Dr.T.THIMMAIAH INSTITUTE OF TECHNOLOGY
(Estd. 1986) Oorgaum, Kolar Gold Fields, Karnataka – 563120
(Affiliated to VTU, Belgaum, Approved by AICTE - New Delhi)

Department of Mining Engineering
B.E. VI Semester, III - Internal Assessment Test

Scheme : 2018
Course Name : Mineral Processing & Fuel Technology
Duration : 90 minutes
Course Instructor : Paul Prasanna Kumar

Academic Year : 2020 - 21
Course Code : 18MN63
Max marks : 50
Date : 10/08/2021

Answer any one full Question from each part

Part-A (20 marks)

Q. No.	Question	Marks	CO	RBT
1a	Explain the working principle of Jigging with neat sketch.	10	CO4	2
1b	Explain the working principle of Wilfley/Shaking table with neat sketch.	10	CO4	2
2a	Discuss the concept of flowing film concentration with neat sketch.	10	CO4	2
2b	Discuss the working process of Heavy media separation.	10	CO4	2

Part-B (20 marks)

3a	With neat sketch, discuss the construction and working principle of thickening process.	10	CO4	2
3b	With neat sketch, discuss the construction and working principle of drying process.	10	CO4	2
4a	With neat sketch, explain the working principle of flotation	10	CO4	2
4b	Draw the beneficiation flow sheet of copper	10	CO5	2

Part-C (10 marks)

5	Draw the beneficiation flow sheet of lead	10	CO5	2
6	Draw the beneficiation flow sheet of iron ore	10	CO5	2

6/8/2021
Course Instructor

6.8.21
PAC (Name & Signature)

6.8.2021
HOD

11/1/22
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F.No-DrTTIT/IQAC/2020-21/059BP

Department of Mining Engineering

B.E. VI Semester III Internal Assessment Test

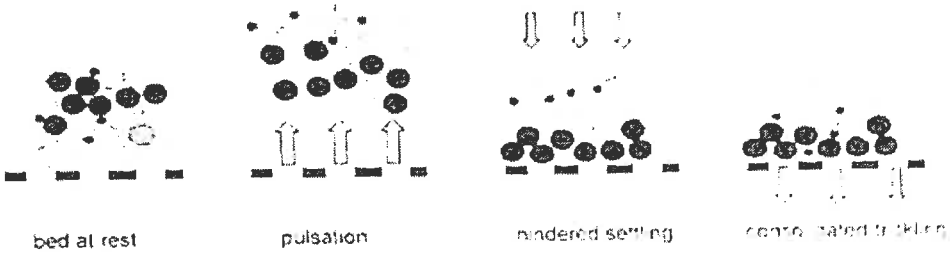
Scheme and Solution

Scheme :2018 **Academic Year: 2020-21**

Course Name: Mineral Processing & Fuel Technology **Course Code: 18MN63**

Course Instructor: Paul Prasanna Kumar **Max marks:50**

Date: 05/10/2021

Q.No.	Brief Solution	Marks
1a	Jigging  bed at rest pulsation hindered settling consolidated stage ✓ It is a special form of hindered settling resulting in stratification of particles into layers of different density followed by removal of different layer. ✓ This stratification is achieved by repeatedly affording an opportunity to a very thick suspension of mixed particles to settle for a short time. ✓ Let a simple experiment with a circular screen fixed inside a vertical hallow cylinder, which can be called a Jig, be considered. ✓ A group of light particles, all of the same size, with one heavy particle at the top of light particles are placed on a screen as shown in figure (A). If water is introduced from the bottom to create a pulsion stroke, all the particles are pushed upwards. ✓ Light particles are pushed more along the distance while heavy particles are pushed less along the distance as shown in figure (B). Now, if the water is withdrawn from the bottom to create a suction stroke, light particles settle down less along the distance while the heavy particles settle down more along the distance.	3 7 10
1b	**Shaking Table (Wilfley Table):** ✓ Here a differential motion(shaking where forward and backward movement occurs) and a riffled deck with cross flowing water is used to create a particle separation. ✓ The shaking motion is asymmetrical, being slow in forward direction and being rapid in backward direction. ✓ Due to differential motion a conveying motion is imparted on the particle	2

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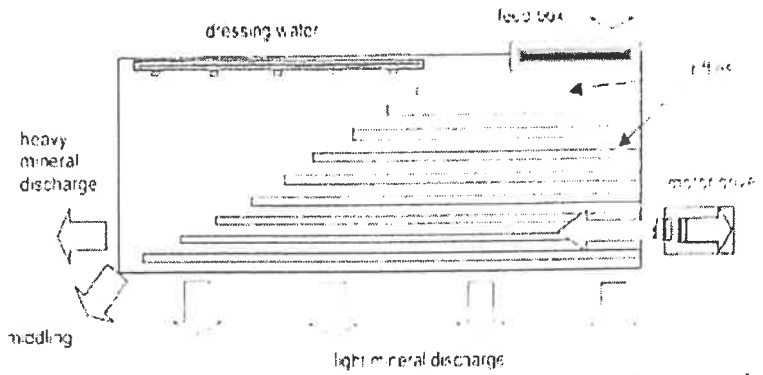
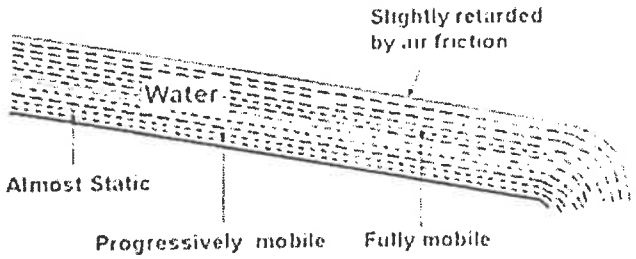
	which are in contact with the table deck in the direction of motion due to friction.  ✓ The feed is screened to < 3mm and fed into a small hopper above the north-east corner of the shaking table, where it is mixed with clean water. ✓ The feed fan outs towards the edge of the table, allowing the operator to see exactly what is happening, and to decide where to subdivide the fan into distinct streams each dominated by a particular mineral. ✓ The shaking motion has a slow westward stroke and rapid return eastward stroke – often with a bump. ✓ This induces settled particles to crawl in a juddering manner westward along the table with the thin film of slurry. ✓ The shaking is usually very rapid with a frequency of 4 to 5.5 strokes per second. ✓ The shaking displacement is usually half to 1-inch to-and-fro.	4 4 10
2a	**FLOWING FILM CONCENTRATION**  Flow of water on Sloping Deck Flowing film concentration has been defined as sorting of mineral particles on flat surfaces in accordance with the size, shape and specific gravity of the particles moved by a flowing film of water. When water is made to flow over a bare sloping deck, the velocity of water adjacent to the deck is zero and increases as the distance from the deck increases reaching maximum at the top surface of water. If a number of spheres, composed of two kinds of minerals, one heavy another light, and are of different sizes, are introduced into a thick layer of water, they will be separated during their fall through this layer. The biggest heavy sphere falls faster on to the deck through water and is least affected by the current and lies nearest to the point of entry. The smallest light sphere will drift furthest downstream.	2 8 10

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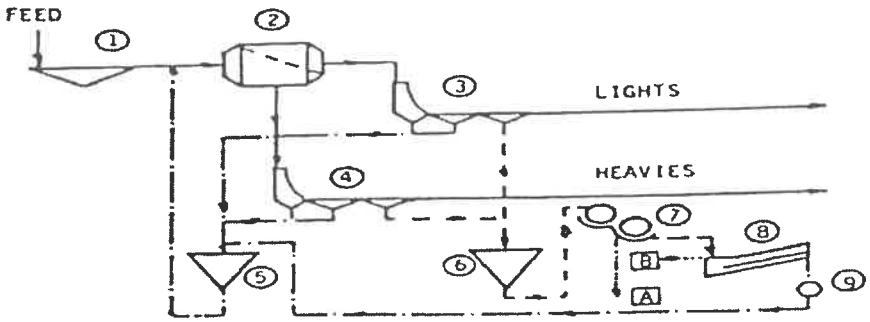
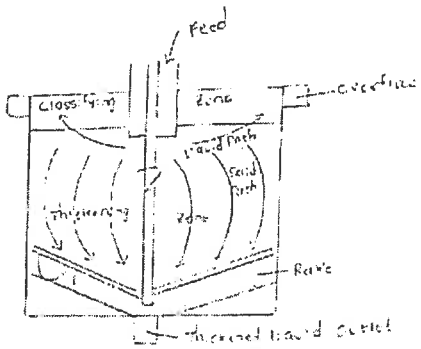
2b	Heavy Media Separation:  1 FEED PREPARATION SCREEN 2 HEAVY MEDIUM SEPARATION 3 LIGHTS DRAIN/WASH SCREEN 4 HEAVIES DRAIN/WASH SCREEN 5 HEAVY MEDIUM SUMP 6 DILUTE HEAVY MEDIUM SUMP 7 MAGNETIC SEPARATOR 8 DENSIFIER 9 DEMAGNETISING COIL ✓ Heavy media separation dates back to several centuries. ✓ Initially, a fine magnetite was used as a heavy media. ✓ In 1936, a plant was designed employing organic liquid as a heavy media for treating anthracite coal containing ore. ✓ The heavy media process is usually used for treatment of coarse coal above 9.5 mm in size. ✓ Finer coal below 9.5 mm cannot be cleaned economically in heavy medium. ✓ The settling velocities of the fine material are very low, and consequently the time required to separate the lighter coal from the heavy becomes excessive. ✓ Nowadays, magnetic field has been used as a heavy media at fineness of between 100 and 325 mesh. ✓ Separation using heavy media can be done in either conventional heavy media tanks or in heavy media cyclones.	3 7 10
3a	Construction & working Principle of thickening process:  ✓ Gravity sedimentation (or) thickening is the most widely applied dewatering techniques in mineral processing. ✓ It is a very cheap, high capacity process, which involves very low shear	2 3

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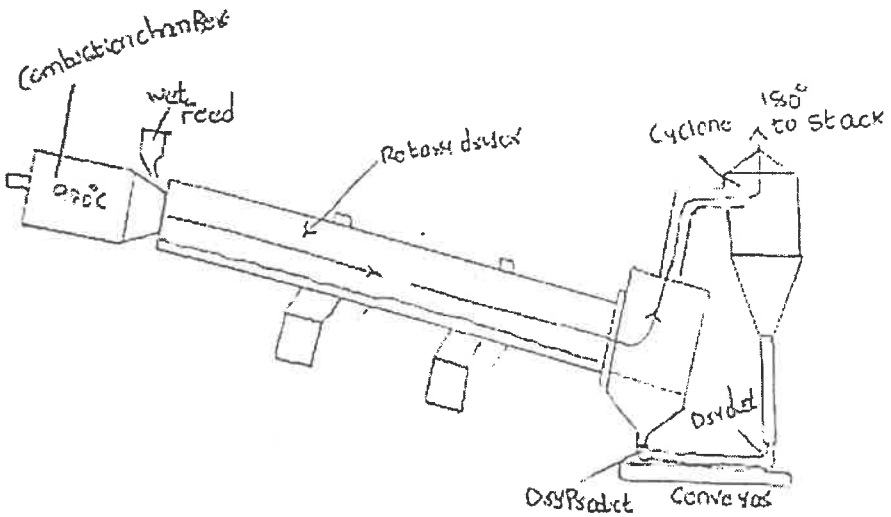
	forces thus providing good conditions for flocculation of the fine particles. ✓ The thickener is used to increase the concentration of the suspension by sedimentation. ✓ The continuous thickener consists of a cylindrical tank of diameter ranging from 2m to 200m in diameter and a depth of 1 – 7m. ✓ Within the tank one or more rotating radial arms from which blades are suspended so as to rake the settled solids towards the central outlet. ✓ Thickener tanks are constructed of steel, concrete or both. ✓ Pulp is fed into the center via feed well placed up to 1 m below the surface, in order to cause little disturbance. ✓ The liquid overflows on peripheral launder, while the solids which settle over the entire bottom of the tank are withdraw as thickened pulp from an outlet at the center.	8 10
3b	Construction & working Principle of Drying:  ✓ Drying of concentrates prior to shipping is the last operation performed in mineral processing plants. ✓ It reduces the cost of transport and it reduces the moisture content to about 5% by weight. Dust losses are more, if the moisture content is low. ✓ Rotary thermal dryers are used for drying operations. ✓ The shell is slightly slope, so that material move from feed to discharge end under gravity. ✓ Hot gases or air are fed in either at the feed end to give parallel flow or at the discharge end to give counter-current flow. ✓ Parallel flow dryers are used in the majority of current operations because they are more fuel efficient and have greater capacity.	2 8 10
4a	**Principles of Flotation:**	

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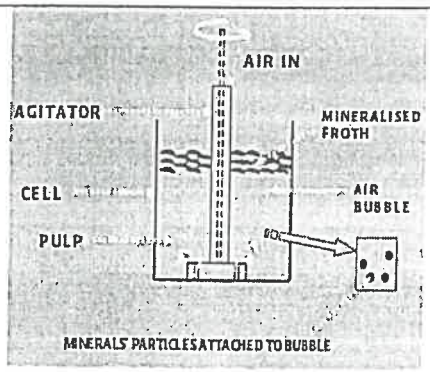


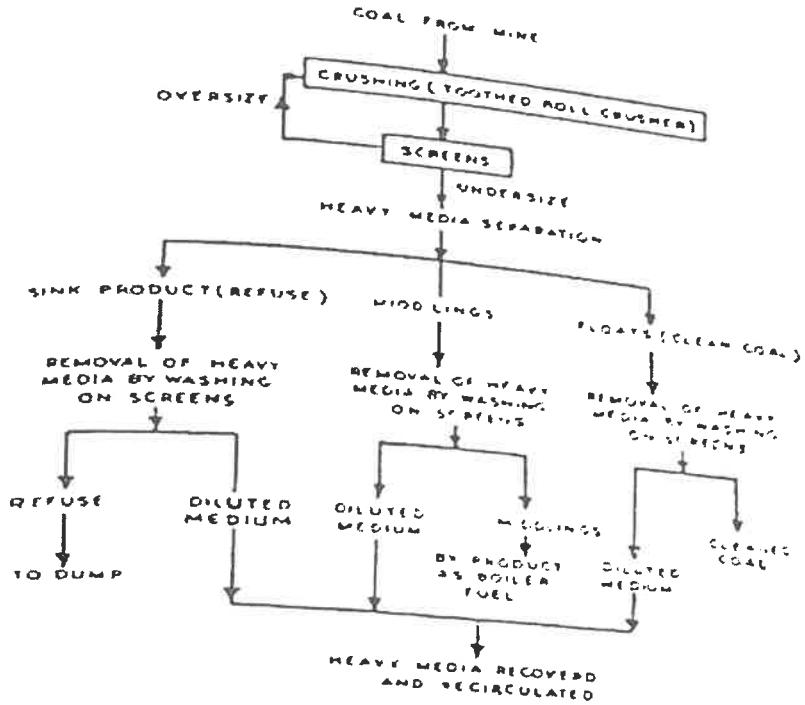
2

- ✓ This process commences with Comminution (to increase the surface area of the ore).
- ✓ The ore is ground to fine powder and wetted with water to form a Slurry.
- ✓ A Surfactant chemical (known as COLLECTOR) is mixed with slurry to render the desired mineral HYDROPHOBIC.
- ✓ This slurry (now PULP) is then placed in the water bath containing FROTHER, which is aerated to create bubbles.
- ✓ The desired mineral escape water by getting attached to the air bubbles, which rise to the surface and form what is called FROTH. This Froth is then removed and the concentrated mineral is refined.

8

10

4b Flow Sheet of Copper



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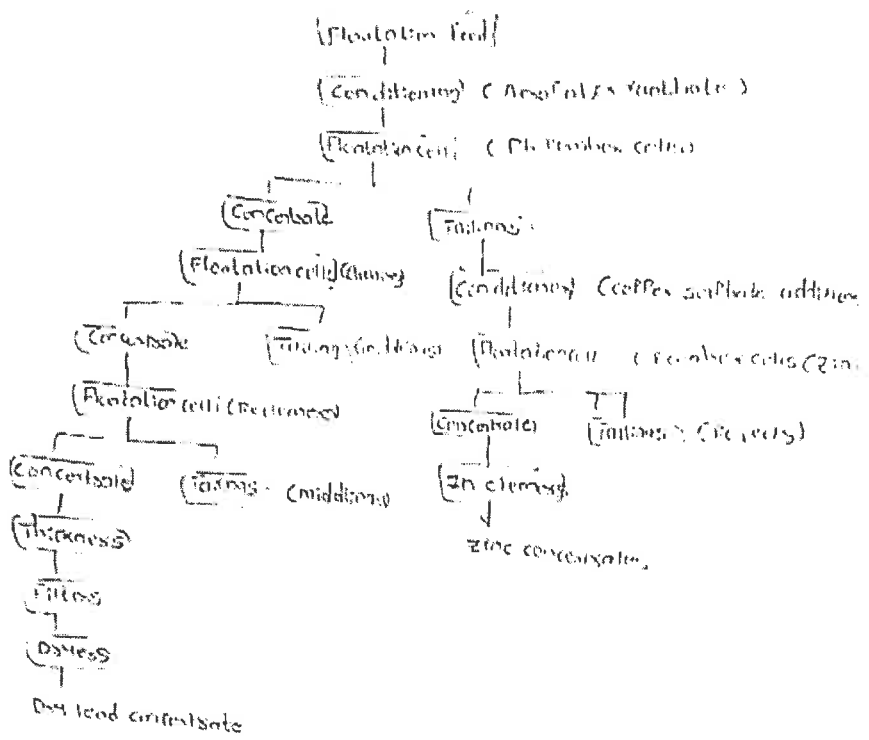
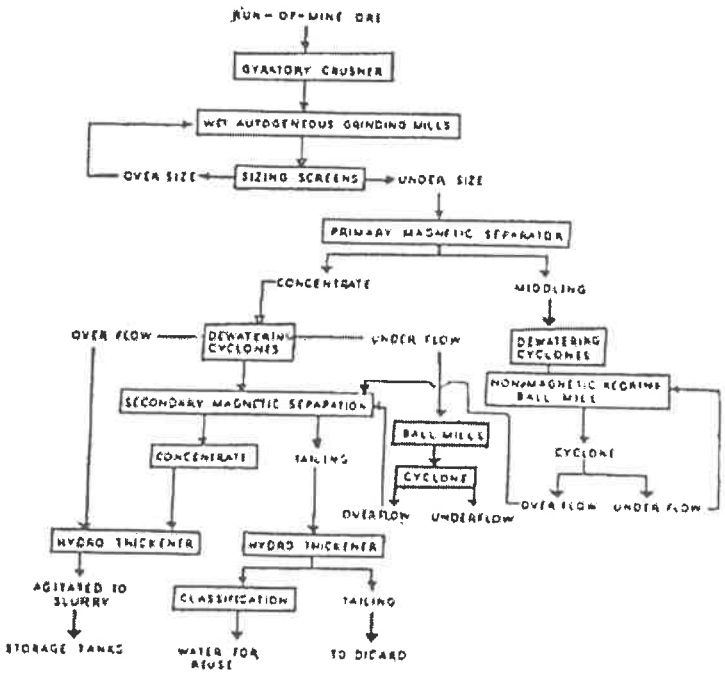
5	Flow Sheet of Lead 	10
6	Flow Sheet of Iron Ore 	10

5/10/2021
Course Instructor

PAC Member (Name & Signature)

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Department of Mechanical Engineering

B.E. –Semester – 4th – Internal Assessment Test

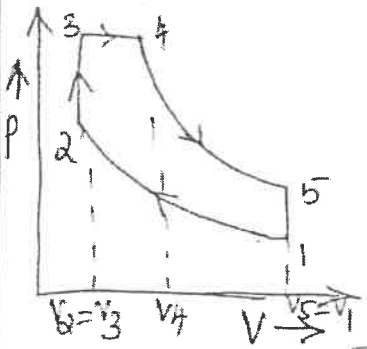
Scheme and Solution – first Internals

Scheme : 2018 Scheme Academic Year: 2020-21

Course Name : Applied Thermodynamics (ATD) Course Code : 18ME42

Max marks : 50

Course Instructor : SHA Date : 25/05/2021

Q.No.	Brief Solution	Marks
	Part - A.	
1.		→ 4 Marks
	$\eta_{air} = 1 - \frac{1}{R_c^{\gamma-1}} \left[\frac{\alpha \cdot \beta^{\gamma} - 1}{(\alpha-1) + \alpha\gamma(\beta-1)} \right]$ Derivation = 15 Marks	
	if $\beta=1 \Rightarrow$ otto cycle, if $\alpha=1 \Rightarrow$ Diesel cycle → 1 Mark (20 Marks)	
2.	Data = 2 Marks.	→ 2 Marks
	$T_2 = 909.43$ K.	→ 3 Marks
	$T_3 = 1992.56$ K	→ 3 Marks
	Net work o/p = 657.7 kJ/kg of air	→ 5 Marks
	$\eta = 60\%$	→ 4 Marks
	Specific air consumption = 5.47 kg/Kw-hr.	→ 3 Marks
		20 Marks

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Part-B.

(3)	P-V & T-S Diagram.	→ 3 Marks
	Data & conversions	→ 2 Marks
	$V_s = 0.0184\ M^3$	→ 2 Marks
	$R_c = 8$	→ 3 Marks
	$\eta_{air} = 56.4\ \%$	→ 3 Marks
	$P_2 = 18.36$ Bar	→ 2 Marks
	$\alpha = 1.36$	→ 2 Marks
	$P_m = 1.33$ Bar	→ 2 Marks
		20 Marks
(4)	P-V & T-S Diagram	→ 3 Marks
	Data & conversions	→ 2 Marks
	$P_2 = 5$ Bar	→ 2 Marks
	$Q_s = 138.5$ KJ/kg.	→ 3 Marks
	$Q_{2-3} = 430.8$ KJ/kg.	→ 3 Marks
	$Q_R = 415.7$ KJ/kg.	→ 2 Marks
	$Q_{4-1} = 430.8$ KJ/kg. $\eta = 66\%$	→ 2 Marks → 3 Marks
		20 Marks
(5)	Carnot cycle.	
	P-V & T-S diagram	→ 2 Marks
	$Q_s = mRT_1 \ln\left(\frac{V_2}{V_1}\right)$	→ 2 Marks
	$\frac{T_2}{T_3} = \left(\frac{V_3}{V_2}\right)^{\gamma-1}$	→ 2 Marks
	$Q_R = mRT_3 \ln\left(\frac{V_3}{V_4}\right)$	→ 2 Marks
	$\eta_{air} = 1 - \frac{T_L}{T_H}$	→ 2 Marks
		10 Marks

6) Assumptions Made for Air standard cycle.

5 Points.

a) PV=mRT

b) closed cycle

c) NO chemical Reactions

d) Compression & Expansion process

$\eta_{std} = \frac{\text{actual Thermal } \eta}{\text{air std } \eta}$

5x2=10 Marks.

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Department of Computer Science & Engineering

2018 CBCS scheme

B.E. 4thSemester Third Internal Assessment Test, 2020/2021

Subject: Microcontroller and Embedded Systems
Duration: 90min
Faculty: Hamsalatha J

SubjectCode:18CS44
Max. Marks: 50
Date:10/08/2021

Note: Answer any ONE FULL question from Each Part.

Q.no	Questions	Marks	CO#	BTL#
	PART- A			
1.	Define **operational and non-operational quality attribute** and also explain the attributes to be considered in any embedded system design.	20M	CO4	L2
2a.	Explain application specific embedded system with its functional block diagram	10M	CO4	L2
2b.	Explain the fundamental issues in hardware software co-design	10M	CO4	L2
	PART-B			
3a.	Differentiate between DFG and CDFG model. Explain their significance in embedded system design	10M	CO4	L2
3b.	Explain the important hardware software 'trade-offs' in hardware software partitioning	10M	CO4	L2
4.	Explain Finite State Machine model and sequential program model for automatic seat belt warning system.	20M	CO4	L2
	PART-C			
5.	Explain in detail the building blocks of UML	10M	CO2	L2
6.	Write short note on i)Assembly Language-Assembler ii)C language v/s Embedded C	10M	CO2	L2

Faculty

PAC Members(Name with Signature)

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Scheme & Solution

Semester: 4th Sem Subject: Microcontroller and Embedded System Subject Code: 18CS44

QNO	Solution	MARKS
1a.	Operational Quality attributes Response Throughput Reliability Maintainability Security Safety explanation of each attribute with example.	10M
b.	Non operational Quality attributes Testability and debugability Evolvability portability Time to prototype and market per unit and total cost	10M
2a.	Block diagram of application Specific embedded System explanation with example of Washing machine	10M
2b.	Fundamental issues in h/w - s/w Codesign Selecting model Selecting architecture VLIW Parallel processing 2 mark each point	10M

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Part C

5 Embedded system is application specific computing device designed specifically for a particular task. Eg: Washing machine, Smart watches, Ovens — 2M

Characteristics of embedded computing devices are as follows:

- Very high peformance, sophisticated functionality
- Multiple task, heterogeneous
- Real-time and Reactive
- often low power
- low manufacturing cost.
- Highly reliable
- Designed to tight deadlines by small teams
- Distributed
- Small size and weight.

detailed explanation of all the characteristics — 8M

10M

6. Purpose of Embedded Systems

1. Data collection, storage and representation
2. Data Communication
3. Data processing
4. Monitoring
5. control
6. Application-specific Circuits

6M

19/1/22

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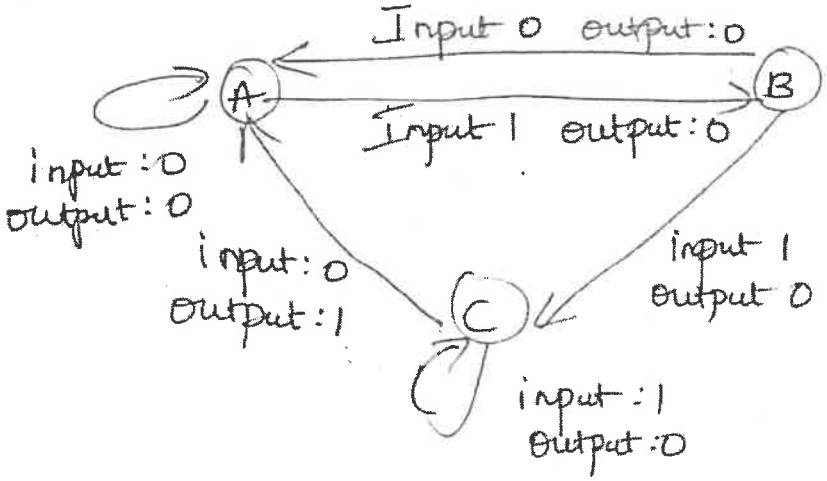
3. Dataflow graph DFG model with its significance in embedded System — 10m

Control data flow graph (CDFG model) with its significance in embedded System — 10m

20m

4. Finite State machine model diagram



5m

explanation of Sensors — 5m

explanation of Process of automatic Seat belt warning System — 5m

Sequential program model advantages and disadvantages — 5m

20m

5. UML building blocks

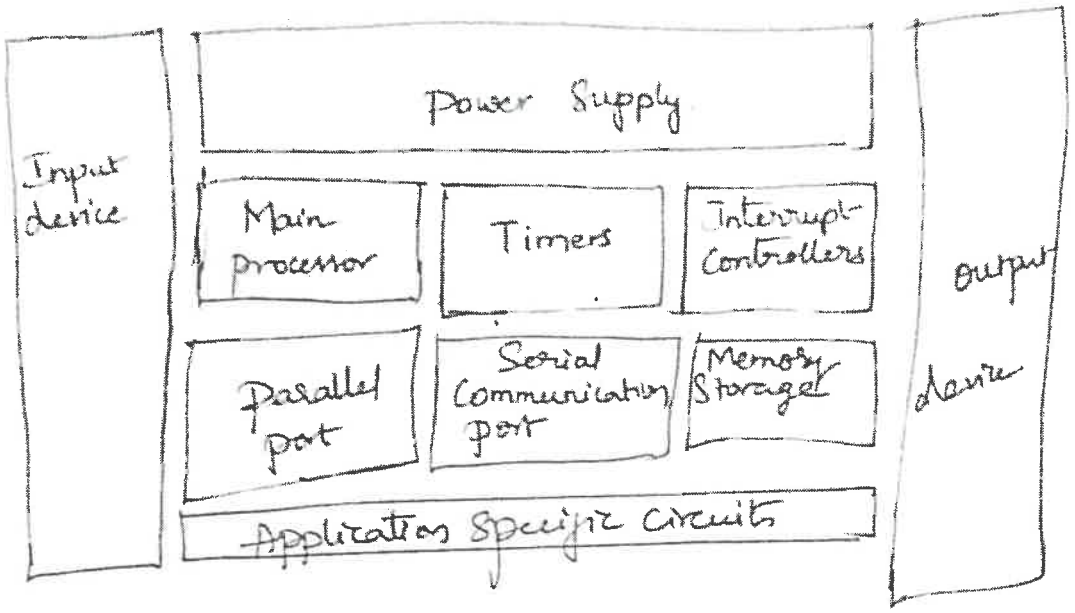
- Structural things
- Behavioural things
- Grouping things
- Annotational things

2m each

Use Case diagram
Sequence diagram
Collaboration diagram
State chart diagram
Activity diagram

10M

Core of embedded System



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F.No:DrTTIT/IQAC/2020-21/C3/3A/01/01

Department of Mining Engineering

B.E. 4th Semester 3rd Internal Assessment Test

Scheme : 2018

Academic Year: 2020-21

Course Name: TDFM

Course Code: 18MN46

Duration : 90 minutes

Max marks:50

Course Instructor: Mahendran.J

Date: 11.08.2021

Answer any one full Question from each part

Part-A (20 marks)

Q.No.	Question	Marks	CO	RBT
1.a	With a neat sketch, Explain Bourdon tube pressure gauge.	10	CO4	2
1.b	Derive an expression for total pressure and center of pressure for an inclined plane surface submerged in liquid.	10	CO4	2
2.a	Explain the condition of equilibrium of floating and submerged bodies.	10	CO4	2
2.b	Define Buoyancy. Explain about meta center and meta centric height.	10	CO4	2

Part-B (20 marks)

3. a	Derive Bernoulli's equation from Euler's equation of motion and also state assumptions made.	10	CO5	2
3.b	Water is flowing through a pipe having a diameter of 300mm and 200mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.525 N/cm2 and the pressure at the upper end is 9.81N/cm2. Determine the difference in datum head if the rate of flow through pipe is40 lit/s.	10	CO5	2
4. a	Explain clearly hydraulic gradient and total Energy line with neat sketch and equations.	10	CO5	2
4. b	Write the limitations of Bernoulli's and Euler's equation.	10	CO5	2

Part-C (10 marks)

5	Explain atmospheric pressure , total pressure gauge pressure and vacuum pressure with the help of diagram	10	CO4	2
6	Explain the concept of pressure measurement by simple manometer.	10	CO4	2

Course Instructor

PAC Member (Name & Signature)

Vijaya Raghavan

HOD

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TUV

Department of Mining Engineering

18 Scheme

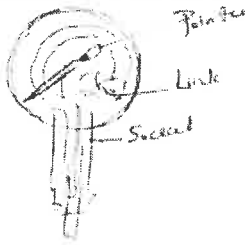
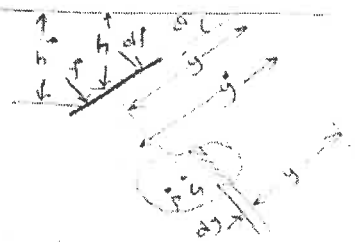
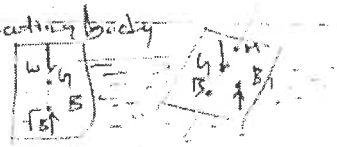
IA3 Question Paper & Answer Scheme

B.E. 4th Semester Third Internal Assessment Test 2020-2021

Subject Name: TDFM
Subject code: 18MN46
Duration : 90 Minutes
Faculty In charge: Mahendran.J

Max Marks: 50
Date: 11.08.2021

NOTE: Answer any ONE full Question from each part

Q.No.	Question	Alloted Marks
1.a.	 Used for measurement of relative pressure It is mechanical pressure measuring instrument & Operate without any electrical power	4 + 6 = 10m
1.b.	 Total Pressure = $\rho g A h$	4+6 = 10m
2.a.	Floating body  Stable Equilibrium : M above G Unstable Equilibrium : M below G Neutral Equilibrium : M Coincide G Submerged body 	5+5 = 10m
2. b	Buoyancy - is an upward force exerted by a fluid that opposes the weight of a Partially or fully immersed object Meta centre may be defined as a point about which a floating body starts oscillating, when given a small angular displacement. It is denoted by M. The meta centre height is the distance b/w the centre of gravity (G) of the floating body and the meta centre (M)	2 + 4 + 4 = 10m
2.c.	Sketch - 4m Derivation - 6m	

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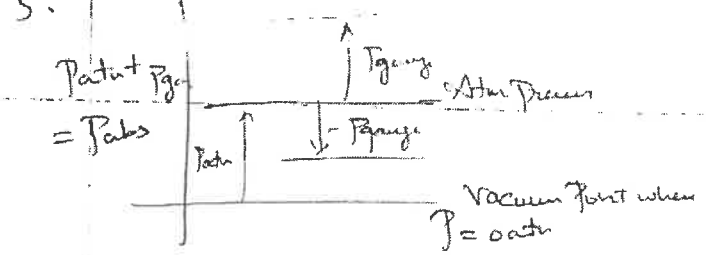
4a. HGL - is defined as the line which gives the sum of Pressure head (H_s) and elevation head (z) of flowing fluid in a pipe with some reference.

TEL - is defined as the line which gives the sum of Pressure head, elevation head & kinetic head of a flowing fluid in a Pipe with some reference line. 5+5 = 10m

4b. → The velocity of liquid Particles in the centre of a pipe is maximum and gradually decrease towards the wall of the pipe due to friction

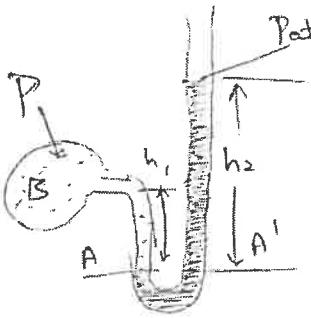
→ There is always some external force acting on the liquid which affects the flow of liquid 5+5 = 10m

5.



Explanation 4+6 = 10m

6.



Consist of a glass tube having one of its ends connected to a point where pressure is to be measured 4+6 = 10m

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USN: | 1 | G | V | | | E | C | | | |

Dr. T. THIMMAIAH INSTITUTE OF TECHNOLOGY
Department of Electronics and Communication Engg.
B.E. 4th Semester, 3rd Internal Assessment Test, August - 2021

Subject Name: Analog Circuits | **Subject code: 18EC42**
Duration: 90 Minutes | **Max Marks: 50**
Faculty In-charge: Rajesh Kumar Kaushal | **Date: 09/08/2021**

NOTE: Answer any ONE full Question from each part

Part-A

Q.No.	Question	Marks	CO	RBT
1a	What is an instrumentation amplifier? With a neat circuit diagram explain an instrumentation amplifier using a transducer bridge	10	CO5	L2
1b	Explain the basic comparator circuit using an op-amp. How can this circuit be used in an application as a zero crossing detector?	6+4	CO5	L3
2a	Consider an inverting op-amp amplifier and explain its application as Summing amplifier, Scaling amplifier and Averaging amplifier..	10	CO5	L3
2b	Consider a differential op-amp amplifier and explain its application as Subtractor and Summing amplifier.	10	CO5	L3

Part-B

3a	Explain the operation of a 4-bit R-2R DAC with neat circuit.	10	CO5	L2
3b	Explain the operation of a binary weighted resistors DAC with neat circuit.	10	CO5	L2
4a	Explain Schmitt trigger with neat circuit, waveforms and hysteresis loop.	10	CO5	L2
4b	Consider a non- inverting op-amp amplifier and explain its application as Summing amplifier and Averaging amplifier.	10	CO5	L3

Part-C

5	With neat circuit diagram, explain DC amplifiers.	10	CO5	L2
6	With neat circuit diagram, explain AC amplifiers	10	CO5	L2

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(Estd. 1986) Oorgaum, Kolar Gold Fields, Karnataka – 563120
(Affiliated to VTU, Belgaum, Approved by AICTE - New Delhi)

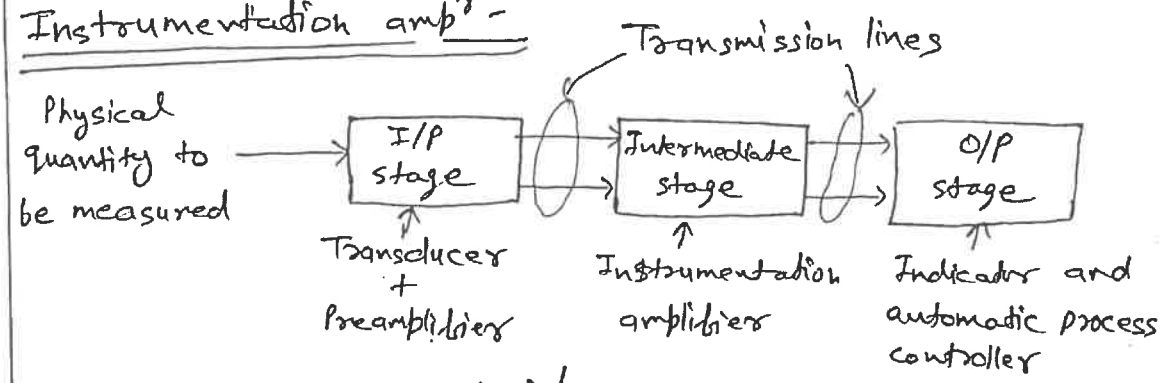
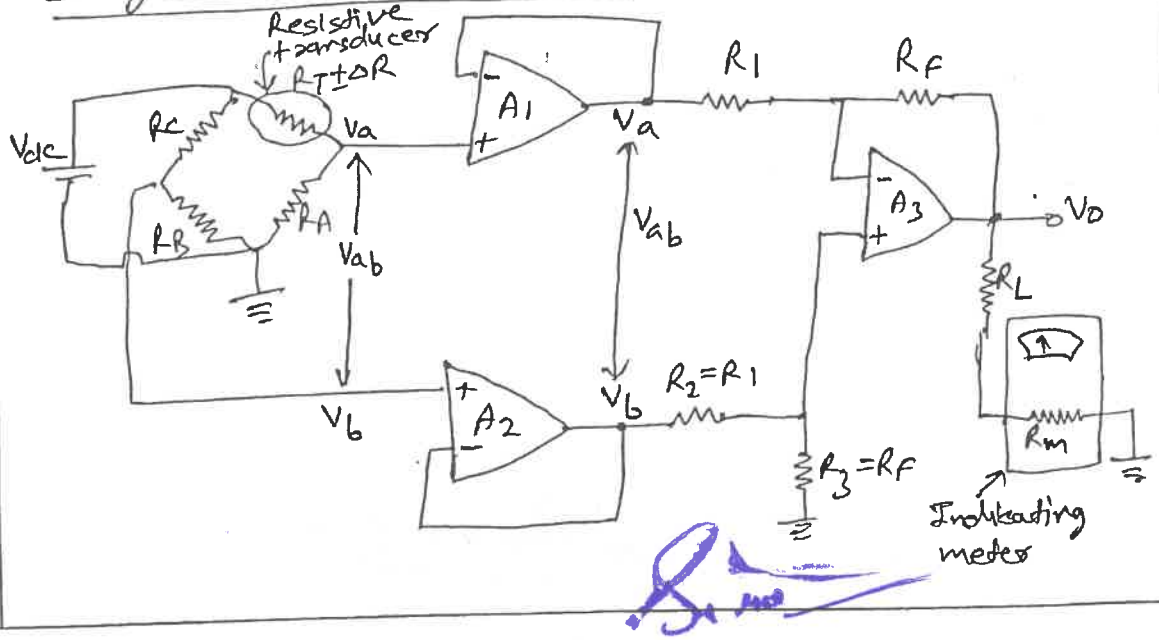
F.No-DrTTIT/IQAC/2020-21/059BP

Department of Electronics & Communication Engineering

B.E. 4th Semester III rd Internal Assessment Test

Scheme and Solution

Scheme : 2018
Academic Year: 2020 – 2021
Course Name : Analog Circuits
Course Code : 18EC42
Max marks : 50
Course Instructor : Rajesh Kumar Kaushal
Date : 09/08/2021

Q.No.	Brief Solution	Marks
1(a)	Instrumentation amp^r – 	1
	Using transducer bridge – 	2

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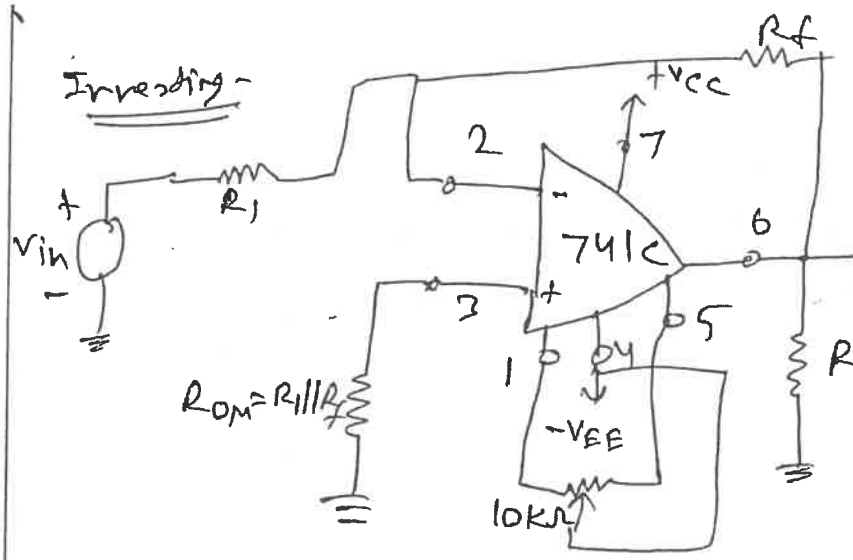
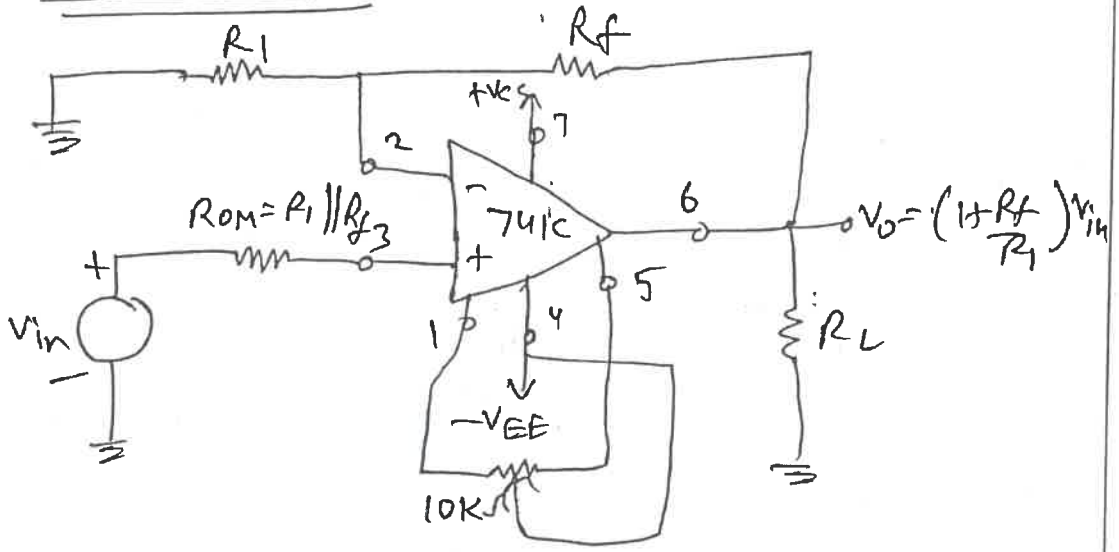
Inverting -



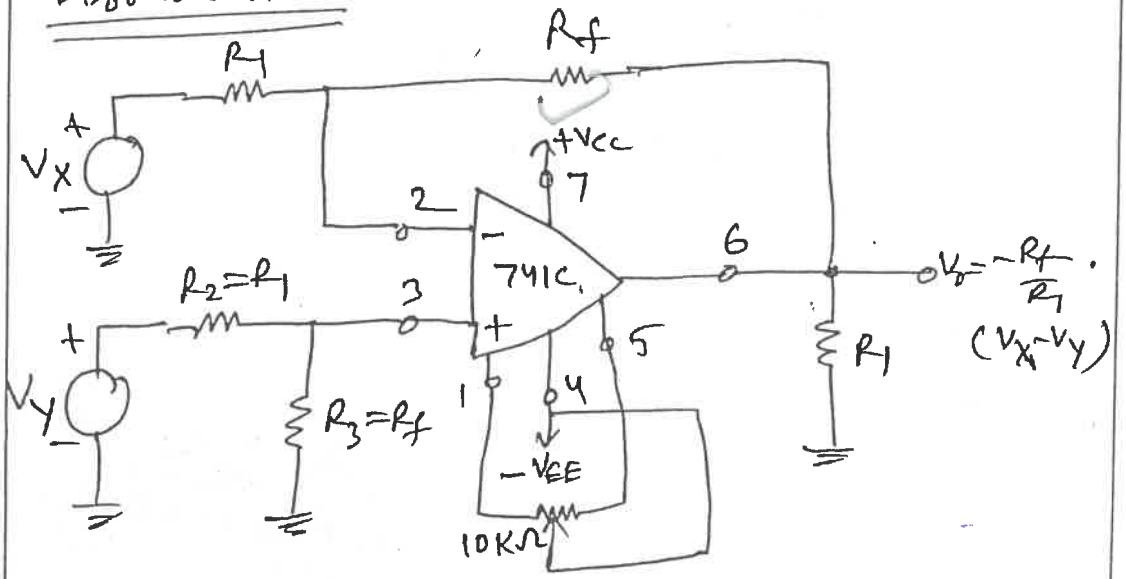
2

Non-inverting -



2

Differential -



2

Explanation

3

Using superposition theorem at V_1

Due to V_a – $V_1' = \frac{V_a \cdot R/2}{R+R/2}$

Due to V_b – $V_1'' = \frac{V_b \cdot R/2}{R+R/2}$

Due to V_c – $V_1''' = \frac{V_c \cdot R/2}{R+R/2}$

$\Rightarrow V_1 = V_1' + V_1'' + V_1'''$

$= \frac{V_a}{3} + \frac{V_b}{3} + \frac{V_c}{3}$

or $V_1 = \frac{V_a + V_b + V_c}{3}$

Now – $V_0 = \left(1 + \frac{R_f}{R_1}\right)\left(\frac{V_a + V_b + V_c}{3}\right)$

1 – Averaging amp^r –

The above ckt can directly be used as an averaging amp^r

2 – Summing amp^r –

If $1 + \frac{R_f}{R_1} = 3$ or in general

$1 + \frac{R_f}{R_1} = n$, where n is no. of i/ps

$\Rightarrow V_0 = V_a + V_b + C$

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(5) – DC amplifiers –

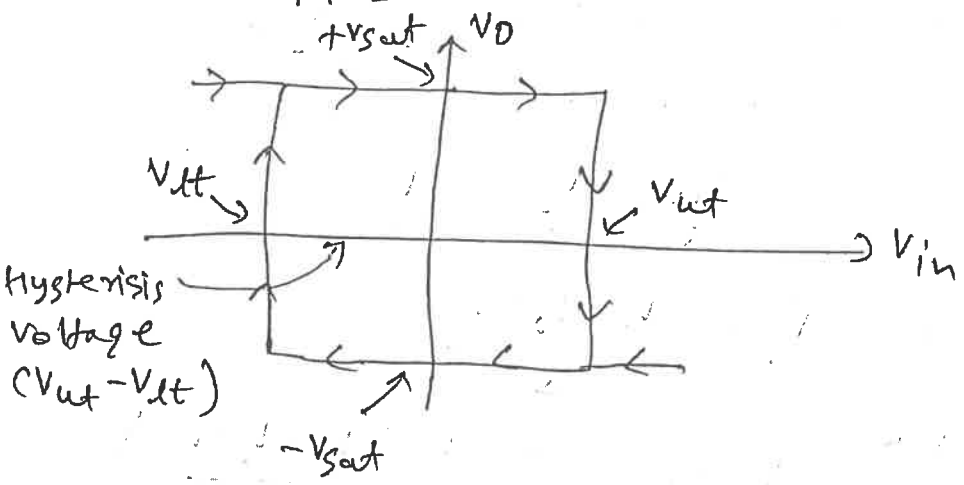
In a dc amp^r, the o/p signal changes its response to the changes in its dc i/p levels.

when $V_o = +V_{sat}$

$$V_{ut} = \frac{R_1}{R_1+R_2}(+V_{sat}) \quad 1$$

when $V_o = -V_{sat}$

$$V_{lt} = \frac{R_1}{R_1+R_2}(-V_{sat}) \quad 1$$



1

The hysteresis voltage is given by -

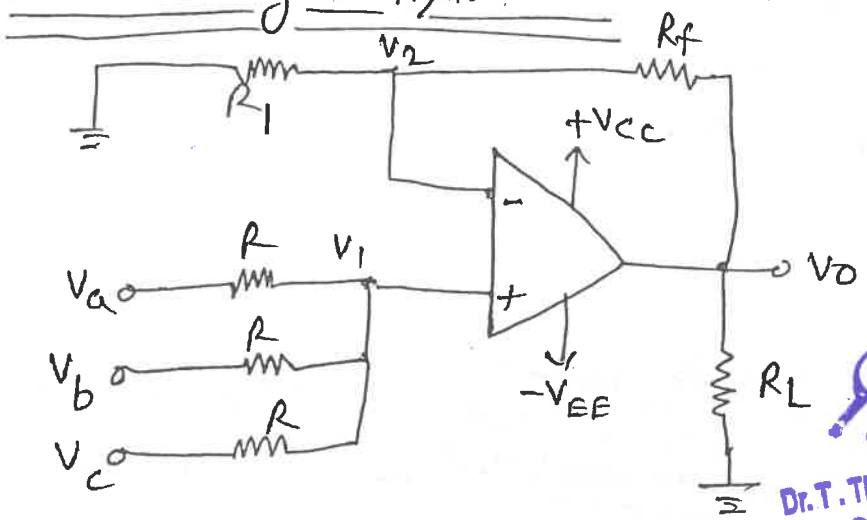
$$V_{hy} = V_{ut} - V_{lt} \quad 1$$

or $$V_{hy} = \frac{R_1}{R_1+R_2}\left[+V_{sat} - (-V_{sat})\right] \quad 1$$

Explaination 2

waveform 2

4-(b) Non-inverting configuration -



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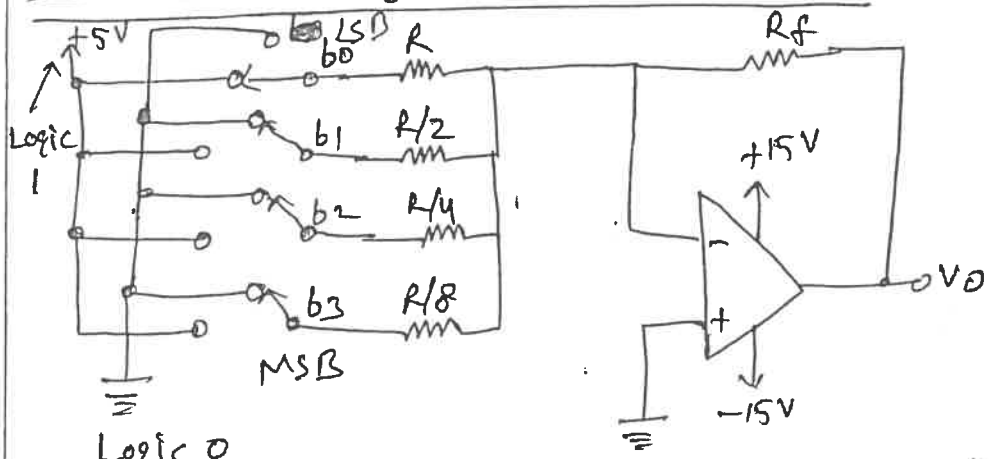
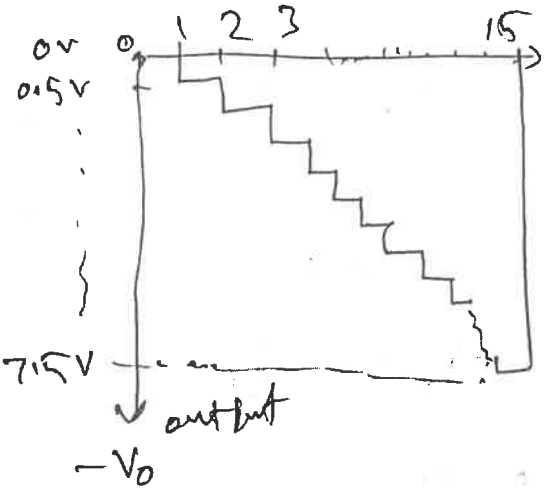
3-(b) DAC with binary-weighted resistors -



4

$$V_o = -R_f\left(\frac{b_0}{R} + \frac{b_1}{R/2} + \frac{b_2}{R/4} + \frac{b_3}{R/8}\right)$$

1

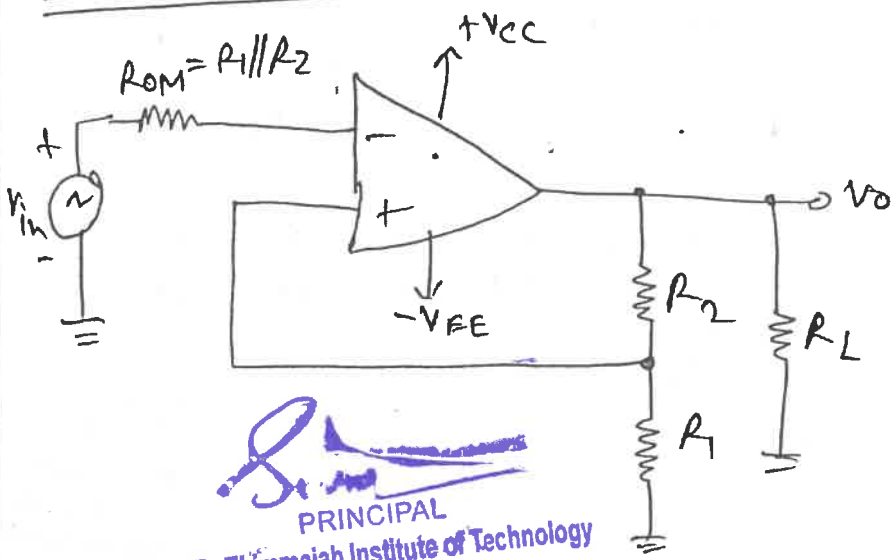


2

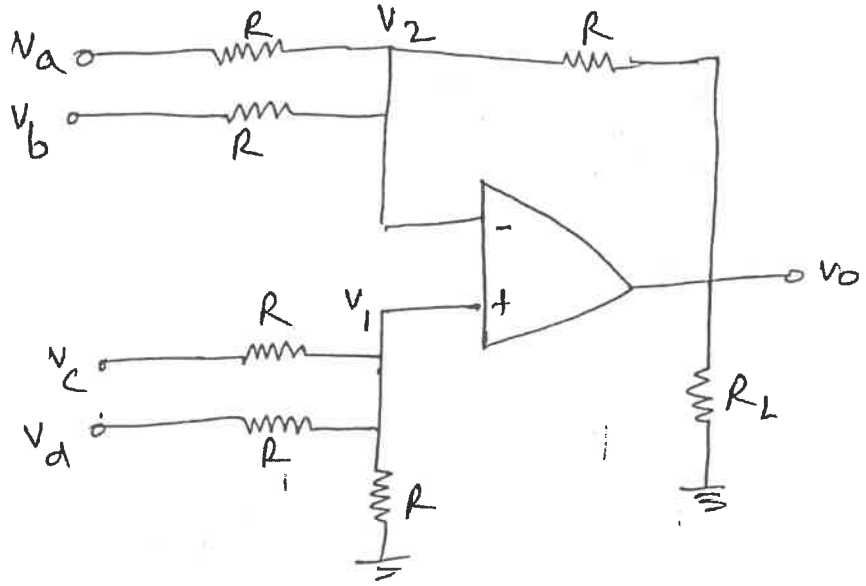
Explanation

3

4-(a) Schmitt trigger -



1



2

Using superposition theorem -

Due to V_a, $V_{oa} = -V_a$

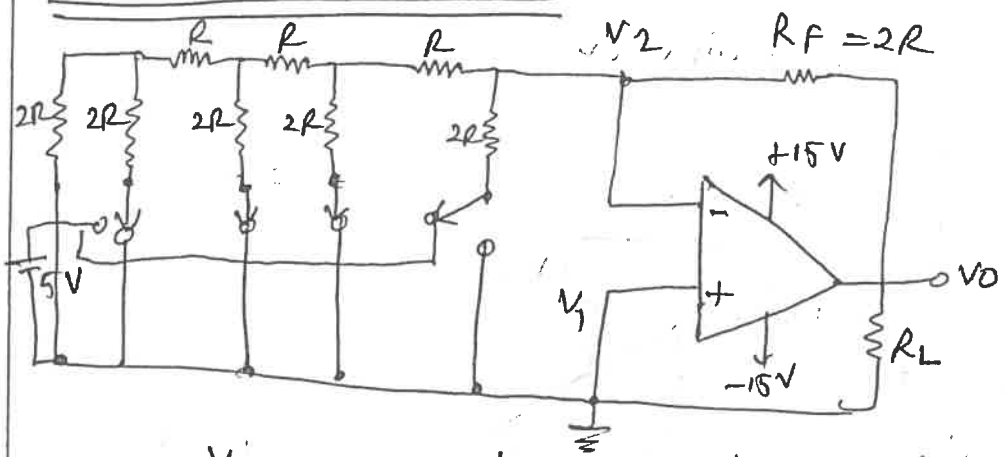
Due to V_b, $V_{ob} = -V_b$ 2

Due to V_c, $V_{oc} = V_c$

Due to V_d, $V_{od} = V_d$

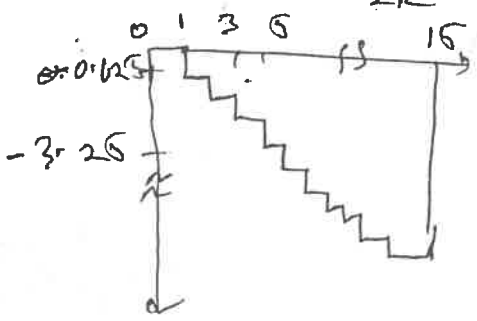
$\Rightarrow V_o = -V_a - V_b + V_c + V_d$ 1

3-(a) 4-bit R-2R DAC -



4

$$V_o = -R_F\left(\frac{b_3}{2R} + \frac{b_2}{4R} + \frac{b_1}{8R} + \frac{b_0}{16R}\right)$$ 1



2

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Explanation 3

3 - Averaging amp^r -

$R_a = R_b = R_c \equiv R$ 1

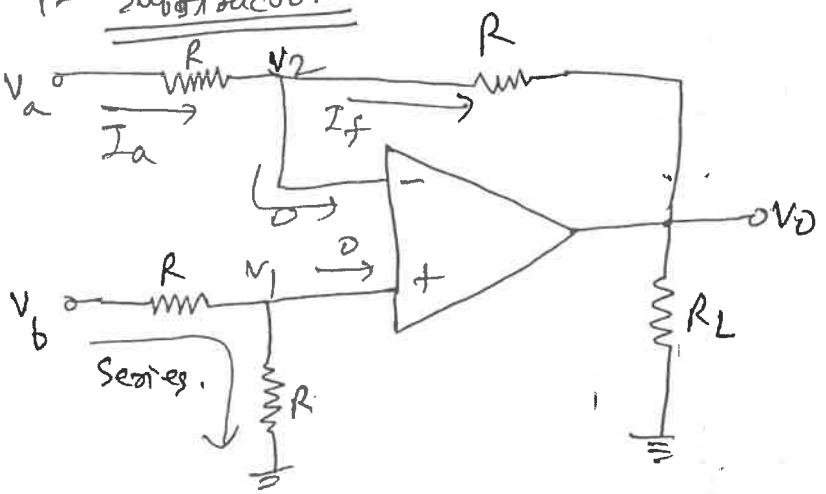
and $\frac{R_F}{R} = \frac{1}{n}$, where n is no. of i/ps. 1

here $\frac{R_F}{R} = \frac{1}{3}$.

now $V_o = -\left(\frac{V_a + V_b + V_c}{3}\right)$ 2

2-(b) Differential configuration -

1- Subtractor -



2

1

$V_1 = \frac{R \cdot V_b}{R+R} = \frac{V_b}{2} \equiv V_2$ (virtual short-ckt) 1

$I_a = \frac{V_a - \frac{V_b}{2}}{R}$ 1

$I_f = \frac{\frac{V_b}{2} - V_o}{R}$

But $I_a \equiv I_f$

$\Rightarrow V_o = V_b - V_a$ 1

2 - Summing amp^r -

The 4-i/p summing amp^r may be constructed as below -

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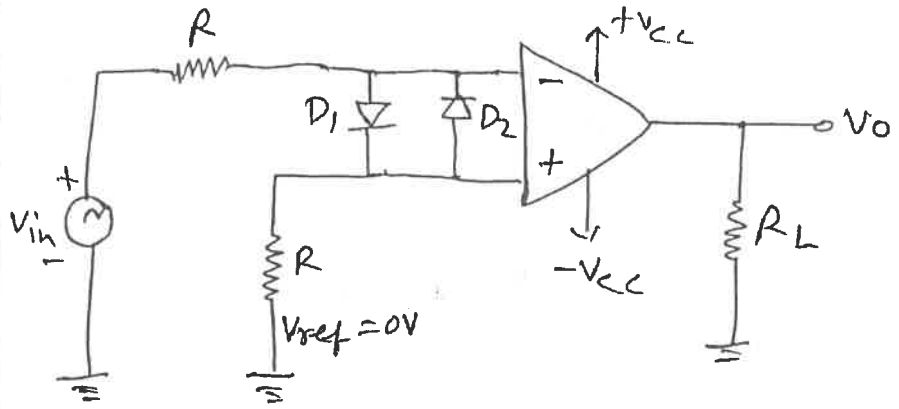
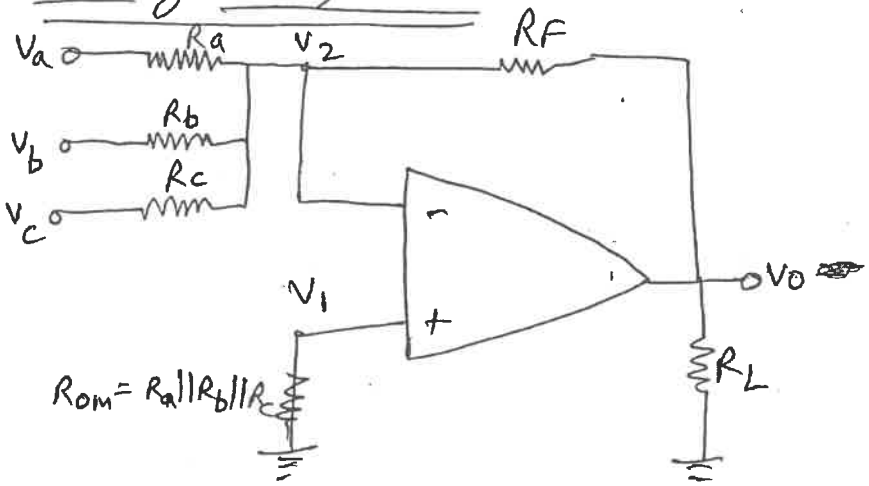
Zero - crossing detector can be implemented by a comparator with $V_{ref} = 0$ V.



waveform

2 (a) Inverting configuration -



$$V_o = -\left(\frac{R_f}{R_a} V_a + \frac{R_f}{R_b} V_b + \frac{R_f}{R_c} V_c\right)$$

1 - Summing amp^r -

If $R_a = R_b = R_c \equiv R$, then

$$V_o = -\frac{R_F}{R}(V_a + V_b + V_c)$$

Again if gain = 1, or $R_a = R_b = R_c = R_f$

then $V_o = -(V_a + V_b + V_c)$

2 - Scaling amp^r -

If $R_a \neq R_b \neq R_c$, then it works as a scaling amplifier.

If bridge is balanced.

$V_b = V_a$

$\Rightarrow \frac{R_C}{R_B} = \frac{R_T}{R_A}$ — 1

Let the change in resistance is ΔR, i.e., the bridge is now unbalanced.

$$V_a = \frac{R_A \cdot V_{dc}}{R_A + (R_T + \Delta R)}$$

& $$V_b = \frac{R_B \cdot V_{dc}}{R_B + R_C}$$ — 2

$V_{ab} = V_a - V_b$

if $R_A = R_B = R_C = R_T \equiv R$, then

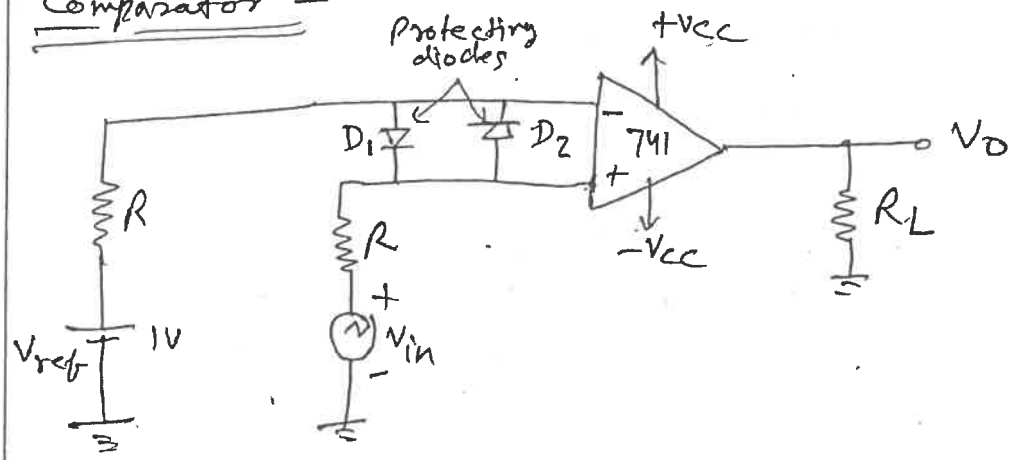
$$V_{ab} = \frac{-\Delta R (V_{dc})}{2(2R + \Delta R)}$$ [-ve means $V_a < V_b$]

Now $V_o = \left(-\frac{R_F}{R_1}\right) V_{ab}$ — 2

$$V_o = \frac{R_F}{R_1} \cdot \frac{\Delta R}{4R} \cdot V_{dc}$$

Explanation — 2

1-(b) **Comparator –**



2

when $V_{in} < V_{ref}$, then $V_o = -V_{sat}$ ($\simeq -V_{EE}$) — 1

when $V_{in} > V_{ref}$, then $V_o = +V_{sat}$ — 1

waveforms — 2

Zero - crossing detector –

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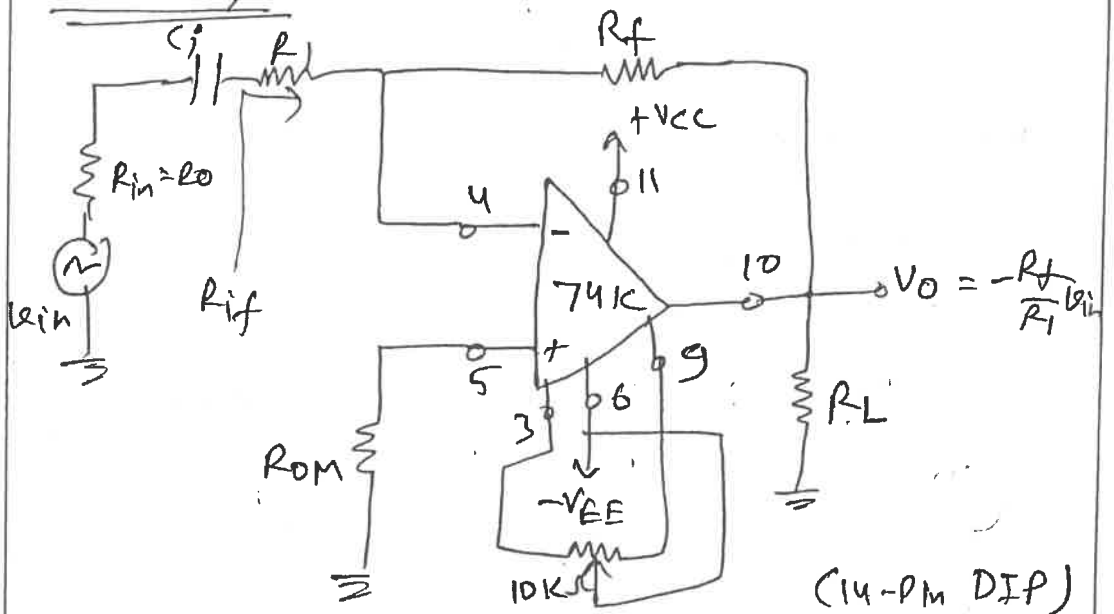
(6) - AC amplifier -

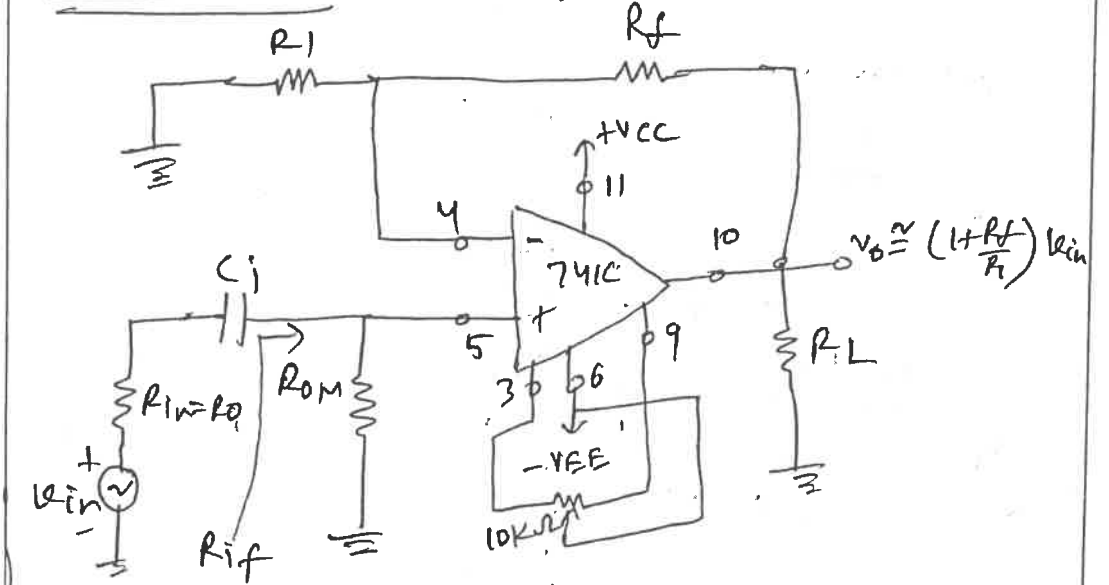
It responses to the ac signals. To block dc component, the coupling capacitors are used. 1

Inverting -



(14-Pin DIP) 2

Non-inverting -



2

$$f_L = \frac{1}{2\pi C_i (R_{if} + R_o)}$$ 1

$$BW = f_H - f_L$$ 1

Explanation 3

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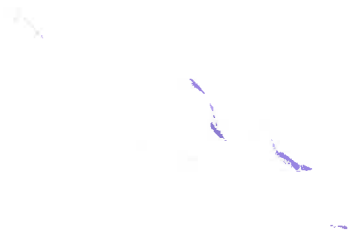

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Department of Computer Science Engineering
2018 Scheme

B.E. 3rd Semester First Internal Assessment Test QP- 2020/2021

Subject Name: Discrete Mathematical Structures
Duration : 90 Minutes
Faculty In charge: Thara devi M

Subject code: 18CS36
Max Marks: 50 Marks
Date: 21/10/2020

PART-A - Two Questions each carry Twenty marks (Answer any one Question)

Q.No.	Question	Marks	CO	RBT
1a	Define the following with an example for each: (i) Compound Proposition (ii) Tautology (iii) Contradiction (iv) Logical Connectives (v) Identity and Inverse Law (vi) Modus Ponens rule	12M	CO1	L1
1b	Show that is tautology or contradiction $\{(p \vee q) \rightarrow r\} \leftrightarrow \{\neg r \rightarrow \neg(p \vee q)\}$	8M	CO1	L3
2a	Test the validity of the foll: $((\neg p \vee q) \rightarrow r) \wedge (\neg s \wedge \neg u)$ $\wedge (r \rightarrow (s \vee t)) \wedge (\neg u \rightarrow \neg t)$ $\therefore p$	10M	CO1	L3
2b	Define Quantified Statement. Find whether the foll argument is valid or not $\forall x, [p(x) \vee q(x)]$ $\exists x, \neg p(x)]$ $\forall x, [\neg q(x) \vee r(x)]$ $\forall x, [s(x) \rightarrow \neg r(x)]$ $\therefore \exists x, \neg s(x)$	10M	CO1	L1, L3

PART-B - Two Questions each carry Twenty marks (Answer any one Question)

3a	Verify the principle of duality for, $[\neg(p \wedge q) \rightarrow (\neg p \vee (\neg p \vee q))] \Leftrightarrow (\neg p \vee q)$	10M	CO1	L3
3b	Find whether the foll argument are valid or not. If the band could not play rock music or the refreshments were not served on time, then the new year party could have been cancelled and Alica would have been angry. If the party were cancelled, then refunds would have to be made. No refunds were made, therefore the band could play rock music	10M	CO1	L3
4a	Find the negation of the following quantified statement "All Integers are Rational numbers and some Rational numbers are not Integers"	6M	CO1	L3
4b	Justify the following using laws of logic: $(p \vee q) \wedge \neg(\neg p \wedge q) \Leftrightarrow p$	7M	CO1	L3
4c	Find the possible truth values for p, q and r if, (i) $p \rightarrow (q \vee r)$ = false (ii) $p \wedge (q \rightarrow r)$ = true	7M	CO1	L3

PART-C -Two Questions each carry Ten Marks (Answer any one Question)

5	Let f : R -> R be defined by f(x) = { (3x – 5) for x > 0 & (-3x + 1) for x<=0 } Solve f(5/3) f(-5/3) , $f^{-1}(1)$, $f^{-1}(-6)$, $f^{-1}([-5,5])$	10M	CO3	L3
6a	Define Function and explain any 4 types of functions with example each	5M	CO3	L1,L2
6b	Let A = {1,2,3} and B = {2,4,5,7} (i) Find the total number of relations and functions from A to B (ii) Find the number of relations on A that contain at least 7 ordered pairs	5M	CO3	L3

Faculty 20/10/20

PAC Members (Name with Signature)

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Department of Computer Science Engineering
2018 Scheme

B.E. 3rd Semester First Internal Assessment Test Answer Scheme - 2020/2021

Subject Name: Discrete Mathematical Structures
Duration : 90 Minutes
Faculty In charge: Thara devi M

Subject code: 18CS36
Max Marks: 50 Marks
Date: 21/10/2020

PART-A - Two Questions each carry Twenty marks (Answer any one Question)

Q.No.	Question	Marks
1a	**Define the following with an example for each:** (i) Compound Proposition combined form of primitive statements by logical connectives or by negation Ex:Today is Friday and it is raining today. (ii) Tautology (iii) Contradiction A compound statement is called a *tautology(T0)* if it is true for all truth value assignments for its component statements. If a compound statement is false for all such assignments, then it is called a *contradiction(F0)* $p \rightarrow (p \vee q)$: tautology $p \wedge (\neg p \wedge q)$: contradiction (iv) Logical Connectives Logical operators are used to form new propositions from two or more existing propositions. The logical operators are also called connectives. (a) conjunction (AND) (b) disjunction(inclusive OR) (c) exclusive or (d) Implication (e) biconditional (v) Identity and Inverse Law Identity Law- $P \vee F \Leftrightarrow P$ $P \wedge T \Leftrightarrow P$ Inverse Law- $P \vee \neg P \Leftrightarrow T$ $P \wedge \neg P \Leftrightarrow F$ (vi) Modus Ponens rule $p \wedge p \rightarrow q \Rightarrow q$ (true) Example	6*2= 12M
1b	**Show that is tautology or contradiction** $\{(p \vee q) \rightarrow r\} \leftrightarrow \{\neg r \rightarrow \neg(p \vee q)\}$	8M

17/11/20
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$\{(p \vee q) \to r\} \leftrightarrow \{\neg r \to \neg(p \vee q)\}$

p	q	r	$\neg r$	$(p \vee q)$	$\neg(p \vee q)$	A	B	$A \leftrightarrow B$
0	0	0	1	0	1	1	1	1
0	0	1	1	0	1	1	1	1
0	1	0	1	1	0	0	0	1
0	1	1	0	1	0	1	1	1
1	0	0	1	1	0	0	0	1
1	0	1	0	1	0	1	1	1
1	1	0	1	1	0	0	0	1
1	1	1	0	1	0	1	1	1

→ ①

7M

Let, $(p \vee q) \to r = A$

$\neg r \to \neg(p \vee q) = B$

It is Tautology

Using same truth table, the above truth table is constructed & proved

1M

2a Test the validity of the foll: $((\neg p \vee q) \to r) \wedge (\neg s \wedge \neg u) \wedge (r \to (s \vee t)) \wedge (\neg u \to \neg t)$ / $\therefore p$ — **10M**

$[(\neg p \vee q) \to r] \wedge (r \to (s \vee t)] \wedge (\neg s \wedge \neg u) \wedge (\neg u \to \neg t)$ — 2M

Rule of Syllogism

$\Rightarrow [(\neg p \vee q) \to (s \vee t)] \wedge (\neg s \wedge \neg u) \wedge (\neg u \to \neg t)$ — 2M

Associative

$\Leftrightarrow [(\neg p \vee q) \to (s \vee t)] \wedge \neg s \wedge [\neg u \wedge (\neg u \to \neg t)]$ — 2M

Modus ponens

$\Rightarrow \{(\neg p \vee q) \to (s \vee t)\} \wedge [\neg s \wedge \neg t]$ DeMorgans.

$\Leftrightarrow [(\neg p \vee q) \to (s \vee t)] \wedge \neg(s \vee t)$ — 2M

Modus Tollens

$\Rightarrow \neg(\neg p \vee q)$

$\Leftrightarrow \neg\neg p \wedge \neg q$ DeMorgans & Double negation

$\Leftrightarrow p \wedge \neg q$ Conjunctive Simplification

$\Rightarrow p$ // It is proved & valid — 2M

2b **Define Quantified Statement. Find whether the foll argument is valid or not** — **10M**

$\forall x, |p(x) \vee q(x)|$

$\exists x, \neg p(x)|$

$\forall x, |\neg q(x) \vee r(x)|$

$\forall x, |s(x) \to \neg r(x)|$

$\therefore \exists x . \neg s(x)$

$\forall a$ can be given as $\exists a$,

So, $\exists a, \{p(a) \vee q(a)\}$
$\exists a, \neg p(a)$
$\exists a, [\neg q(a) \vee r(a)]$
$\exists a, [s(a) \Rightarrow \neg r(a)]$ — 2M

so, $\{p(a) \vee q(a)\} \wedge \neg p(a) \wedge \{\neg q(a) \vee r(a)\} \wedge \{s(a) \to \neg r(a)\}$
$\Leftrightarrow \{p(a) \vee q(a)\} \wedge \neg p(a) \wedge \{q(a) \to r(a)\} \wedge \{r(a) \to \neg s(a)\}$
using law of conditional & contrapositive — 2M

$\Leftrightarrow \{p(a) \vee q(a)\} \wedge \neg p(a) \wedge \{q(a) \to \neg s(a)\}$
Rule of syllogism — 2M

$\Leftrightarrow \{p(a) \vee q(a)\} \wedge \neg p(a) \wedge \{q(a) \to \neg s(a)\}$
$\Leftrightarrow \{\neg(\neg p(a)) \vee q(a)\} \wedge \neg p(a) \wedge \{q(a) \to \neg s(a)\}$ — 2M
law of conditional

$\Leftrightarrow \{\neg p(a) \to q(a)\} \wedge \neg p(a) \wedge \{q(a) \to \neg s(a)\}$
Modus ponens rule

$\Rightarrow q(a) \wedge \{q(a) \to \neg s(a)\}$ — 2M
Modus ponens rule

$\Rightarrow \neg s(a)$ proved $\Rightarrow \exists x, \neg s(x)$
It is valid
(using Generalisation)

PART-B - Two Questions each carry Twenty marks (Answer any one Question)

3a	Verify the principle of duality for, $[\neg(p \wedge q) \to (\neg p \vee (\neg p \vee q))] \Leftrightarrow (\neg p \vee q)$	**10M**

Let s be a statement, If s contains only $\wedge$ & $\vee$ connectives, then the dual of s, denoted by s^d is the statement obtained from s by replacing each occurrence of $\wedge$ & $\vee$ by $\wedge$ & $\wedge$ respectively & T_0 & F_0 by F_0 & T_0 respectively — 2M

ie, $s \Leftrightarrow t$, then $s^t \Leftrightarrow t^d$ | duality property | principle.

$\{\neg(p \wedge q) \to \neg p \vee (\neg p \vee q)\} \Leftrightarrow (\neg p \vee q)$
$u \qquad\qquad\qquad\qquad v$

$u = \neg(p \wedge q) \to (\neg p \vee (\neg p \vee q))$ & $v = \neg p \vee q$.
$u = \neg\neg(p \wedge q) \vee (\neg p \vee (\neg p \vee q))$ law of conditional
$= (p \wedge q) \vee (\neg p \vee (\neg p \vee q))$ Double negation
$= (p \wedge q) \vee ((\neg p \vee \neg p) \vee q)$ Associative — 4M
$= (p \wedge q) \vee (\neg p \vee q)$ Idempotent
$= (p \wedge q) \vee (q \vee \neg p)$ Commutative.

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Vijayapur-586103

$= [(P \wedge q) \vee q] \vee \neg P$ Associative.

$= q \vee \neg P$ Absorption

$u = (\neg P \vee q)$ Commutative

So the dual of u is $u^d = (\neg P \vee q)^d = (\neg P \wedge q) \rightarrow ①$

the dual of v is $v^d = (\neg P \vee q)^d = (\neg P \wedge q) \rightarrow ②$

So $u^d \Leftrightarrow v^d$ i.e. ① ⇔ ②

4M

3b **Find whether the foll argument are valid or not. If the band could not play rock music or the refreshments were not served on time, then the new year party could have been cancelled and Alica would have been angry. If the party were cancelled, then refunds would have to be made. No refunds were made, therefore the band could play rock music** **10M**

P : The band could play rock music

q : The refreshments were served on time

r : The new year party could have been cancelled

s : Alica would have been angry

t : Refunds would have been made

2M

Argument is

$$\begin{array}{l} (\neg P \vee \neg q) \rightarrow (r \wedge s) \\ r \rightarrow t \\ \neg t \\ \hline \therefore P \end{array}$$

2M

$(\neg P \vee \neg q) \rightarrow (r \wedge s) \wedge (r \rightarrow t) \wedge (\neg t) \Rightarrow P$ Modus Tollens rule.

LHS,

$\Rightarrow (\neg P \vee \neg q) \rightarrow (r \wedge s) \wedge (r \rightarrow t) \wedge (\neg t)$ DeMorgans

$\Leftrightarrow \neg(P \wedge q) \rightarrow (r \wedge s) \wedge (\neg r)$ Conjunctive Simplification.

$\Rightarrow \neg(P \wedge q) \rightarrow r \wedge (\neg r)$ Conjunctive Simplification

$\Rightarrow (\neg P \rightarrow r) \wedge (\neg r)$ Modus Tollens rule.

$\Rightarrow \neg(\neg P)$ Double Negation

$\Rightarrow P$ //

2M

4M

It is proved &

hence it is valid.

4a **Find the negation of the following quantified statement "All Integers are Rational numbers and some Rational numbers are not Integers"** **6M**

p(x): x is a rational number
q(x):x is an integer
Z:Set of all integers, Q:Set of all rational numbers — 1M

$\{\forall x \in Z, p(x)\} \wedge \{\exists x \in Q, \neg q(x)\}$ — 1M

So, the negation is.

$= \neg[\{\forall x \in Z, p(x)\} \wedge \{\exists x \in Q, \neg q(x)\}]$ — 2M

$= \neg\{\forall x \in Z, p(x)\} \vee \neg\{\exists x \in Q, \neg q(x)\}$

$= \{\exists x \in Z, \neg p(x)\} \vee \{\forall x \in Q, q(x)\}$ — 2M

Some Integers are not rational numbers or
All rational numbers are Integers

4b **Justify the following using laws of logic:** $(p \vee q) \wedge \neg(\neg p \wedge q) \Leftrightarrow p$ — **7M**

$(p \vee q) \wedge \neg(\neg p \wedge q)$

$\Leftrightarrow (p \vee q) \wedge (\neg\neg p \vee \neg q)$ Demorgan's Law — 2M

$\Leftrightarrow (p \vee q) \wedge (p \vee \neg q)$ Law of Double Negation — 2M

$\Leftrightarrow p \vee (q \wedge \neg q)$ Distributive Law

$\Leftrightarrow p \vee F_0$ Inverse Law and Identity Law

$\Leftrightarrow p$ — 3M

4c **Find the possible truth values for p, q and r if,** — **7M**

(i) $p \rightarrow (q \vee r)$ = false (ii) $p \wedge (q \rightarrow r)$ = true

(i) $p \rightarrow (q \vee r)$ false

$p \rightarrow (0)$ false $(0) \Rightarrow 1 \rightarrow (0)$

so, $(q \vee r) = 0$

$0 \vee 0 = 0$

so $p=1, q=0, r=0$ — 3M

(ii) $p \wedge (q \rightarrow r)$ - True

$1 \wedge (1)$ - True(1)

so $(q \rightarrow r) = 1$

so, $p=1, q=0, r=0$

$p=1, q=0, r=1$

$p=1, q=1, r=1$ — 4M

for

q	r	$q \rightarrow r$
0	0	1
0	1	1
1	1	1

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PART-C -Two Questions each carry Ten Marks(Answer any one Question)

5	**Let f : R -> R be defined by** **f (x) = { (3x – 5) for x > 0 & (-3x + 1) for x<=0 }** **Solve f (5/3) f (-5/3) , f^{-1} (1) , f^{-1} (-6), f^{-1} ([-5,5])**	**10M**
	f(5/3) = 3x – 5 = 3(5/3) – 5 = 0	1M
	f(-5/3) = -3x + 1 = -3(-5/3) + 1 = 6	1M
	$f^{-1}(1)$ = { x Ɛ R | f(x) = 1 } since f(x) =1 and should find x so, use both the formulae 3x – 5 = 1 (if x>0) 3x = 6 x= 2 (valid) -3x+1 = 1 (if x≤0) 3x= 1-1 x = 0 (valid) so $f^{-1}(1)$ = { 2, 0}	2M
	$f^{-1}(-6)$ = { x Ɛ R | f(x) = -6 } since f(x) = -6 and should find x so, use both the formulae 3x – 5 = -6 (if x>0) 3x = -1 x= -1/3 (Invalid because x ≤ 0) -3x+1 = -6 (if x≤0) 3x= 1+6 x = 7/3 (Invalid because x > 0) so $f^{-1}(-6) = \Phi$	2M
	$f^{-1}([-5,5])$ = { x Ɛ R | f(x) Ɛ [-5,5]} = { x Ɛ R | -5 ≤ f(x) ≤ 5} use both the formulae first, f(x) = 3x – 5 (if x>0) so, -5 ≤ (3x – 5) ≤ 5 if f(x) = -5 then, (3x – 5) = -5 3x = -5 +5 x = 0 if f(x) = 5 then, (3x – 5) = 5 3x = 5 + 5 x = 10/3 hence, x can be in the range [0, 10/3] as x > 0, so x=10/3 is valid Second, f(x) = -3x + 1 (if x≤0) so, -5 ≤ (-3x + 1) ≤ 5 if f(x) = -5 then, (-3x + 1) = -5 3x = 1 + 5 x = 2 if f(x) = 5 then, (-3x + 1) = 5 3x = 1 - 5 x = -4/3 hence, x can be in the range [7/3, -4/3] as x≤0, so x= -4/3 is valid so f^{-1}([-5,5]) = { [-4/3, 10/3] }	4M
6a	**Define Function and Explain any 4 types of functions with example each** Let A and B be 2 non empty sets, then function from A to B is f: A → B is a relation from	**5M**

	A to B such that for a ∈ A there is a unique element b ∈ B such that (a, b) ∈ f Types of Functions Identity function Constant function One to one function Onto function Many to one function One to one Correspondance	1M
	Identity Function For function f: **A→A** , f(a) = a, for every a∈ A, then the function is known as Identity function. Every element of A as image itself.	1M
	Constant Function For function f: **A→B** , f(a) = c, for every a∈ A Where c is a fixed element of B and is constant function Have same image in B	1M
	Onto Function If there exists a function for which every element of set B there is (are) pre-image(s) in set A, it is Onto Function. Onto is also referred as Surjective Function.	1M
	One to One Function A function f: A → B is One to One if for each element of A there is a distinct element of B. It is also known as Injective.	1M
6b	**Let A = {1,2,3} and B = {2,4,5,7}** **(i) Find the total number of relations and functions from A to B** **(ii) Find the number of relations on A that contain at least 7 ordered pairs**	**5M**
	(i)Total number of relations from A to B is 2^{mn}, m=3,n=4 $= 2^{3*4}$ $= 4096$ Total number of functions from A to B is n^m, $4^3 = 64$	2M
	(ii)Number of binary relations on A that contain at least 7 ordered pairs is, Binary relation on A means it is A x A, so the ordered pairs is m * m = 3 * 3 = 9 So, Number of binary relations on A that contain at least 7 ordered pairs is, $^9C_7 + {}^9C_8 + {}^9C_9$ = 36 + 9 + 1 = 46	3M

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