss the training and development process. 4
(b) State on-the-job training methods. 5
(c) What do you mean by performance appraisal and performance management? 3

SECTION : B

Q.5. (a) What do you mean by Accounting? Who are the users of accounting information? 3
(b) Discuss the basic assumptions in accounting. 4
(c) Give journal entries from the following transactions in the books of M/S Hadi & Sons for the month of January 2018: 5

2018 January 1, Mr. Hadi started business with cash Tk. 500000.
January 5, Bought a Machine for cash Tk. 300000.
January 10, Purchased goods from Rabbi & sons of Tk. 200000.
January 20, Sold goods for cash Tk. 100000.
January 25, Interest received of Tk. 5000.

Q.6. (a) Define Cost Accounting. 2
(b) What are the three major elements of Product costs in a manufacturing company? 3
(c) The record of the Alpha Company show the following information for the year ended 31st December 2017: 7

Stock of Raw Materials (01.01.2017)	Tk. 6000
Stock of finished goods (01.01.2017)	Tk. 10000
Raw materials purchased	Tk. 27000
Direct Expenses	Tk. 4000
Direct labour	Tk. 19500

Finished goods sold	Tk. 81000
Stock of raw materials (31.12.2017)	Tk. 4500
Stock of Finished goods (31.12.2017)	Tk. 7000

Factory overhead constitutes 30% of direct labour cost. Administrative and selling overheads are 10% each on work cost.

Required:

(i) Cost of materials used
(ii) Prime cost
(iii) Work cost
(iv) Total cost of goods sold and
(v) Profit for the year ended 31st December 2017.

Q.6. From the following trial balance of M/S Rahim & Sons prepare a trading Account and profit & loss Account for the year ended 31st December 2017 and a balance sheet as on that date: 12

Trial Balance		
Particulars	Amount (Dr.)	Amount (Cr.)
Purchases	Tk. 549000	-
Drawings	Tk. 11500	-
Salaries	Tk. 12500	-
Investment	Tk. 80000	-
Wages	Tk. 10000	-
Carriage in	Tk. 1100	-
Lighting	Tk. 600	-
Furniture	Tk. 26000	-
Buildings	Tk. 150000	-
Insurance	Tk. 400	-
S/ Debtors	Tk. 7000	-
Cash at Bank	Tk. 3250	-
Opening stock	Tk. 30250	-
Motor & Car	Tk. 50000	-
Return In	Tk. 2000	-
Bad debts	Tk. 1400	-
Import Duty	Tk. 10000	-
Office expenses	Tk. 5000	-
Rent	Tk. 4000	-
Capital	-	Tk. 200000
Loan from Bank	-	Tk. 60000
Sales	-	Tk. 666000
Discount	-	Tk. 2500
Return out	-	Tk. 5500
S/Creditors	-	Tk. 20000
Total=	Tk. 9,54,000	9,54,000

Adjustments:

(i) Closing stock was valued at 75500.
(ii) Salaries outstanding Tk. 5000 and prepaid Tk. 1000.
(iii) Depreciate furniture by 10%, Motor car by 7.5%, and building by 5%.

Q.8. (a) What is meant by the term breakeven point? What are the methods that can be used to calculate breakeven point? 3

(b) Saha & Company sells a single product. The company's sales and expenses for a recent month follow: 9

		Total	Per unit
Sales	(20,000 units)	Tk.1200000	Tk.60
Less:	Variable Expenses	Tk.900000	Tk.45
	Contribution Margin	Tk.300000	Tk.15
Less:	Fixed Expenses	Tk.240000	
	Net operating Income	Tk.60000	

Required:

(i) Compute the Company's CM ratio and variable expenses ratio.
(ii) Compute the Company's breakeven point in both units and sales amount.
(iii) How many units will have to be sold to earn a minimum target profit of Tk.90,000?
(iv) Compute the Company's margin of safety.
(v) Compute the Company's degree of operating leverage at the present level of sales.

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