School of Aeronautics(Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

Fortnightly/Term : Mid Term -1 Date : 24. 02. 2018

Subject : **Digital Technique (Th)** Batch : AE - 7,8,9

Faculty Name : Mr. Raviraj Shrikrishna Semester: VI

(Answer any FIVE Questions. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions	Unit Name / Topic
1.	Implement the following using NAND gate (i) $Y = \overline{A}\,\overline{B}\,\overline{C}$ (ii) $Y = A\overline{B} + \overline{C}\overline{D}$ (4.5x2)	Unit No.: Topic Name: Source:
2.	Explain the following (i) Universal logic gate (ii) Positive & negative logic system (4.5x2)	Unit No.: Topic Name: Source:
3.	Convert the following (i) $(11010)_G$ to binary form (ii) $(379)_{10}$ to BCD form (iii)$(64.2)_{10}$ to Octal form (3+3+3)	Unit No.: Topic Name: Source:
4.	(a) Construct Ex-OR gate using NAND gate. (b) Construct AND gate using NOR gate. (4.5+4.5)	Unit No. Topic Name: Source:

Q.No.	Questions	Unit Name / Topic
5.	(a) Given $\overline{AB} + \overline{A}\ B = C$ find $\overline{AC} + \overline{A}\,C$ (b) Express the Boolean function F=AB+AC in a product of maxterm form. (4.5+4.5)	Unit No.: Topic Name: Source:
6.	Obtain the real minimal expression for $f = \sum m(0,1,2,3,5,7,8,9,10,12,13)$ using K'map and draw the minimal expression in terms of universal logic. (9)	Unit No.: Topic Name: Source:
7.	Simplify the expression Y="m(3,4,5,7,9,13,14,15)using K'map method. (9)	Unit No.: Topic Name: Source:
8.	(a) Explain the logic diagram,truth table and switching diagram of NOR gate and Ex-OR gate. (b) Simplify the Boolean expression Y= [AB(C+BD) +AB] C (4.5+4.5)	Unit No. Topic Name: Source:

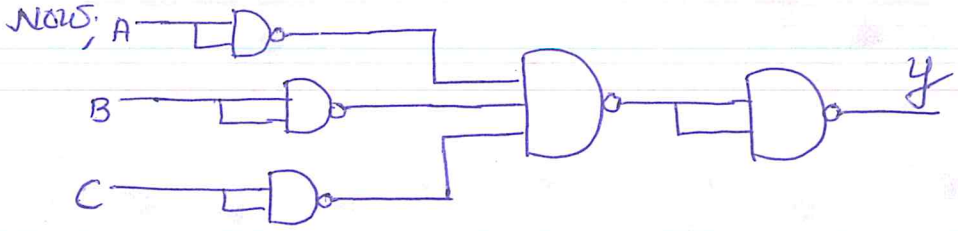
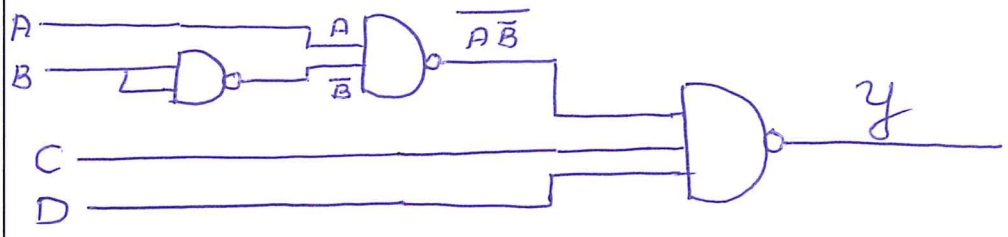
School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

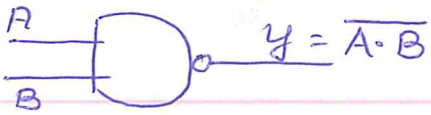
Name of Examination: MIDTERM-1 Date of Examination: 24-02-2018

Subject DIGITAL TECHNIQUE Batch 7, 8, 9 Semester VI

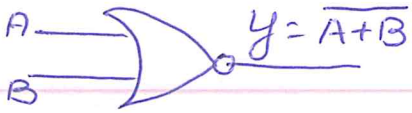
Q. NO.	ANSWER	MARKS
1	(i) Ans:- $Y = \bar{A}\bar{B}\bar{C}$	
	or, $\bar{Y} = \overline{\bar{A}\bar{B}\bar{C}}$	
	$\therefore \bar{\bar{Y}} = \overline{\overline{\bar{A}\bar{B}\bar{C}}}$	
	Now, 	4·5
	(ii) Ans:- $y = A\bar{B} + \overline{CD}$	
	Now, $\bar{y} = \overline{A\bar{B} + \overline{CD}} = \overline{A\bar{B}} \cdot CD$	
	$\therefore \bar{\bar{y}} = \overline{\overline{A\bar{B}} \cdot CD}$	4·5
	Now, 	

Q. NO.	ANSWER	MARKS

2 (i) Ans:- Universal Gate: NAND and NOR are called universal gate because, they can express any boolean function.



NAND GATE



NOR GATE

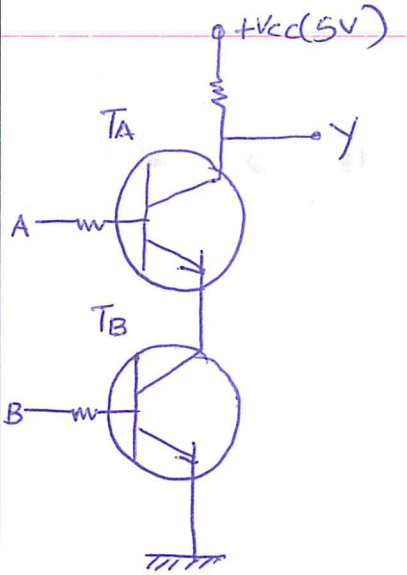
Truth Table

A	B	$Y = \overline{A \cdot B}$
0	0	1
0	1	1
1	0	1
1	1	0

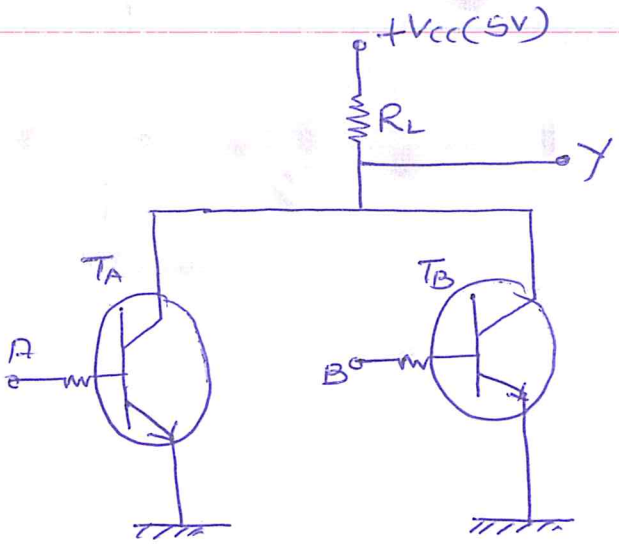
Truth Table

A	B	$Y = \overline{A+B}$
0	0	1
0	1	0
1	0	0
1	1	0

4.5



fig(i)



fig(ii)

fig(i) → Transistor circuit diagram of NAND

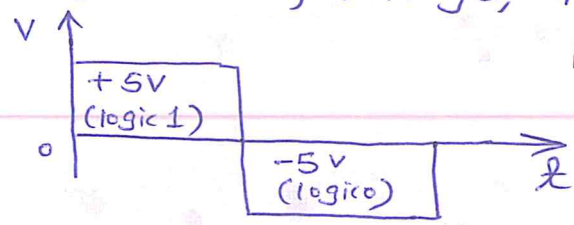
fig(ii) → Transistor circuit diagram of NOR

Q. NO.	ANSWER	MARKS

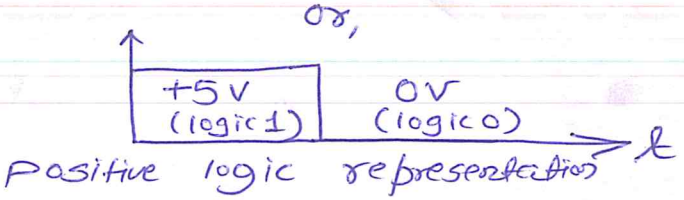
2 (ii) Ans:- Positive logic and Negative logic

→ In +ve logic, Bit 1 means logic high and Bit 0 means logic low

→ In terms of voltage; high logic : +5V
low logic : −5V, OR 0V



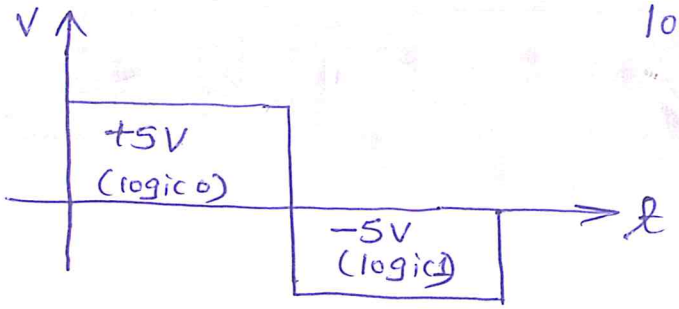
OR,



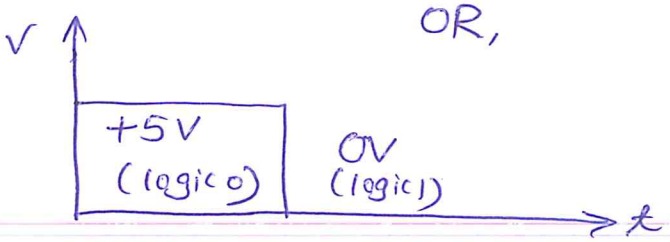
Positive logic representation

→ In −ve logic; Bit 1 means : logic low
Bit 0 means : logic high 4.5

→ In terms of voltage; high logic : −5V or 0V
low logic : +5V



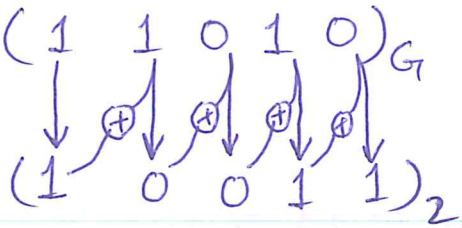
OR,



Negative logic representation

Q. NO.	ANSWER	MARKS

3 (i) Ans:-



3

Modulo 2 addition is done; while converting Gray code to Binary code.

(ii) Ans:- $(379)_{10} \longrightarrow (\ ?\ )_{BCD}$

$3 \longrightarrow 0011$
$7 \longrightarrow 0111$
$9 \longrightarrow 1001$

Hence; $(379)_{10} \longrightarrow (0011, 0111, 1001)_{BCD}$ 3

(iii) Ans:- $(64.2)_{10} \longrightarrow (\ ?\ )_8$

Case 1:- Solving integral part

	Q	R
$\frac{64}{8}$	8	0 ↑
$\frac{8}{8}$	1	0 |
$\frac{1}{8}$	0	1 |

$\therefore (64)_{10} \longrightarrow (100)_8$

Q. NO.	ANSWER	MARKS

3. (iii) Remaining part

Case 2: Solving Fractional part

$0.2 \times 8 = 1.6$ → 1

$0.6 \times 8 = 4.8$ → 4

$0.8 \times 8 = 6.4$ → 6 ↓

3

$\therefore (0.2)_{10} \longrightarrow (146)_8$

Hence; $(64.2)_{10} \longrightarrow (100.146)_8$

4 (A) Ans:- We need to construct Ex-OR gate using NAND gate

Let $Y = \bar{A}B + A\bar{B}$ (Expression for X-OR)

$\Rightarrow Y = \bar{A}B + A\bar{B} + A\bar{A} + B\bar{B}$

$\Rightarrow Y = A(\bar{A}+\bar{B}) + B(\bar{A}+\bar{B})$

$\Rightarrow Y = A(\overline{AB}) + B(\overline{AB})$

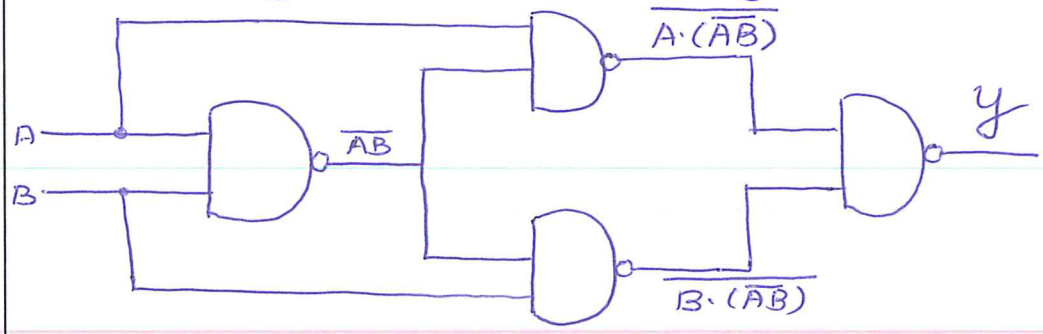
$\Rightarrow \overline{Y} = \overline{A(\overline{AB}) + B(\overline{AB})}$ [Using De-morgan's theorem]

$\Rightarrow \overline{Y} = \overline{A(\overline{AB})} \cdot \overline{B(\overline{AB})}$

$\therefore \overline{\overline{Y}} = \overline{\overline{A(\overline{AB})} \cdot \overline{B(\overline{AB})}}$

Q. NO.	ANSWER	MARKS

The NAND gate realisation is given below



4.5

4(B) Ans:- We need to construct AND gate using NOR gate

Let $y = A \cdot B$

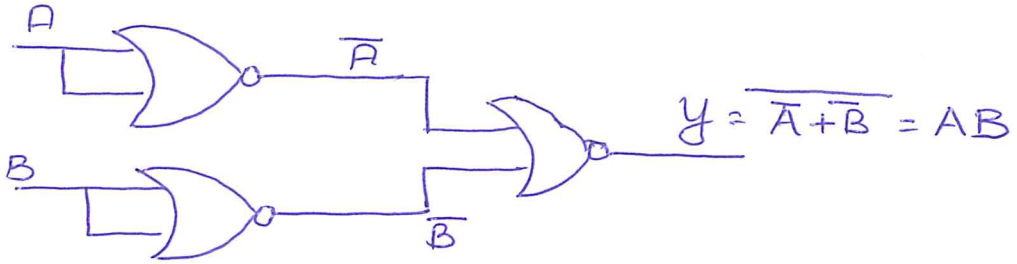
$\Rightarrow \overline{y} = \overline{AB}$

$\Rightarrow \overline{y} = \overline{A} + \overline{B}$ [using Demorgan's theorem]

$\Rightarrow \overline{\overline{y}} = \overline{\overline{A} + \overline{B}}$

4.5

Hence, NOR gate realisation is given below.



Q. NO.	ANSWER	MARKS

5(A) Ans:- Given $\overline{A}B + A\overline{B} = C$

then, $\overline{A}C + A\overline{C}$

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

$= \overline{A(A + \overline{B} + \overline{A}B)} + A(A + \overline{B} + \overline{A}B)$ [Using De-morgans theorem]

$= \overline{A}\overline{B} + A[A(1+B) + \overline{B}]$ [Distribution theorem]

$= \overline{A} + B + A[A + \overline{B}]$ [$\because 1+B=1$]

$= \overline{A} + B + A + A\overline{B}$ [$\because A \cdot A = A$] 4.5

$= \overline{A} + A\overline{B} + B$

$= \overline{A}(1+\overline{B}) + B$

$= \overline{A} \cdot 1 + B$ [$\because 1+\overline{B}=1$]

$= \overline{A} + B$ [$\because A \cdot 1 = A$]

(5) (B) Ans:- $F = AB + \overline{A}C$

First writing in SOP form we have;

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

$= ABC + AB\overline{C} + \overline{A}BC + \overline{A}\overline{B}C$

$= \overline{A}\overline{B}C + \overline{A}BC + AB\overline{C} + ABC$

001 (1) 011 (3) 110 (6) 111 (7)

$= m_1 + m_3 + m_6 + m_7$

$= \sum m(1, 3, 6, 7)$

Q. NO.	ANSWER	MARKS

Remaining part of (5) (B) Ans:-

In the above expression the minterms m_0, m_2, m_4 and m_5 is absent.

Hence the max terms M_0, M_2, M_4 and M_5 will be present in the corresponding POS form.

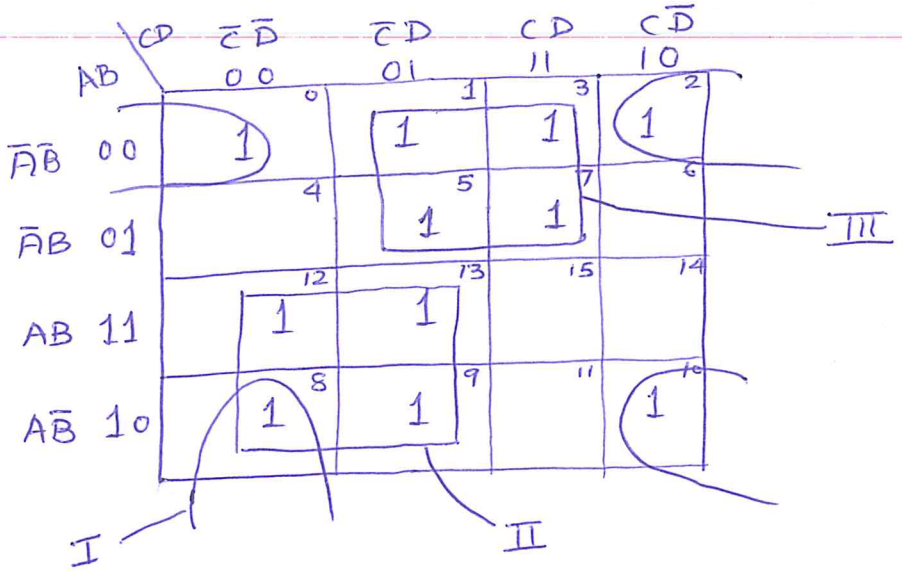
Hence, the product of maxterms, can be represented as;

$$f = \Pi M(0, 2, 4, 5)$$

4.5

(6) Ans:- $f = \sum m(0, 1, 2, 3, 5, 7, 8, 9, 10, 12, 13)$

This can be solved using 4-variable K'map in SOP form.



$f_{min} = I + II + III$

$= \bar{B}\bar{D} + A\bar{C} + \bar{A}D$

Q. NO.	ANSWER	MARKS

Now;

$$f_{min} = \bar{B}\bar{D} + A\bar{C} + \bar{A}D$$

or,

$$\overline{f_{min}} = \overline{\bar{B}\bar{D} + A\bar{C} + \bar{A}D}$$

$$= \overline{\bar{B}\bar{D}} \cdot \overline{A\bar{C}} \cdot \overline{\bar{A}D}$$

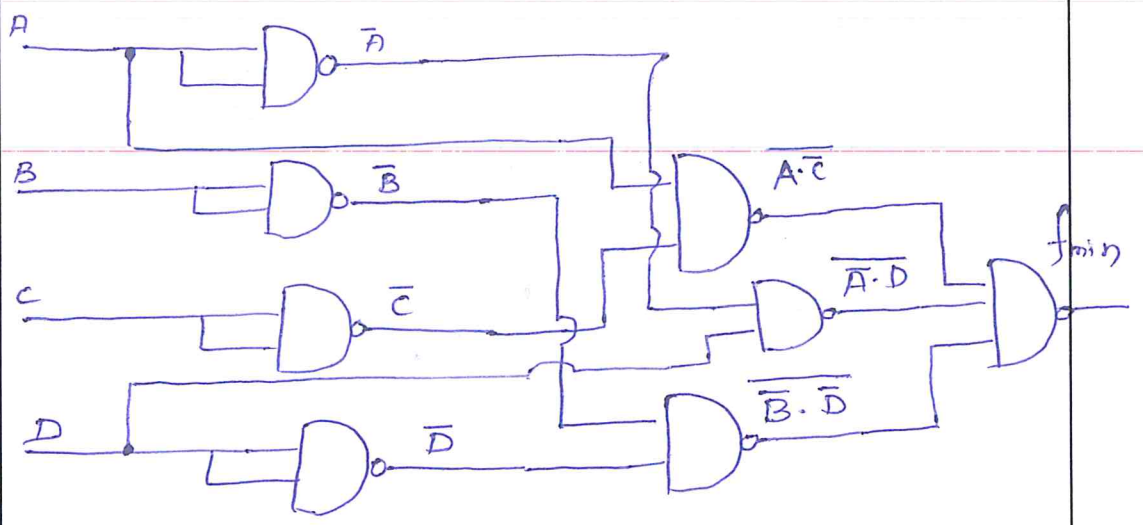
[using Demorgan's laws]

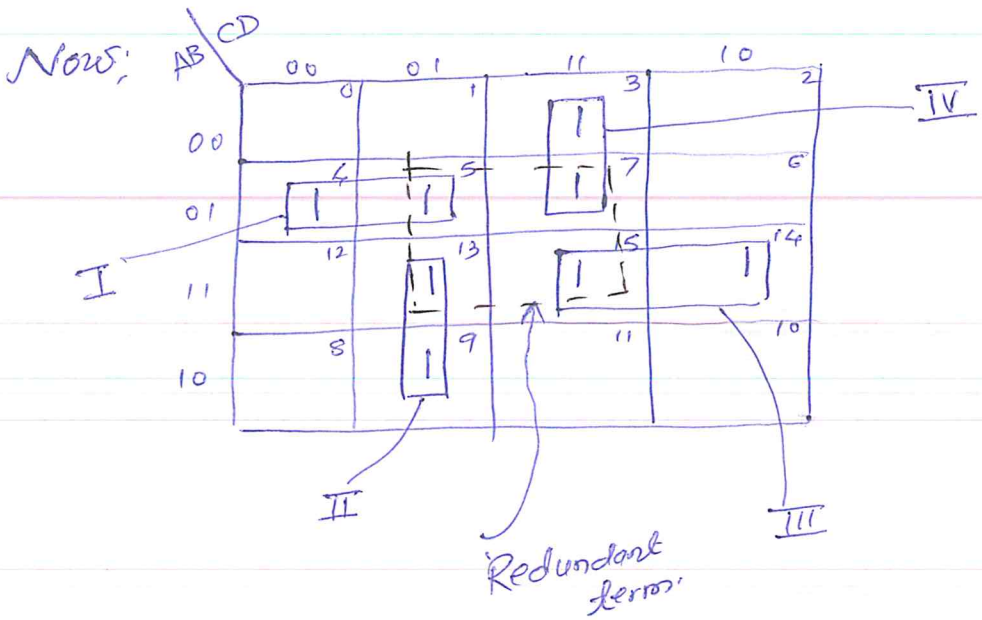
or,

$$\overline{\overline{f_{min}}} = \overline{\overline{\bar{B}\bar{D}} \cdot \overline{A\bar{C}} \cdot \overline{\bar{A}D}}$$

9

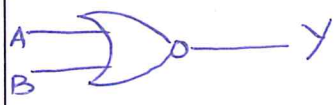
Hence;



Q. NO.	ANSWER	MARKS
(7)	Soln:- $Y = \Sigma m(3, 4, 5, 7, 9, 13, 14, 15)$ It's a 4-variable K'map.  $Y_{min} = \bar{A}CD + ABC + A\bar{C}D + \bar{A}B\bar{C}$ NOTE:- here the Quand is Redundant and must be excluded while solving K'map.	(9)

Q. NO.	ANSWER	MARKS

(5) (A) Sol^n:— NOR GATE:-



$Y = \overline{A+B}$

$= \overline{A} \cdot \overline{B}$

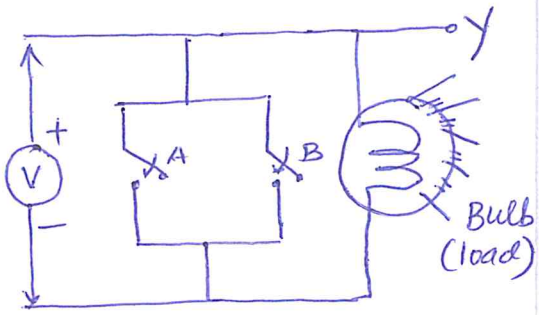
↑ As per Demorgan's

Truth TABLE:

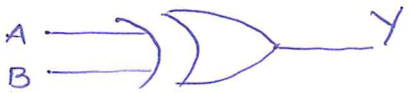
A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

→ It is also called as Bubbled AND GATE

Switching diagram:-



Ex-OR GATE



$Y = A \oplus B$

$= \overline{A}B + A\overline{B}$

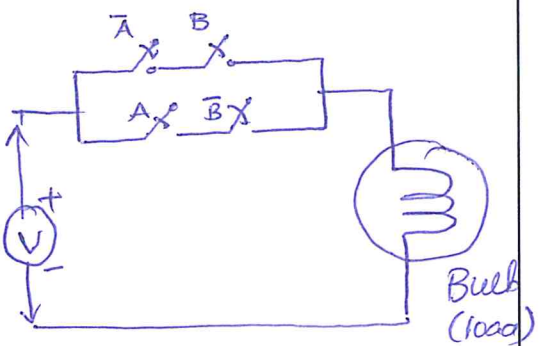
$= (A+B)(\overline{A}+\overline{B})$

TRUTH TABLE

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

→ Also called as odd no of 1's detector and used in parity generation

Switching diagram:-



4.5

Q. NO.	ANSWER	MARKS
(8)	(B) Ans:- $Y = [A\bar{B}(C+BD) + \overline{AB}]C$ $= [A\bar{B}(C+BD) + \bar{A} + \bar{B}]C$; using Demoogans $= [A\bar{B}C + AB\bar{B}\bar{D} + \bar{A} + \bar{B}]C$ $= [\bar{B} + A\bar{B}C + \bar{A}]C$ $\because [\because B\bar{B} = 0]$ $= [\bar{B}(1+AC) + \bar{A}]C$ $= [\bar{B}\cdot 1 + \bar{A}]C$ $(\because 1+AC = 1)$ $= (\bar{A}+\bar{B})C$ $= \overline{AB}\,C$ $(\because \overline{AB} = \bar{A}+\bar{B})$	4.5

Note

1. Paper Setter is required to carefully write the answers for the questions, after consulting all the relevant books.
2. For any discripencies found in answers, paper setter will be held responsible for playing with the career of the students,and doing breach of trust with them, and accordingly action can be taken by the disiplinary committee in this regard.
3. Principal before signing for the correctness of the answer shall ensure the same from relevant books. Point No. 1 & 2 above are applicable to Principal also in case any discripencies are found in answers

Dated 20-02-18 **Signature of Paper Setter** **Signature of Principal/HOD**

School of Aeronautics(Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

Fortnightly/Term : Mid Term -1 Date : 24. 02. 2018

Subject : **Mechanics of Composite materials (Th)** Batch : AE - 7,8,9

Faculty Name : Mr. Saurabh Malpotra Semester: VI

(Answer any FIVE Questions. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions	Unit Name / Topic
1.	What do you mean by composite materials? Classify different types of composite materials and discuss? (9)	Unit No.: Topic Name: Source:
2.	What are the various applications of composite material in aircraft industry?Discuss various advantages and disadvantages of composite material? (9)	Unit No.: Topic Name: Source:
3.	Explain: - a. Hand lay-up technique b. Pultrusion (9)	Unit No.: Topic Name: Source:
4.	What are the various moulding component techniques to manufacture composite? Discuss each technique? (9)	Unit No. Topic Name: Source:

Q.No.	Questions	Unit Name / Topic
5.	Discuss: - a. Resin-transfer moulding b. Injection moulding (9)	Unit No.: Topic Name: Source:
6.	Discuss various manufacturing techniques of different fibres? (9)	Unit No.: Topic Name: Source:
7.	Explain:- 1. Properties of different synthetic fibres 2. Properties of different natural fibres (9)	Unit No.: Topic Name: Source:
8.	1. What do you understand by Fibre-reinforced composite? Explain different types of matrix materials and their properties? 2. Surface treatment of fibers? (9)	Unit No. Topic Name: Source:

Annexure No. SA/35

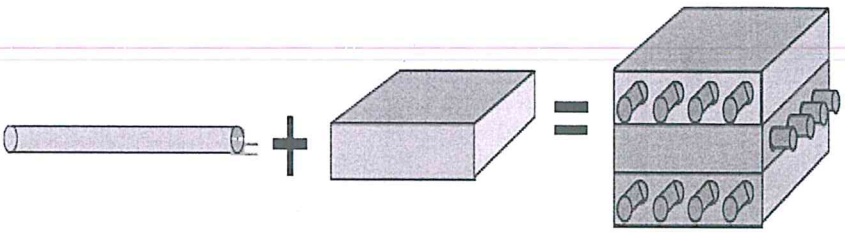
School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

Name of Examination: Mid Term - 1 Date of Examination: 28.02.2018

Subject: Mechanics of Composite Materials Batch AE- 7, 8, 9 Semester VI

Q. NO.	ANSWER	MARKS
Ans. 1.	Composites consist of two distinct materials, which together improve product performance and lower production costs. Composite materials typically include plated, clad, or coated metals, however the term 'composites' has evolved to mean a material containing a matrix, or base substance, and a reinforcement material. The **matrix** acts as a binder for the reinforcement while controlling the physical shape and dimensions of the part. Its primary purpose however is to transfer the load, or stress, applied to the part to the reinforcement. The **matrix** also protects the reinforcement from adverse environmental effects. **reinforcement's** function is to enhance the mechanical properties of the composite and is typically, the main load bearing element. **Reinforcements** are usually in the form of either fibers or particles. Matrix and reinforcement materials can be polymers, metals, ceramics, or carbon. The most widely used composite materials are fiber- reinforced thermosetting polymers. A composite can be defined as a combination of two or more materials that retain their macro- structure resulting in a material that can be designed to have improved properties than the constituents alone. Advanced composite materials have been used to fabricate many structural parts in engineering applications. This is due to their many attractive characteristics such as light weight, high strength, high stiffness, good fatigue resistance and good corrosion resistance. Also, the ability to manufacture parts with complicated geometry using fewer components enables manufacturers to save cost as compared with the same parts made of conventional metallic materials. **Composition of Composites** 	

Q. NO.	ANSWER	MARKS

Fiber/Filament Reinforcement

- High strength
- High stiffness
- Low density

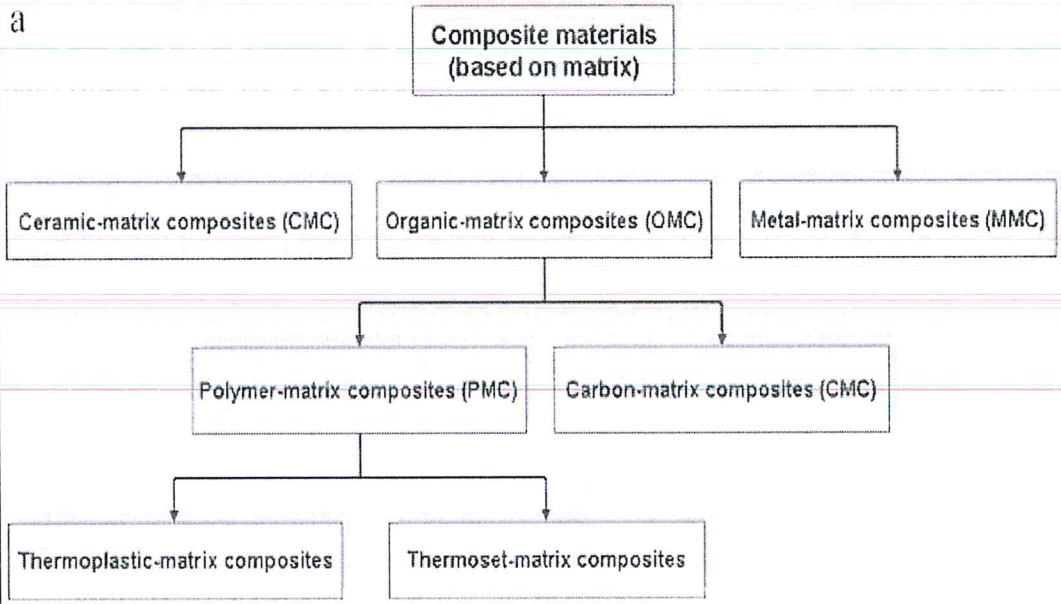
Matrix

- Good shear properties
- Low density

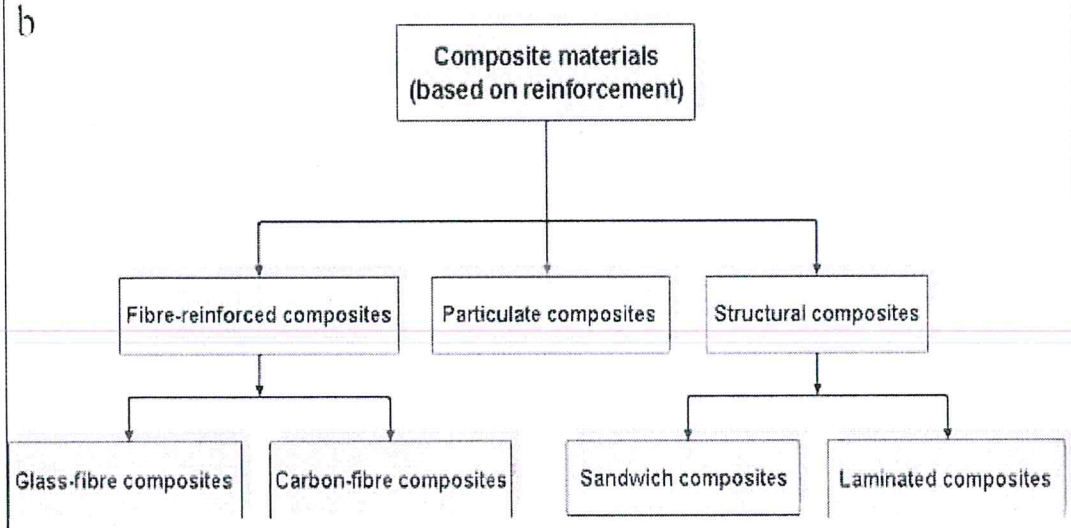
Composite

- High strength
- High stiffness
- Good shear properties
- Low density

a



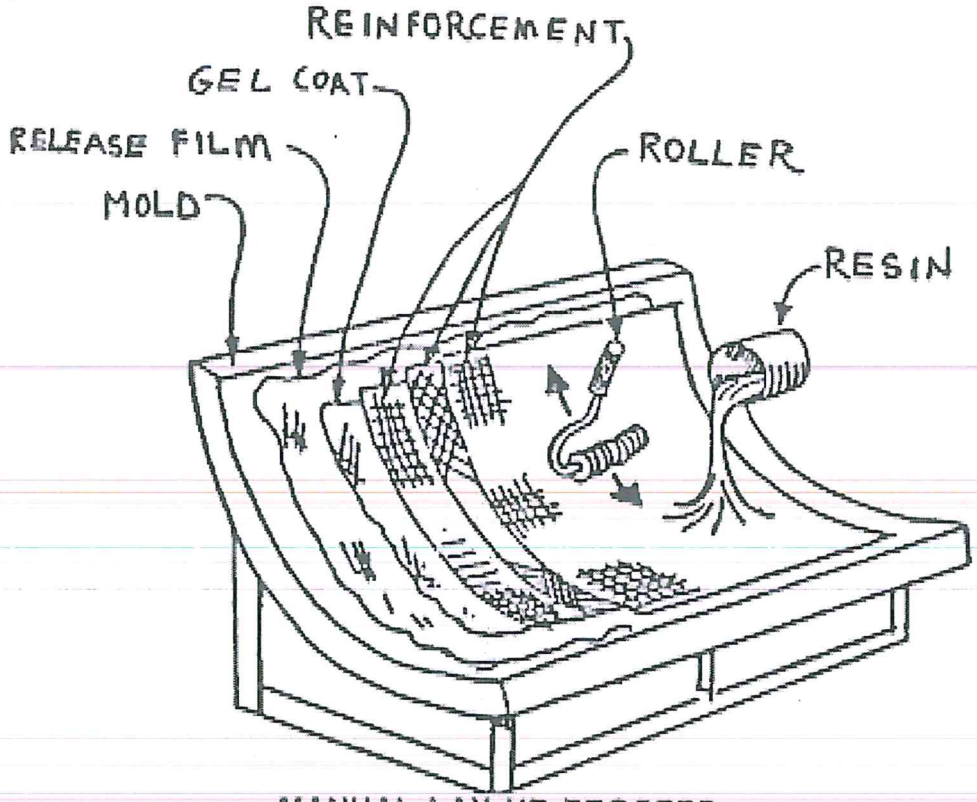
b



Q. NO.	ANSWER	MARKS
Ans 2.	The main aim of the aerospace/aircraft industries is to reduce weight keeping the same or more strength than the regular metals have. This criterion leads to use composite. Aeronautical engineering comprises of various distinct areas that produces vehicles capable of performing distinct flight programmes. Initially importance was given to weight, speed and power, but other parameters that influence market acceptance of the aircraft should also be considered during design. Nowadays, composites are used in peripheral structures of **aerodromes**. Conventional constructions of composites ought to cost much less in future and will not be a constraint. Automation along with high standard for filament and matrix materials will also decrease fabrication costs, as the rejection on grounds of quality will be less. **APPLICATION IN AIRCRAFT INDUSTRIES: -** Fuselage (Bulkhead) Wing flaps Rudder Elevators Radome Spoilers Floor beams and panels Helicopter main and tail rotor blades Space vehicles: Satellites, Missiles, Rockets etc. **EXAMPLES TO BE THERE** **Commercial:** Boeing 777 Boeing 787 "Dreamliner" Airbus A380 **Military:** o B-2 Bomber o LCA Tejas (HAL) **1. BOEING777: -** The Boeing 757 and 767 employs about 3000 pounds each of composites for doors and control surfaces. The 767 rudders at 36 feet is the largest commercial component in service. The 737- 300 uses approximately 1500 pounds of composites, which represents about 3% of the overall structural weight. Composites are widely used in aircraft interiors to create luggage compartments, sidewalls, floors, ceilings, galleys, cargo liners and bulkheads.	

Q. NO.	ANSWER	MARKS
Ans 3.	**2. BOEING 787 "DREAMLINER": -** Use of composite is 80% by volume and 50% by weight. **3. AIRBUS A380 :-** In 1979, a pilot project was started to manufacture carbon fiber fin box assemblies for the A300/A310 aircraft. A highly mechanized production process was established to determine if high material cost could be offset by increased manufacturing efficiency. Although material costs were 35% greater than a comparable aluminum structure, total manufacturing costs were lowered 65 to 85%. Robotic assemblies were developed to handle and process materials in an optimal and repeatable fashion. **4. B-2 Bomber: -** The B-2 derives much of its stealth qualities from the material properties of composites and their ability to be molded into complex shapes. Each B-2 contains an estimated 40,000 to 50,000 pounds of advanced composite materials. **DISADVANTAGES OF COMPOSITE MATERIAL**: - Use of composite is more challenging to design. NDT test for composite material is much more difficult as compared to metals. Delamination of layers. High cost Damage tolerance. Need specialized repair techniques. i) **HAND-LAYUP TECHNIQUES**: - Manual lay-up involves cutting the reinforcement material to size using a variety of hand and power-operated devices. These cut pieces are then impregnated with wet matrix material, and laid over a mold surface that has been coated with a release agent and then typically, a resin gel-coat. The impregnated reinforcement material is then hand-rolled to ensure uniform distribution and to remove trapped air. More reinforcement material is added until the required part thickness has been built-up. Manual lay-up can also be performed using pre-impregnated reinforcement material, called 'prepreg'. The use of prepreg material eliminates separate handling of the reinforcement and resin, and can improve part quality by providing more consistent control of reinforcement and resin contents.	

Q. NO.	ANSWER	MARKS

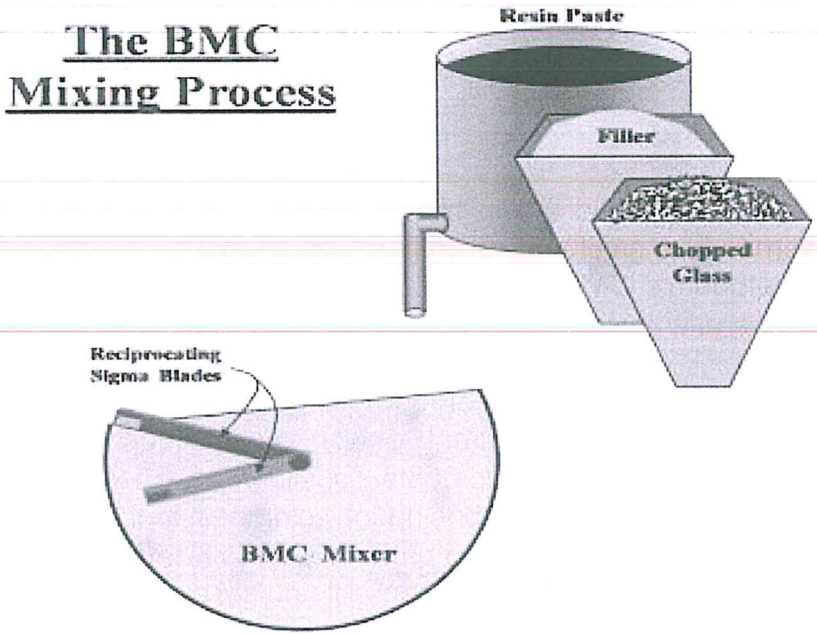


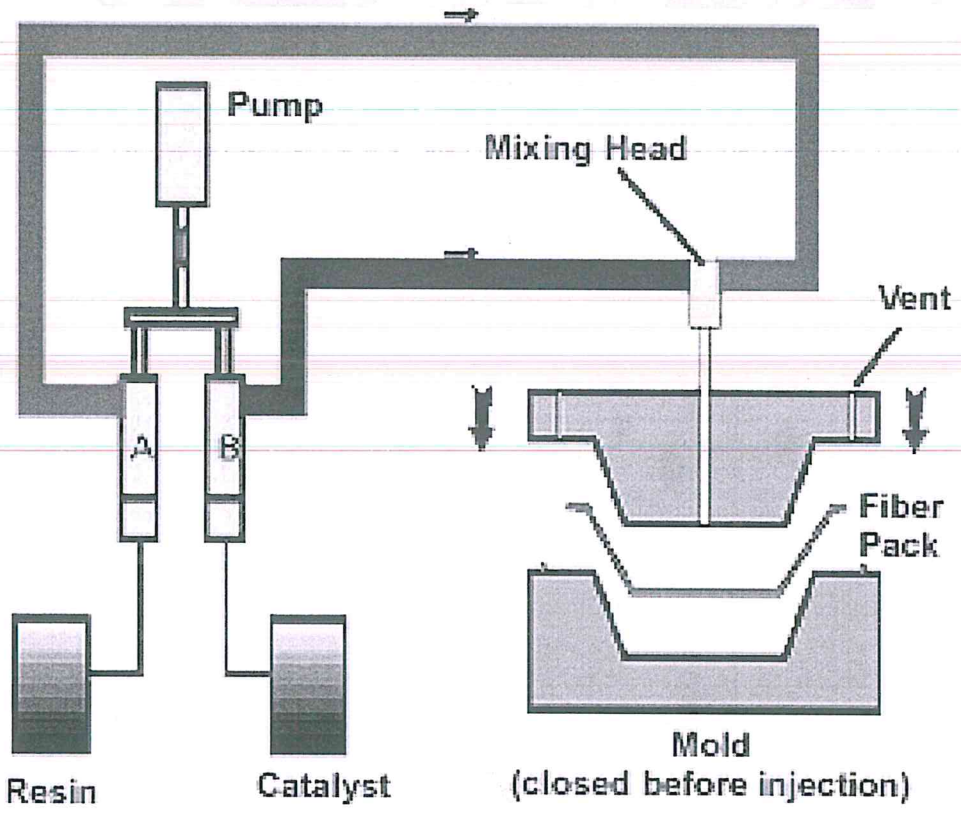
MANUAL LAY UP PROCESS

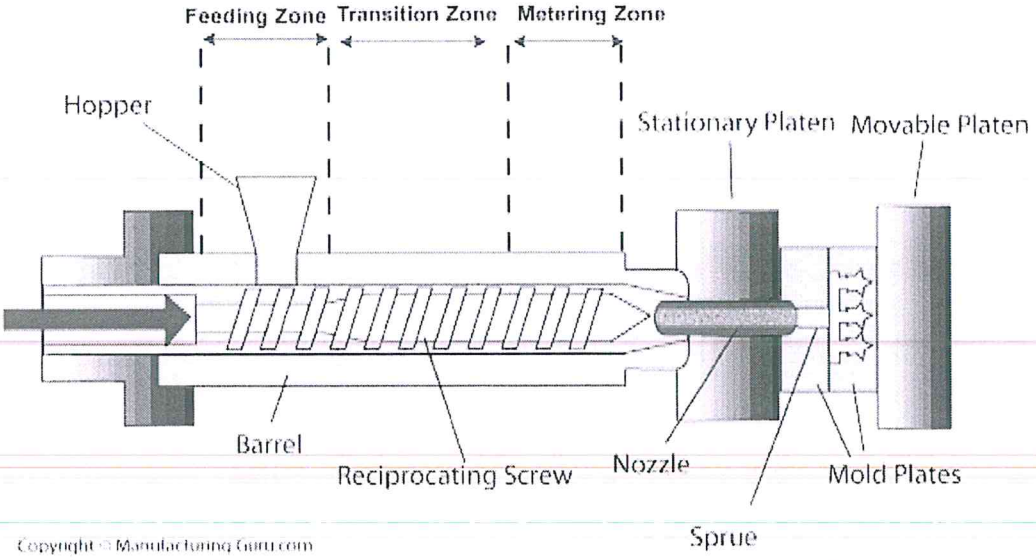
(ii) PULTRUSION: -

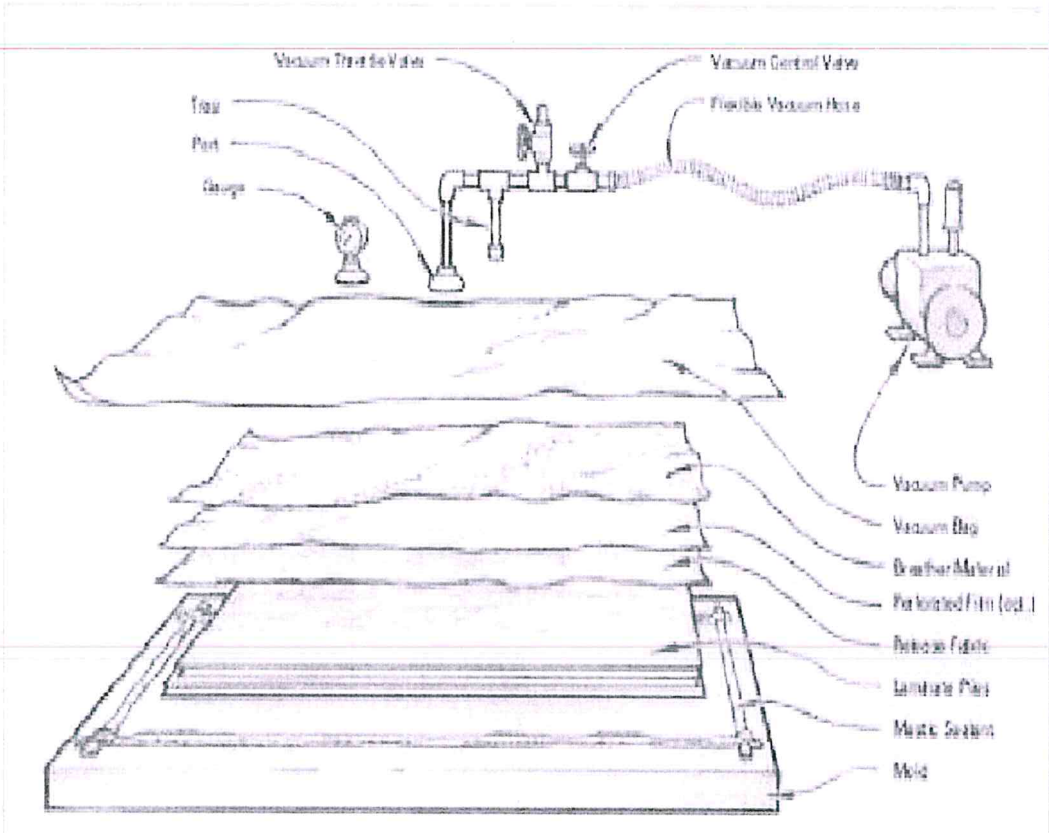
1. Continuous roll of reinforced fibers/woven fiber mat
2. Tension roller
3. Resin Impregnator
4. Resin soaked fiber
5. Die and heat source
6. Pull mechanism
7. Finished hardened fiber reinforced polymer

a. Fibers are pulled from a creel through a resin bath and then on through a heated die.
b. As the fiber passes through the die, the resin cures.
c. This process is limited to components with constant, or near constant, cross-sections.
e. Additionally, the cost of the heated die can be high.
f. Pultrusion yields smooth finished parts that typically do not require post processing.
g. A wide range of continuous, consistent, solid and hollow profiles are pultruded, and the process can be custom-tailored to fit specific applications such as the constant cross-section spar in some windmill.

Q. NO.	ANSWER	MARKS
Ans 4.	**BULK MOLDING COMPOUND (BMC)** :- or bulk molding composite is a ready to mold, glass-fiber reinforced thermoset polyester material primarily used in injection moulding and compression moulding. The material is provided in bulk or logs.BMC is manufactured by mixing strands (>1") of chopped glass fibers in a mixer with a thermoset resin (commonly polyester resin, vinyl ester or epoxy resin). The glass fibers in BMC result in better strength properties than standard thermoplastic products.Typical applications include demanding electrical applications, corrosion resistant needs, appliance, automotive, and transit. It is a polyester moulding material that resembles dough and which has been supported with appropriate glass fiber. It can be adjusted by changing the additive materials according to the required feature. It is in the thermoset plastics group because of its main characteristics and it can be produced with hot press (straight, transfer, injection) moulding method  **SHEET MOULDING COMPOUND (SMC)**: - or **sheet moulding composite** is a ready to mould glass-fibre reinforced polyester material primarily used in compression moulding. The sheet is provided in rolls weighing up to 1000 kg. Alternatively, the resin and related materials may be mixed on site when a producer wants greater control over the chemistry and filler. SMC is both a process and reinforced composite material. This is manufactured by dispersing long strands (usually >1") of chopped fiber (commonly glass fibers or carbon fibers on a bat of thermoset resin (commonly polyester resin, vinyl ester or epoxy resin)). The longer fibers in SMC result in better strength properties than standard bulk moulding compound (BMC) products. Typical applications include demanding electrical applications, corrosion resistant needs, structural components at low cost, automotive, and transit.	

Q. NO.	ANSWER	MARKS
Ans 5.	**RESIN TRANSFER TECHIQUE: -** Resin transfer moulding (RTM) is an increasingly common form of moulding, using liquid composites. It is primarily used to mold components with large surface areas, complex shapes and smooth finishes. RTM is unlike reaction injection moulding and structural reaction injection moulding processes (SRIM), in which the chemical reaction is induced by the mixture of reactants. The chemical reaction for resins used in RTM are thermally activated from the fiber mat or preform and mold wall.The reaction speed of RTM is much slower than that in SRIM, allowing for a longer fill time at lower injection pressure.  **INJECTION MOULDING :-** It is a manufacturing technique for making parts from thermoplastic and thermosetting material. • The plastics used in the injection molding process are liquefied at temperatures between 220° C and 270° C. • Molten plastic is injected at high pressure (ranges 70MPa to 200MPa) into a mold, which is the inverse of the desired shape.	

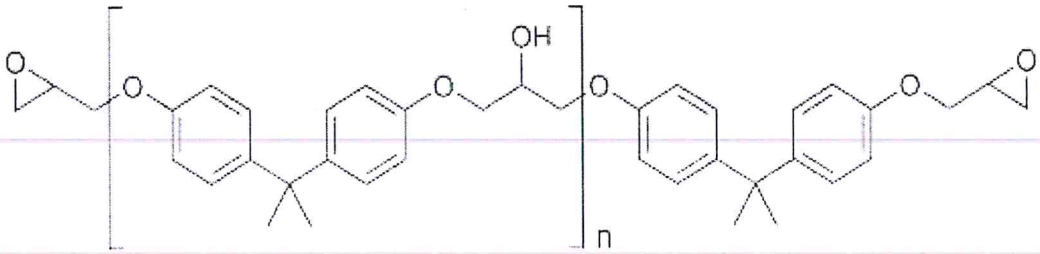
Q. NO.	ANSWER	MARKS
Ans 6.	 **Hopper :-** The thermoplastic material used in the plastic injection molding process is supplied in the form of small pellets. These pellets are loaded into the hopper, then gravity- fed into the barrel and the screw assembly. **Barrel :-** This is a chamber in which the reciprocating screw is located. The barrel is heated by electric heater bands. **NOZZLE :-** The nozzle forms a sealed connection between the barrel and the **sprue bushing** of the mold. The temperature of the nozzle is usually set near the plastic's melt temperature. The mold's **sprue bushing** has a concave radius. The nozzle fits into this radius with the aid of a locating ring. **Reciprocating Screw :-** The reciprocating screw compresses and melts the plastic material. It also moves the material toward the die. The reciprocating screw is divided into three zones: **the feeding zone**, the **transition zone**, and the metering **zone**. **There are many techniques used for manufacturing of composite: -** 1. Hand layup Technique 2. Pressure bag and vacuum bag technique 3. Pultrusion 4. Resin – transfer Moulding 5. Injection Moulding	

Q. NO.	ANSWER	MARKS
	PRESSURE BAG AND VACUUM BAG TECHNIQUES: - This technique is widely used for high performance mouldings such as for aerospace applications. This vacuum consolidation method produces high- quality mouldings, with complete exclusion of air bubbles and improvement to the inner surface of the moulding, which is not in contact with the mould. The controlled curing conditions also improve quality and consistency and allow superior resin systems to be used, while opening the way to a more rapid cure with faster turn round of moulds. Vacuum bag moulding is a modification of hand lay-up, in which the lay-up (necessarily smaller) is completed and placed inside a bag made of flexible film and all edges are sealed. The bag is then evacuated, so that the pressure eliminates voids in the laminate, forcing excess air and resin from the mould. By increasing external pressure, a higher glass concentration can be obtained, as well as better adhesion between the layers/plies of laminate. *Vacuum bagging -Equipment*  	

Q. NO.	ANSWER	MARKS
Ans 7.	(i) **PROPERTIES OF DIFFERENT SYNTHETIC FIBRES :-**	

(a) EPOXY POLYMER :- High Mechanical Properties:

Large cohesive force, Good Adhesive Performance: great number of polar group, Excellent stability: without impurities(base and salt), Flexibility and diversity in Designing.



(b) BISPHENOL A EPOXY RESIN :-

(i) The most common and important class of epoxy resins is formed from reacting epichlorohydrin with bisphenol A to form diglycidyl ethers of bisphenol A.

(ii) Reacting two moles of epichlorohydrin with one mole of bisphenol A to form the bisphenol A diglycidyl ether (commonly abbreviated to DGEBA or BADGE).

(iii) DGEBA resins are transparent colourless-to-pale-yellow liquids at room temperature, with viscosity typically in the range of 5-15 Pa.s at 25 °C.

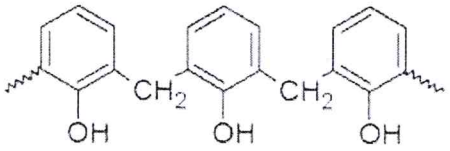
(iv) As the molecular weight of the resin increases, the epoxide content reduces and the material behaves more and more like a thermoplastic. Very high molecular weight polycondensates (ca. 30 000 – 70 000 g/mol) form a class known as phenoxy resins.

Properties of Amino-Formaldehyde Thermostats

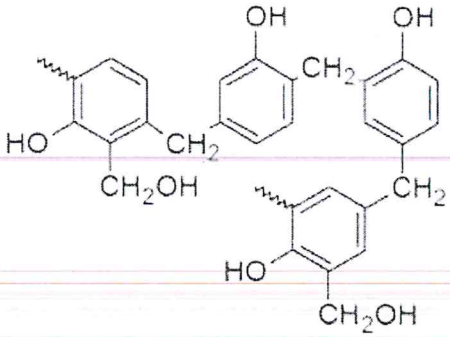
Property	Urea Formaldehyde Cellulose Filler	Melamine Formaldehyde Cellulose Filler
Density (10^3 kg/m^3)	1.5 to 1.6	1.5 to 1.6
Tensile Strength (MPa)	50 to 80	55 to 85
Tensile Modulus (GPa)	7.0 to 13.5	7.0 to 10.5
% Elongation	0.5 to 1.0	0.5 to 1.0
Maximum Service Temperature (°C)	80	95

Q. NO.	ANSWER	MARKS

A



B



PROPERTIES OF POLYESTER: -

- PEEK is a semi-crystalline thermoplastic with excellent mechanical and chemical resistance properties that are retained to high temperatures.
- The processing conditions used to mold PEEK can influence the crystallinity and hence the mechanical properties.
- The Young's modulus is 3.6 GPa and its tensile strength 90 to 100 MPa.
- PEEK has a glass transition temperature of around 143 °C (289 °F) and melts around 343 °C (662 °F). Some grades have a useful operating temperature of up to 250 °C (482 °F).

PROPERTIES OF KEVLAR: -

- Kevlar is a polymer
- Kevlar is a high strength material
- It is very light when compared to its strength
- It is 5 times stronger than steel of same weight
- It has very high tensile strength
- Thus, it can be said as a Super strong plastic

(II) PROPERTIES OF DIFFERENT NATURAL FIBRES :-
GENERAL PROPERTIES OF TEXTILE FIBRES:-

1. **Staple Fibres :-**
   Natural or man made or short length fibres which measures in inches or fraction of inch example 3/4 inch to 18 inches except silk all other natural fibres are staple fibres. Staple fibres are of limited length.

2. **Filament :-**
   Long continuous fibres strands of indefinite length measured in yards or meters fibres of continuous length long enough to be used in fabric as such Natural silk filament is 360-1200 meters. Synthetic filaments can be made many kilometers long. The only natural fibre available is silk.

Q. NO.	ANSWER	MARKS
	3. Texture (Apparence) It is the tactile sensation experienced when hand is passed over a surface. **4. Resilience** It means that when fibre is compressed and later when the pressure is released. It will tend to return to its original shape. Resistance to compression varies from fibre to fibre. This quality causes the fabric to be **wrinkle resistant** with the resistance varying according to the degree of elasticity inherent in the fibre. Wool has outstanding resiliency while it is poor in cotton. **5. Luster** It is seen when light reflected from a surface. It is more subdued than shine. Silk and synthetics have luster than cellulosic fibres. Infact synthetics have high luster which is purposefully removed during spinning. **6. Static Electricity** It is generated by the friction of a fabric when it is rubbed against itself or other objects. If the electrical charge that is not conducted away, It tends to build up on the surface and when fabric comes in contact with a good conductor a shock or transfer occurs. This transfer may sometimes produce sparks. This is more feel during hot and humid conditions. **7. Crimp** Wool fibre is more or less wavy and has twists. This waviness is termed as crimp. Finer the wool more will be the crimps in it. Marino wool will have 30 crimps per inch while coarse wool has only one or two. This property of having crimps gives elasticity to the fibre. **8. Elasticity** It is the ability of stretched material to return immediately to its original.	
Ans 8.	**(i) FIBRE-REINFORCED COMPOSITE :-** A fiber-reinforced composite (FRC) is a composite building material that consists of three components: (i) the fibers as the discontinuous or dispersed phase, (ii) the matrix as the continuous phase, and (iii) the fine interphase region, also known as the interface. This is a type of advanced composite group, which makes use of rice husk, rice hull, and plastic as ingredients. This technology involves a method of refining, blending, and compounding natural fibers from cellulosic waste streams to form a high-strength fiber composite material in a polymer matrix. The designated waste or base raw materials used in this instance are those of waste thermoplastics and various categories of cellulosic waste including rice husk and saw dust.	

Q. NO.	ANSWER	MARKS

FRC is high-performance fiber composite achieved and made possible by cross-linking cellulosic fiber molecules with resins in the FRC material matrix through a proprietary molecular re-engineering process, yielding a product of exceptional structural properties. Through this feat of molecular re-engineering selected physical and structural properties of wood are successfully cloned and vested in the FRC product, in addition to other critical attributes to yield performance properties superior to contemporary wood. This material, unlike other composites, can be recycled up to 20 times, allowing scrap FRC to be reused again and again.

PROPERTIES :-

Tensile Strength	ASTM D 638	15.9 MPa
Flexural Strength	ASTM D 790	280 MPa
Flexural Modulus	ASTM D 790	1582 MPa
Failure Load	ASTM D 1761	1.5 KN - 20.8 KN
Compressive Strength	20.7MPa	
Heat Reversion	BS EN 743 : 1995	0.45%
Water Absorption	ASTM D 570	0.34%
Termite Resistant	FRIM Test Method	3.6

MATRIX MATERIAL: -
Al2O3 , Si02

SURFACE TREATMENT OF FIBERS: -
This review is based on the surface treatment of natural fibres which can be used in technical applications. Natural fibres on their own have some draw backs regarding moisture uptake, quality variations, low thermal stability, and poor wettability. Insufficient adhesion between polymer matrix and fibre leads in time to debonding. Overcoming the weaknesses of these natural fibres gave the motivation for this study where physical and chemical methods of modification were considered.

Physical methods such as electric discharge and mercerization were reported as well as the chemical methods such as graft copolymerization and treatment with isocyanates, and the results due to these modifications were discussed. This study reveals that natural fibres are good candidates for reinforcement but they have to be suitably treated to improve their properties if they are to be used in technical applications. The various fibre surface treatments actually improve the interfacial adhesion between the fibre surface and the matrix, thereby giving good mechanical properties to the resulted polymer composites. **Corona treatment** (sometimes referred to as **air plasma**) is a surface modification technique that uses a low temperature corona discharge plasma to impart changes in the properties of a surface.

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Q. NO.	ANSWER	MARKS
	The corona plasma is generated by the application of high voltage (15KV) to an electrode that has a sharp tip. The plasma forms at the tip. A linear array of electrodes is often used to create a curtain of corona plasma. Materials such as plastics, cloth, or paper may be passed through the corona plasma curtain in order to change the surface energy of the material. All materials have an inherent surface energy . The corona treatment was invented by the Danish engineer Verner Eisby in 1951.	

Note

1. Paper Setter is required to carefully write the answers for the questions, after consulting all the relevant books.
2. For any discripencies found in answers, paper setter will be held responsible for playing with the career of the students,and doing breach of trust with them, and accordingly action can be taken by the disiplinary committee in this regard.
3. Principal before signing for the correctness of the answer shall ensure the same from relevant books. Point No. 1 & 2 above are applicable to Principal also in case any discripencies are found in answers

Dated 12/03/2018 **Signature of Paper Setter** 12/3/2018 **Signature of Principal/HOD**

School of Aeronautics(Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

Fortnightly/Term : Mid Term -1 Date : 26. 02. 2018

Subject : **Aerodynamics - I (Th)** Batch : AE - 7,8,9

Faculty Name : Mr. Bipin Kumar Dwivedi Semester: VI

(Answer FIVE Questions. Two questions are compulsory from each section. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions A	Unit Name / Topic
1.	Define and prove the kutta - Joukowski Theorem. (9)	Unit No.: Topic Name: Source:
2.	Define and explain the blasius theorem. (9)	Unit No.: Topic Name: Source:
3.	Explain the following a) Stream functions of source and sink b) Stream function of vortex (9)	Unit No.: Topic Name: Source:
4.	Obtain the equation of pressure coefficient on the surface of cylinder placed in a uniform flow. (9)	Unit No. Topic Name: Source:

Q.No.	Questions B	Unit Name / Topic
5.	A source with strength 0.25m^2/sec and a vortex with strength 1 m^2/sec are located at the origin determine the equation of stream function and velocity components. (9)	Unit No.: Topic Name: Source:
6.	A 5 cm diameter cylinder has been immersed in a fluid stream having a uniform velocity of 0.8 m/sec. Determine the radial and tangential component of velocity on the surface of the cylinder at point (2.25, 12^0) (9)	Unit No.: Topic Name: Source:
7.	A Long circular cylinder lies in an air stream having a velocity of 60 m/ sec The circulation around the cylinder is 400 m^2/sec (clockwise) Determine. a) Maximum velocity at the surface of the cylinder b) Lift force per unit long of the cylinder The density of air is 1.2 kg/m^3 & the cylinder diameter is 1.2 cm. (9)	Unit No.: Topic Name: Source:
8.	Consider the lifting flow over a circular cylinder. The lift coefficient is 5. Calculate. a) The pressure coefficient at top of the cylinder. b) The location of the stagnation points. (9)	Unit No. Topic Name: Source:

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MODEL ANSWER PAPER

Name of Examination: MID TERM – I Date of Examination: _____

Subject AERODYNAMICS – I Batch VII, VIII Semester VI

Q. NO.	ANSWER	MARKS
(1)	To Prove Kutta-Joukowski Theorem. $L = \rho U_\infty \Gamma$	

The lift on the cylinder can be evaluated

$$C_l = \frac{1}{c}\int_0^c (C_{P_l} - C_{P_u})\,dx$$

$x = r\cos\theta \qquad r = R.$

$y = r\sin\theta.$

$dx = -R\sin\theta\,d\theta$

$$C_l = \frac{-1}{2R}\int_\pi^{2\pi} C_{P_l}\sin\theta\cdot R\,d\theta + \frac{1}{2R}\int_0^\pi C_{P_u} R\sin\theta\,d\theta.$$

$$C_l = -\frac{1}{2}\left[\int_0^\pi C_{P_u}\sin\theta\,d\theta + \int_\pi^{2\pi} C_{P_l}\sin\theta\,d\theta\right]$$

$C_P = C_{P_u} = C_{P_l}$

$$C_l = -\frac{1}{2}\int_0^{2\pi} C_P \sin\theta\,d\theta$$

$$C_P = 1 - \left[4\sin^2\theta + \frac{2\Gamma\sin\theta}{\pi R V_\infty} + \left(\frac{\Gamma}{2\pi R V_\infty}\right)^2\right]$$

$$C_l = \frac{\Gamma}{RV_\infty}$$

$$L = C_l \tfrac{1}{2}\rho V_\infty^2 \cdot c \times 1 \qquad c = 2R.$$

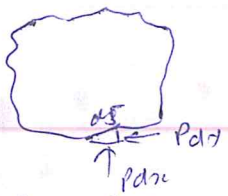
$$L = \frac{\Gamma}{RV_\infty} \propto \frac{1}{2}\rho V_\infty^2 \propto 2R$$

$$\boxed{L = \rho V_\infty \Gamma}$$

Q. NO.	ANSWER	MARKS

(2) Blasius Theorem : Complex potential function for any arbitrary body can be obtained by sum of the diffent elemenby flow.

$$w = w_1 + w_2 + w_2 - - - - - w_n$$



$$dD - i dL = -P dy - i P dx$$

$$\oint (dD - i dL) = \oint (-P dy - i P dx)$$

$$D - iL = -\oint P (dy + i dx)$$

$$D - iL = -i \oint_C P d\bar{z}$$

$$D - iL = -i \oint \left[k - \tfrac{1}{2}\rho (u^2 + v^2)\right] d\bar{z}$$

$P + \frac{1}{2}\rho V^2 = k.$
$V^2 = u^2 + v^2$

$$(u + iv)\, d\bar{z} = (u - iv)\, dz$$

$$\oint k = 0$$

$$D - iL = -i \oint k\, d\bar{z} + i \oint \tfrac{1}{2} \rho . (u + iv)(u - iv)\, d\bar{z}$$

$$D - iL = i \tfrac{1}{2} \rho \oint (u - iv)^2 dz$$

$\frac{dw}{dz} = u - iv$

$$\boxed{D - iL = i \frac{\rho}{2} \oint \left(\frac{dw}{dz}\right)^2 dz .}$$

Q. NO.	ANSWER	MARKS

3- (a) i- Stream function of Source

$$v_r = \frac{m}{2\pi r}$$

$$v_r = \frac{1}{r}\frac{\partial \psi}{\partial \theta}$$

$$\frac{m}{2\pi r} = \frac{1}{r}\frac{\partial \psi}{\partial \theta}$$

$$\psi = \frac{m}{2\pi}\theta + C_1 \quad \text{at } \psi = 0, \theta = 0, \; C_1 = 0$$

$$\text{Stream function } (\psi)_{\text{Source}} = \frac{m}{2\pi}\theta$$

(a) ii- Stream function of Sink.

$$v_r = -\frac{m}{2\pi r}$$

$$v_r = \frac{1}{r}\frac{\partial \psi}{\partial \theta}$$

$$\psi = -\frac{m}{2\pi}\theta + C_1 \quad \text{at } \psi = 0, \theta = 0, \; C_1 = 0$$

$$\text{Stream function } (\psi)_{\text{Sink}} = -\frac{m}{2\pi}\theta$$

(b) (5)- Stream function of Vortex.

$$v_\theta = \frac{\Gamma}{2\pi r}$$

$$v_\theta = -\frac{\partial \psi}{\partial r}$$

$$\frac{\Gamma}{2\pi r} = -\frac{\partial \psi}{\partial r}$$

$$\text{Stream function } (\psi)_{\text{vortex}} = -\frac{\Gamma}{2\pi}\log r$$

Q. NO.	ANSWER	MARKS

4- Flow Past over a cylinder (Doublet + uniform) flow.

R = radius of cylinder.

~~$\psi = \sin\theta\left(\frac{\mu_0 r}{2\pi r}\right)$~~

$$V_r = u_0 \cos\theta\left(1 - \frac{R^2}{r^2}\right)$$

$$V_\theta = -u_0 \sin\theta\left(1 + \frac{R^2}{r^2}\right)$$

$$V = \sqrt{V_r^2 + V_\theta^2}$$

on the surface of cylinder $r = R$.

$$V_r = 0$$

$$V_\theta = -2u_0 \sin\theta, \quad V = 2u_0 \sin\theta.$$

$$C_p = 1 - \left(\frac{V}{u_0}\right)^2 = 1 - 4\sin^2\theta.$$

$$\boxed{C_p = 1 - 4\sin^2\theta}$$

5- $\psi = \psi_{source} + \psi_{vortex}$.

$$= \frac{m}{2\pi}\theta - \frac{\Gamma}{2\pi}\log r$$

$$= \frac{1}{2\pi}(m\theta - \Gamma \log r)$$

$$= \frac{1}{2\pi}(0.25\theta - \log r)$$

Q. NO.	ANSWER	MARKS
6 -	$\psi = U_0 \sin\theta \left(r - \frac{R^2}{r}\right)$, $V_r = \frac{1}{r}\frac{\partial \psi}{\partial \theta}$, $V_\theta = -\frac{\partial \psi}{\partial r}$ $V_r = U_0 \cos\theta \left(1 - \frac{R^2}{r^2}\right)$ $V_\theta = -U_0 \sin\theta \left(1 + \frac{R^2}{r^2}\right)$ $V_r = 0.3$ m/sec, $V_\theta = -0.866$ m/sec	
7 -	$V = 2U_0 \sin\theta + \frac{\Gamma}{2\pi R}$ (a) Maximum velocity $= 2U_0 = 2 \times 60 = 120$ m/s ~~$2U_0 + \frac{\Gamma}{2\pi R}$~~ (b) - $L = \rho U_0 \Gamma$ $L = 1.22 \times 60 \times 400$ $L = 29280$ N	
8 -	$V = 2U_0 \sin\theta + \frac{\Gamma}{2\pi R}$ $L = \rho U_0 \Gamma$ $C_l \frac{1}{2}\rho U_0^2 \times 2R \times 1 = \rho U_0 \Gamma$ $C_l = \frac{\Gamma}{R U_0}$ $\frac{\Gamma}{R U_0} = 5$ $\Gamma = 5 R U_0$ (a) $C_p = 1 - \left(\frac{V}{U_0}\right)^2$ at $\theta = \pi/2$ $C = 2R$. $0 = 2U_0 \sin\theta + \frac{5 U_0}{2\pi}$ $\sin\theta = -\frac{5}{4\pi}$ $\theta = 203.9°$ & $336.6°$	

Note

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Dated 27/02/18 **Signature of Paper Setter** **Signature of Principal/HOD**

Annexure No. SA/14

School of Aeronautics(Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

Fortnightly/Term : Mid Term -1 Date : 26. 02. 2018

Subject : **Aircraft Structure - II (Th)** Batch : AE-7,8,9

Faculty Name : Mr. S.K. Tripathy Semester: VI

(Answer any FIVE Questions. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions	Unit Name / Topic
1.	Explain Bradt batho theorem in detail. (9)	Unit No.: Topic Name: Source:
2.	Derive $J = \frac{4Am^2}{\int_0^{Lm} \frac{ds}{t}}$ (9)	Unit No.: Topic Name: Source:
3.	Derive $Q = \frac{-v}{Ix} \int_0^s ydA$ For shear flow in open section (9)	Unit No.: Topic Name: Source:
4.	Draw the shear flow diagram and derive the shear centre distance for channel section e = $\frac{3b^2}{6b+h}$ **Fig. No. 1** (9)	Unit No. Topic Name: Source:

Q.No.	Questions	Unit Name / Topic
5.	Draw the shear flow distribution and its shear centre of a channel beam with double flange and constant thickness. **Fig. No. 2** (9)	Unit No.: Topic Name: Source:
6.	Derive $e = \frac{3t_f (b_2^2 - b_1^2)}{ht_w + btF(b_1 + b_2)}$ for an unbalanced I- beam **Fig. No. 3** (9)	Unit No.: Topic Name: Source:
7.	Determine the shear centre for given cross section. All members have same thickness through out all dimensions are in mm. **Fig. No. 4** (9)	Unit No.: Topic Name: Source:
8.	For derive $\frac{\tau_1}{\tau_2} = \frac{4\beta^2 + 1}{2\beta(2\beta + 1)}$ For closed ring of radius r and thickness t, β = r/t. (9)	Unit No. Topic Name: Source:

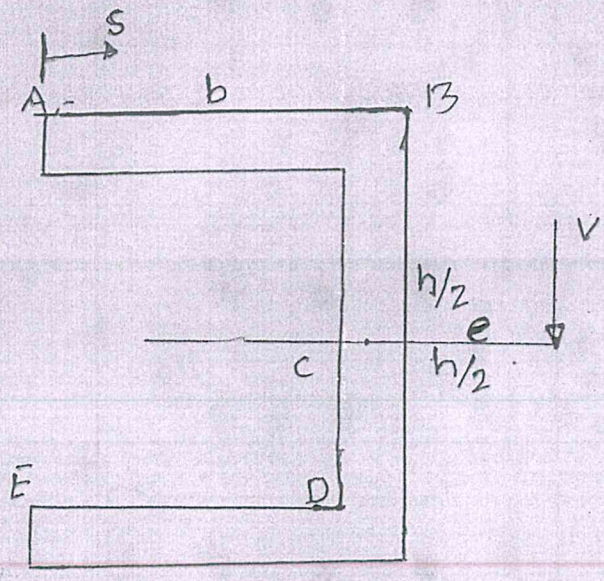


Fig 1

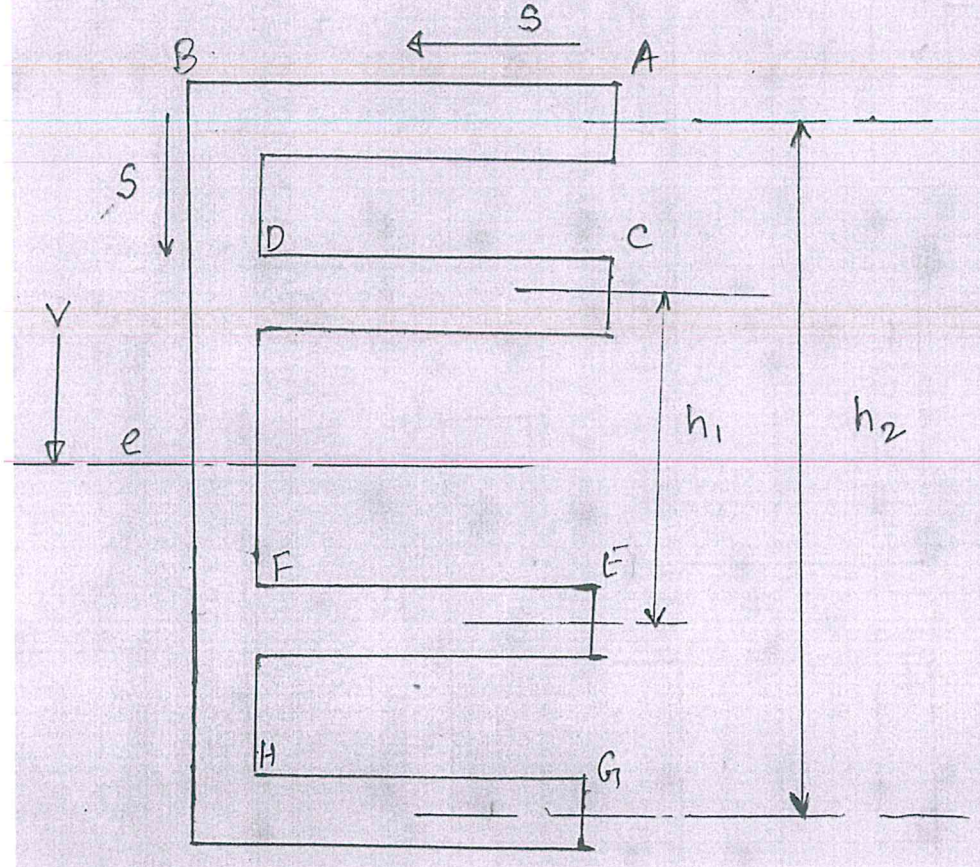


Fig 2

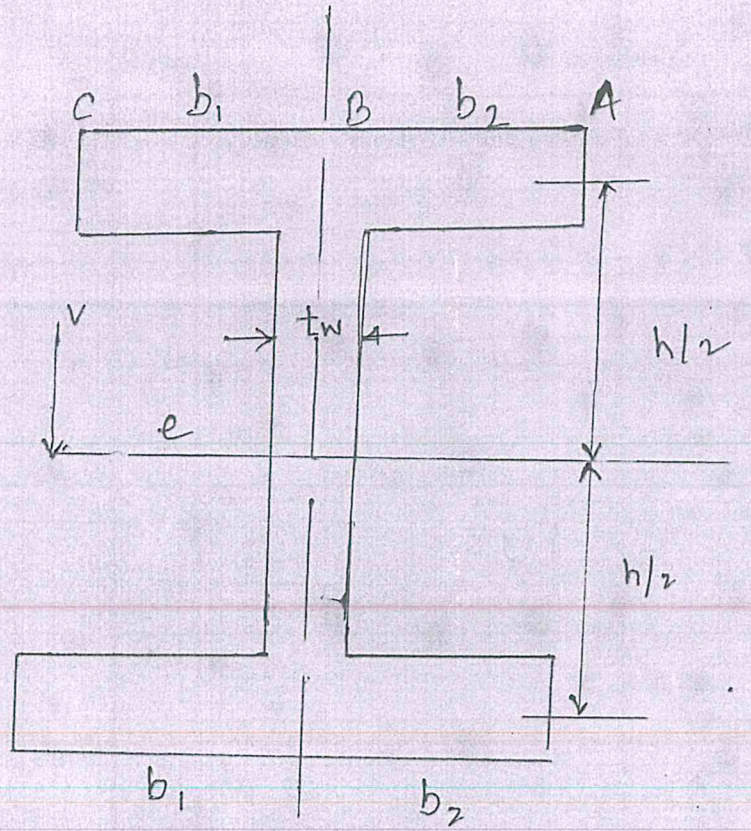


Fig 3

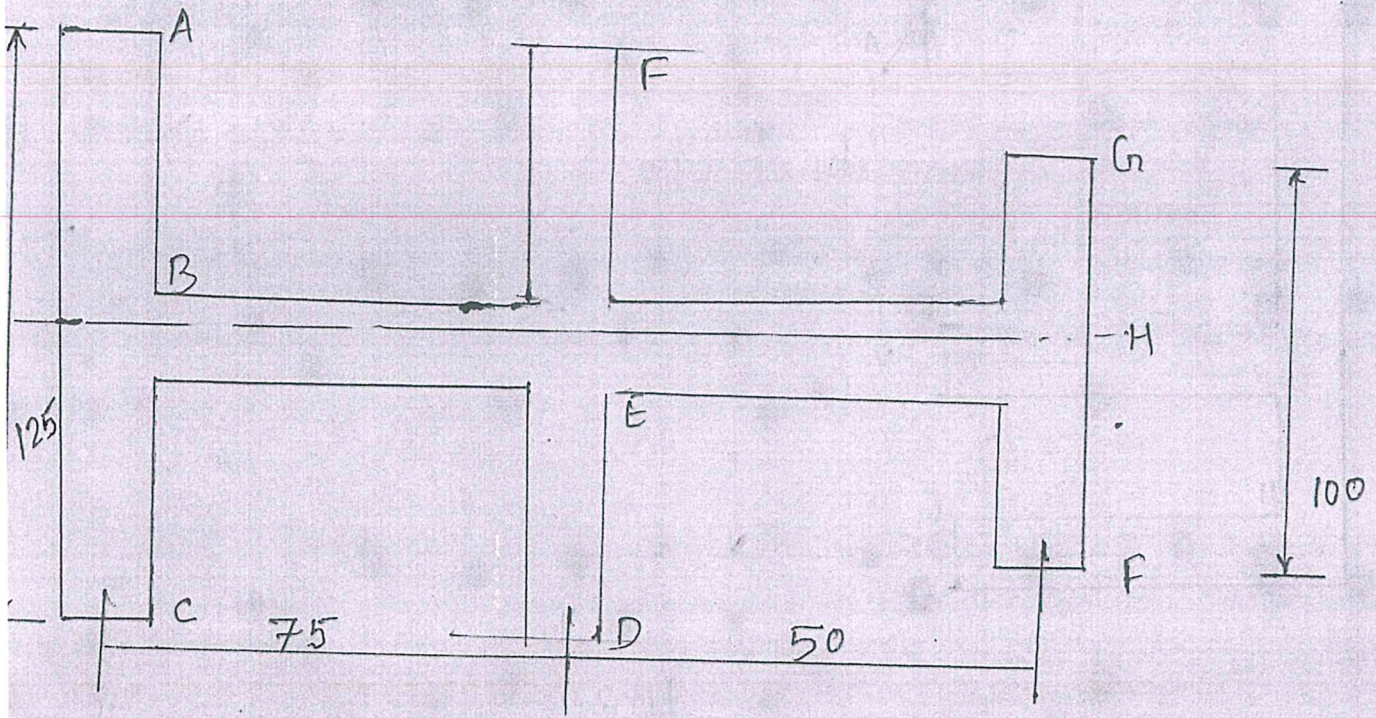


Fig 4

School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

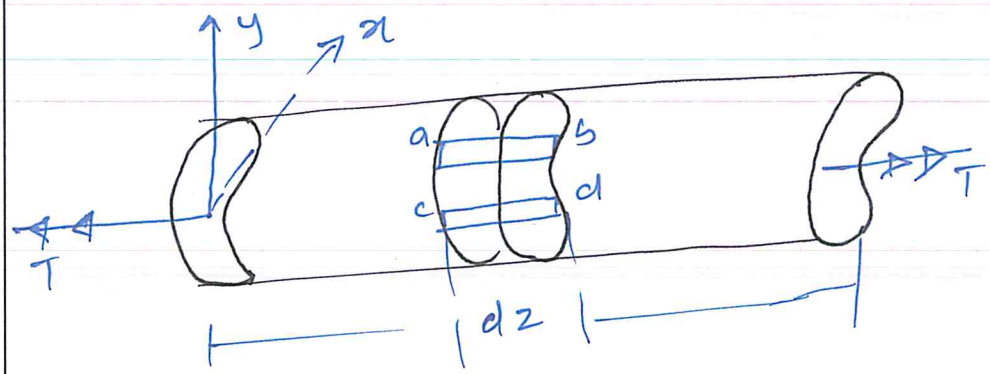
Name of Examination: MT-1 Date of Examination: 26/2/18

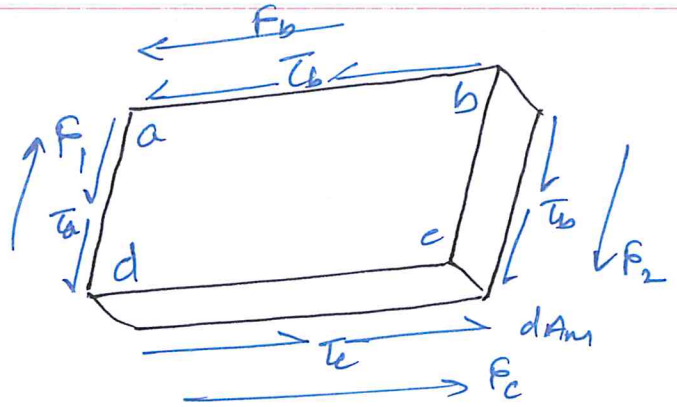
Subject AIRCRAFT STRUCTURE-II Batch 7, 8, 9 Semester 6

Q. NO.	ANSWER	MARKS
1.	a) Bredt Batho formula for single and multicells structures, provides an approximate method to determine the shear flow, in single and multicell structure, under torsion shear flow in single and multicells under bending with walls effective and ineffective thickness. Thin walled tubes - a) In light weight structures, such as aircraft and spacecraft, thin walled tubular members of non-circular shapes are often required to resist torsion. To obtain formulae that are appropriate and applicable to verify of shapes. Consider a thin walled tube of arbitrary cross-section shape and subjected to pure torsion by torque (T) acting at the ends, the thickness (t) of the wall of the tube may varry around the cross-	

Q. NO.	ANSWER	MARKS

section, (t) is assumed to be small in comparison with total width of the tube. The shear stress (τ) acting on the cross-section as shown in the figure, a small element of the tube cut out between two cross-section at a distance (dz) apart.





Consider a rectangular element, obtained by two longitudinal cuts (ab) & (cd).

The force on (bc) -

$$F_b = \tau_b \cdot t_b \cdot dz$$

$$F_c = \tau_c \cdot t_c \cdot dz$$

Q. NO.	ANSWER	MARKS

Under equilibrium condition –

$$F_b = F_c$$

Then,

$$\tau_b \cdot t_b = \tau_c \cdot t_c$$

---

02 Let, dA_m → Median area

q → Shear flow

ds → elemental ring for a distance

Now,

dT = elemental force × radius

$= dF \times r$

$= \tau \cdot dA \times r$

$= \tau \cdot ds \cdot t \times r$ $\quad \{q = \tau \cdot t$

$\Rightarrow dT = q \cdot ds \cdot r$

02 $\int_0^{T} dT = q \int_0^{A_m} r\, ds$

$$T = q \cdot 2A_m \quad -(1) \quad \left\{ \because \int_0^{A_m} r \cdot ds = 2 \cdot A_m \right.$$

04 $\left[\tau = \frac{q}{t} = \frac{T}{(2A_m)\,t} \right] -(2)$

Strain energy –

$$V = \frac{\tau^2}{2G} \cdot \text{Volume}$$

Q. NO.	ANSWER	MARKS

(b) $dU = \frac{\tau^2}{2G} \cdot t\,ds \cdot dz$

$\Rightarrow U = \int dU = \frac{Q^2}{2G} \oint_0 \int_0^{t_m} dz \cdot \frac{ds}{t}$

(a) $U = \frac{T^2 L}{8Am^2 G} \cdot \left[\int_0^{t_m} \left(\frac{ds}{t}\right) \right] - (3)$

As, $\varphi = \frac{\partial U}{\partial t}$

$\Rightarrow \left[\varphi = \frac{TL}{4Am^2 G} \int_0^{t_m} \frac{ds}{t} \right] - (4)$

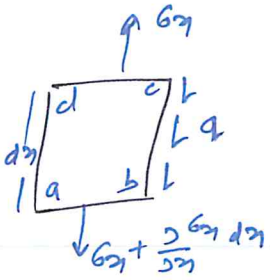
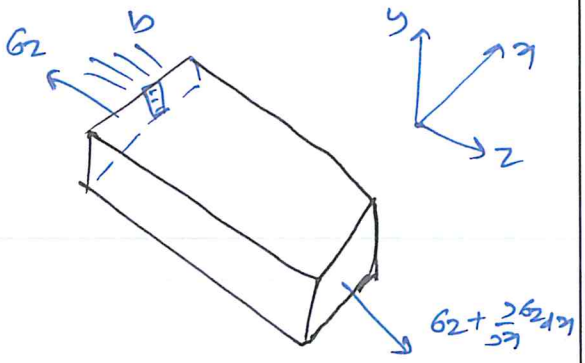
As, $\frac{G\theta}{L} = \frac{T}{J}$

$\Rightarrow \theta = \frac{TL}{GJ} \quad] (5)$

On comparing (4) & (5) -

$\frac{1}{J} = \frac{1}{4Am^2} \int_0^{t_m} \left(\frac{ds}{t}\right)$

$\Rightarrow$ $\boxed{J = \frac{4Am^2}{\int_0^{t_m} \left(\frac{ds}{t}\right)}}$ Proved

Q. NO.	ANSWER	MARKS
03.	 	

The summation of forces in z-direction.

$$\int_0^s \left(\sigma_x + \frac{\partial \sigma_z}{\partial x} dz\right) t\, ds + q\, dz = \int_0^s \sigma_z \cdot t\, ds$$

OR

$$q = -\int_0^s \frac{\partial}{\partial z}\left(\frac{M_x y}{I_x}\right) t\, ds$$

$$q = -\int_0^s \frac{\partial M_x}{\partial z} \cdot \frac{y}{I_x} \cdot t\, ds$$

$$\Rightarrow q = -\frac{V}{I_x}\int_0^s y\, t\, ds$$

OR

$$\boxed{q = -\frac{V}{I_x}\int_0^s y\, dA} \quad \{t\, ds = dA$$

Proved

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Dated _____ . **Signature of Paper Setter** **Signature of Principal/HOD**

School of Aeronautics (Neemrana)
I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

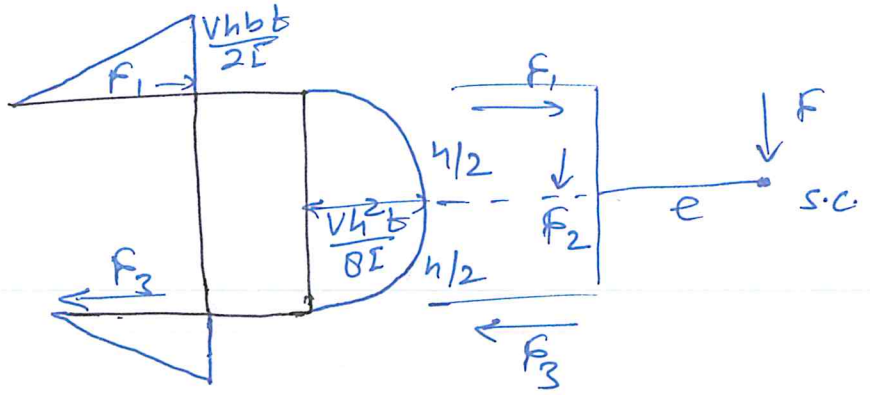
MODEL ANSWER PAPER

Name of Examination: _____ Date of Examination: _____

Subject _____ Batch _____ Semester _____

Q. NO.	ANSWER	MARKS
04	As, $q = -\frac{V}{I}\int y\,t\,ds$ for section AB, $q = -\frac{V}{I}\int_0^s \frac{h}{2}(t\,ds)$ $\quad \{y=\frac{h}{2}$ $q_{AB} = -\frac{Vht}{2I}\int_0^s ds$ $= -\frac{Vht}{2I}s$ —(1) At, $s=0$ $q_A = 0$ $s=b$ $q_B = -\frac{Vht}{2I}\cdot b$ for section BC, $q = q_B - \frac{V}{I}\int_0^s (\frac{h}{2}-s)\,t\,ds$ $\quad \{y=(\frac{h}{2}-s)$ $= q_B - \frac{V}{I}\left[\frac{hs}{2} - \frac{s^2}{2}\right]t$ $= -\frac{Vhtb}{2I} - \frac{Vh^2t}{8I}\Big]$ —(2) Now, $f_3 = f_1 = \frac{1}{2}\cdot b\cdot\frac{Vhbt}{2I}$ $= \frac{Vhb^2t}{4I}$	

Q. NO.	ANSWER	MARKS



$$F_2 = \frac{Vhbt}{2I} \times h + \frac{2}{3} \cdot h \times \frac{Vh^2 t}{8I}$$

On taking moment about shear centre (e).

$$2F_1 \times \frac{h}{2} - F_2 \times e = 0$$

$$\Rightarrow \quad e = \frac{F_1 \times h}{F_2}$$

OR

$$e = \frac{\frac{Vhtb^2}{4I} \times 1}{\frac{Vh^2tb}{2I} + 2\frac{Vh^3t}{24I}}$$

$$= \frac{b^2/4}{b/2 + h/2} = \frac{b/2\,(b/2)}{b/2\,(1 + \frac{h}{6b})}$$

$$\boxed{e = \frac{3b^2}{6b+h}}$$ Proved

Q5.

$$I = \frac{th_2^3}{12} + 2\left[\frac{bt^3}{12} + bt\left(\frac{h_2}{2}\right)^2\right] + 2\left[\frac{bt^3}{12} + bt\left(\frac{h_1}{2}\right)^2\right]$$

$$= \frac{t}{12}\left[h_2^3 + 6b(h_1^2 + h_2^2)\right] \quad -(1)$$

Now, for section AB –

Q. NO.	ANSWER	MARKS

$$q_{AB} = -\frac{V}{I}\int_0^s \left(\frac{h_2}{2}\right) t\, ds \qquad \left\{ y = \frac{h_2}{2} \right.$$

$$= -\frac{V}{I}\left(\frac{h_2}{2}\right) t s$$

At, $s = 0$, $q_A = 0$

$s = b$ $\quad q_B = -\frac{V}{I}\left(\frac{h_2}{2}\right) t b$] - (2)

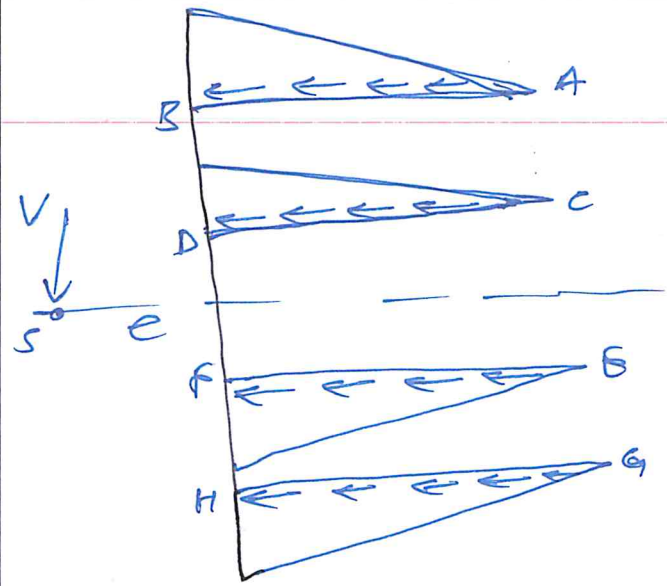
For section CD -

$$q_{CD} = -\frac{V}{I}\left(\frac{h_1}{2}\right) t s \qquad \left\{ y = \frac{h_1}{2} \right.$$

At, $s = 0$, $q_C = 0$

$s = b$, $q_D = -\frac{V}{I_2}\left(\frac{h_1}{2}\right) t b$] - (3)

Shear flow diagram -



On taking moment about 'S' at a distance 'e' -

$$2\left[\frac{1}{2}\left(\frac{V h_2 t b}{2I} \times \frac{h_2}{2}\right)\right] + 2\left[\frac{1}{2}\left(\frac{V h_1 t b}{2I}\right) \times \frac{h_1}{2}\right] - Ve = 0$$

$$\Rightarrow \quad \boxed{e = \frac{3b^2(h_1^2 + h_2^2)}{h_2^3 + 6b(h_1^2 + h_2^2)}}$$

Q. NO.	ANSWER	MARKS

06.

$$I = 2\left[\frac{b_2 t_f^3}{12} + b_2 t_f \left(\frac{h}{2}\right)^2\right] + 2\left[\frac{b_1 t_f^3}{12} + b_1 t_f \left(\frac{h}{2}\right)^2\right] + \frac{t_w h^3}{12}$$

$$= \frac{h^2}{12}\left[h t_w + 6 t_f (b_1 + b_2)\right] \quad \text{— (1)}$$

For section AB –

$$q_{AB} = -\frac{V}{I}\int \frac{h}{2} t_f \, ds$$

$$= -\frac{V h t_f}{2I} \cdot s$$

At – $s = 0$, $q_A = 0$

$s = b_2$, $q_B = -\frac{V h t_f b_2}{2I}$ — (2)

For section CB –

$$q_{CB} = -\frac{V}{I}\int \frac{h}{2} t_f \, ds$$

$$= -\frac{V h t_f}{2I} \cdot s$$

at, $s = 0$ $q_C = 0$

$s = b_1$, $q_B = -\frac{V h t_f b_1}{2I}$ — (3)

Now, from fig. –

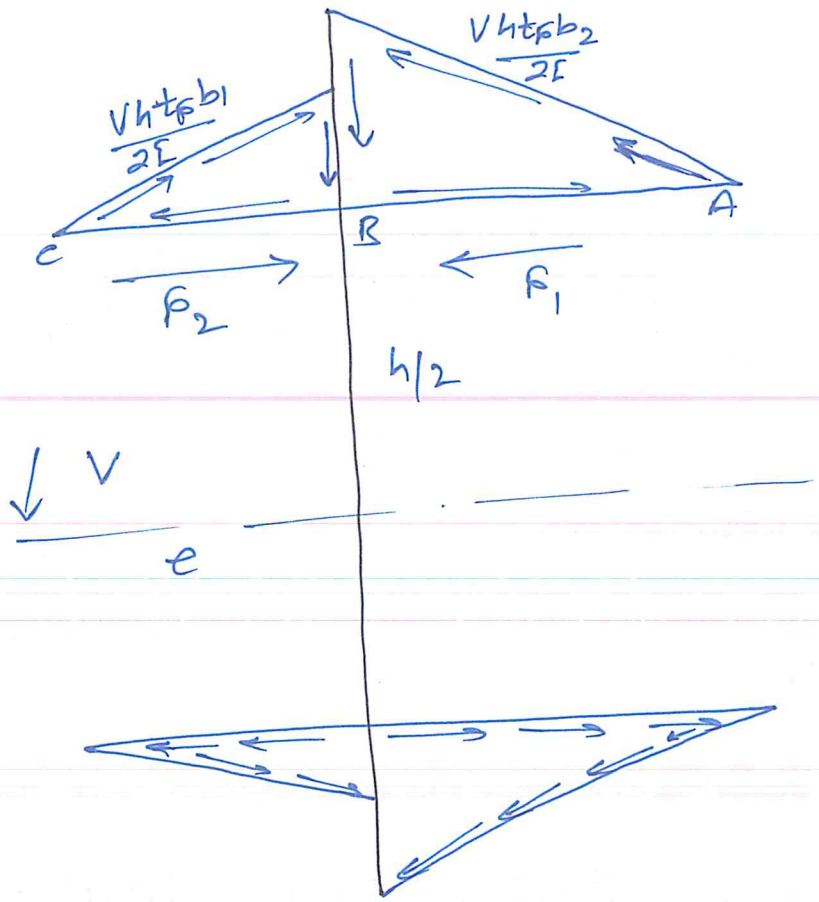
On taking moment about shear centre –

$$2\left[\frac{1}{2} b_2 \left(\frac{V h t_f b_2}{2I}\right) \times \frac{h}{2}\right] + V e - 2\left[\frac{1}{2} b_1 \times \frac{V h t_f b_1}{2I} \times \frac{h}{2}\right]$$

$$= 0 \quad \text{— (4)}$$

Q. NO.	ANSWER	MARKS

Shear flow diagram -



from eq^n (4)

$$e = \left[\frac{h^2 t_f b_2^2 - h^2 t_f b_1^2}{4I} \right]$$

$$= \frac{h^2}{12I} \left[3 t_f \left(b_2^2 - b_1^2 \right) \right]$$

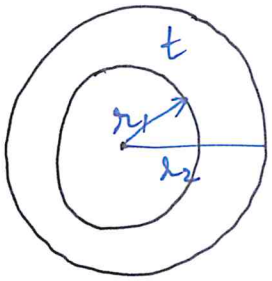
(Ans)

$$\boxed{e = \left(\frac{3 t_f b^2}{4 t_w + 6 t_f b} \right)}$$

Ans.

Q. NO.	ANSWER	MARKS

(00.)



$A_m = \pi r^2$

$$\tau_1 = \frac{T}{2t A_m} = \frac{T}{2t\pi r^2} \quad -(1)$$

$$\frac{\tau}{R} = \frac{I}{J} \Rightarrow \tau_2 = \frac{T}{J}\cdot R \quad -(2)$$

As,

$$J = \frac{\pi}{32}(d_1^4 - d_2^4) \qquad \begin{cases} d_1 = 2r_1 \\ d_2 = 2r_2 \end{cases}$$

$$= \frac{\pi}{32}\left[(2r_1)^4 - (2r_2)^2\right]$$

$$= \frac{\pi}{2}\left[r_1^4 - r_2^4\right]$$

$$= \frac{\pi}{2}\left[\left(r+\frac{t}{2}\right)^4 - \left(r-\frac{t}{2}\right)^4\right] \qquad \begin{cases} \text{As,} \\ r_1 = r + \frac{t}{2} \\ r_2 = r + \frac{t}{2} \end{cases}$$

$$= \frac{\pi}{2}\left[\left\{\left(r+\frac{t}{2}\right)^2 + \left(r-\frac{t}{2}\right)^2\right\}\cdot\left\{\left(r+\frac{t}{2}\right)^2 - \left(r-\frac{t}{2}\right)^2\right\}\right]$$

$$= \frac{\pi r t}{2}\left[4r^2 + t^2\right] \quad -(3)$$

Hence,

$$\tau_2 = \frac{2T\cdot R}{\pi r t(4r^2+t^2)} \quad -(4) \qquad \begin{cases} \text{As,} \\ R = r + \frac{t}{2} \end{cases}$$

from (3) & (4) -

$$\frac{\tau_1}{\tau_2} = \frac{T}{2\pi t r^2} \times \frac{\pi r t(4r^2+t^2)}{T(2r+t)}$$

$$= \frac{\frac{4r^2}{t^2}+1}{2\frac{r}{t}\left(\frac{2r}{t}+1\right)} \qquad \begin{cases} \text{As,} \\ \left(\beta = \frac{r}{t}\right) \end{cases}$$

$$\boxed{\left(\frac{\tau_1}{\tau_2}\right) = \frac{4\beta^2+1}{2\beta(2\beta+1)}}$$

proved

Q. NO.	ANSWER	MARKS
07		

Moment of Inertia -

$$I = \frac{t \times 125^3}{12} + \frac{t \times 125^3}{12} + \frac{t \times 100^3}{12}$$

$$= (4008\,54.167)\ mm^4 \quad] \rightarrow (1)$$

For section AB -

$$Q = -\frac{V}{I}\int y\,t\,ds$$

Here, $y = \frac{125}{2} - 3$

$$= -\frac{Vt}{I}\left(\frac{125}{2}s - \frac{s^2}{2}\right)$$

at (A) $s = 0$, $Q = 0$

(B) $s = \frac{125}{2}$

$$Q_B = -\frac{1953.125\,Vt}{I} \quad] \rightarrow (2)$$

For section GH -

$$Q_{GH} = -\frac{V}{I}\int y\,t\,ds$$

$$= -\frac{V}{I}\int (50-s)\,t\,ds \qquad \{y = (50-s)$$

$$= -\frac{V}{I}.t\left[50s - \frac{s^2}{2}\right]$$

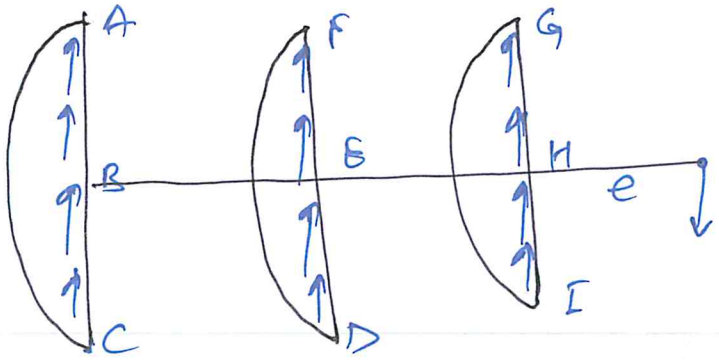
At (G) $s = 0$, $Q_G = 0$

At (H) $s = 50$

$$Q_H = -\frac{1250\,Vt}{I} \quad] \rightarrow (3)$$

Q. NO.	ANSWER	MARKS

Shear flow diagram -



Now,
- On taking moment about shear centre -

$$2\left[\frac{2}{3}(125)\times\frac{193.125\,Vt}{I}\right]\times 125$$

$$+\left[\frac{2}{3}\times 150\times\frac{1250\,Vt}{I}\right]\times 50 - Ve = 0$$

$$\Rightarrow \boxed{e = 69.66556\ mm}$$

Ans.

Note

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Dated 9/3/18. **Signature of Paper Setter** **Signature of Principal/HOD**

Annexure No. SA/14

School of Aeronautics(Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

Fortnightly/Term : Mid Term -1 Date : 27. 02. 2018

Subject : **Aircraft Design (Th)** Batch : AE-7,8,9 & MT-1

Faculty Name : Mr. D. Sukumar Semester: VI

(Answer any FIVE Questions. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions	Unit Name / Topic
1.	With neat sketches, explain the V-n diagram. (9)	Unit No.: Topic Name: Source:
2.	Explain about takeoff and landing performance. (9)	Unit No.: Topic Name: Source:
3.	Write about the weight estimation of out line approach (9)	Unit No.: Topic Name: Source:
4.	Write about the different mission performance of an aircraft. (9)	Unit No. Topic Name: Source:

Q.No.	Questions	Unit Name / Topic
5.	Calculate the thrust required for a Gulfstream IV twin-turbofan executive transport in cruise velocity of 500ft/s and in cruise velocity of 800ft/s at an altitude of 30,000 ft, assuming a weight of 73,000 lb. Airplane data: S = 950 ft2 , AR= 5.92, CD0 = 0.015, $\tilde{n}$ = 8.9068 x 10-4 slug/ft^3 and K = 0.08. (9)	Unit No.: Topic Name: Source:
6.	Calculate the value of (L/D) for a Gulfstream IV twin-turbofan executive transport in cruise velocity of 400ft/s at an altitude of 30,000 ft, assuming a weight of 73,000 lb. Airplane data: S = 950 ft^2 , AR= 5.92, C_{D0} = 0.015, $\tilde{n}$ = 8.9068 x 10-4 slug/ft^3 and K = 0.08. (9)	Unit No.: Topic Name: Source:
7.	Calculate the weight of payload and weight of crew and fuel weight ratio for the cruise flight of Regional transport airplane with turboprop engine with 70 passengers of range 1740 km with V_{cruise}: Around 500 kmph at around 4.5 km altitude with wing area of 61.43 m^2 & aspect ratio is 12. Take e=0.737. (9)	Unit No.: Topic Name: Source:
8.	Calculate the weight of payload and weight of crew and fuel weight ratio for the 30 minutes of loiter phase flight of Regional transport airplane with turboprop engine with 40 passengers of range 1740 km with V_{cruise}: Around 500 kmph at around 4.5 km altitude with wing area of 61.43 m^2 & aspect ratio is 12. Take e=0.737 and W_0=21500. (9)	Unit No. Topic Name: Source:

Annexure No. SA/35

School of Aeronautics (Neemrana)

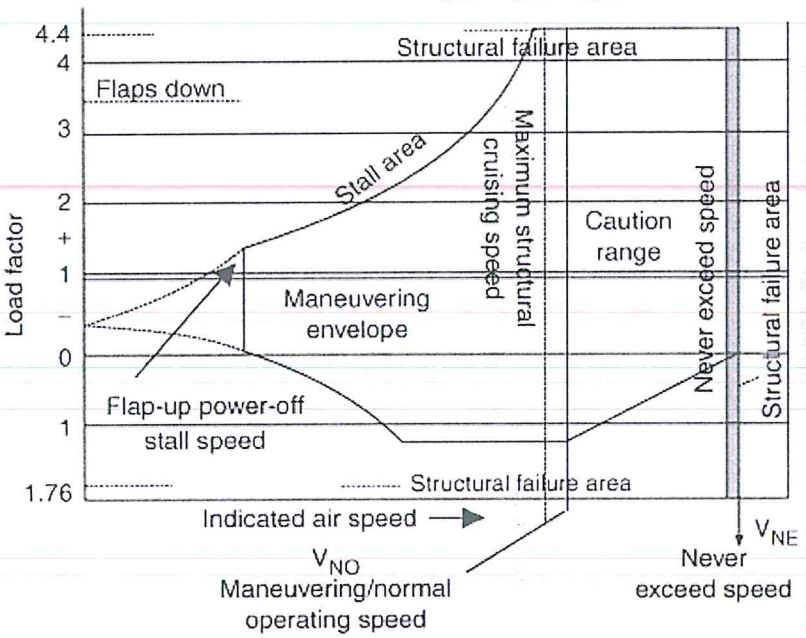
I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

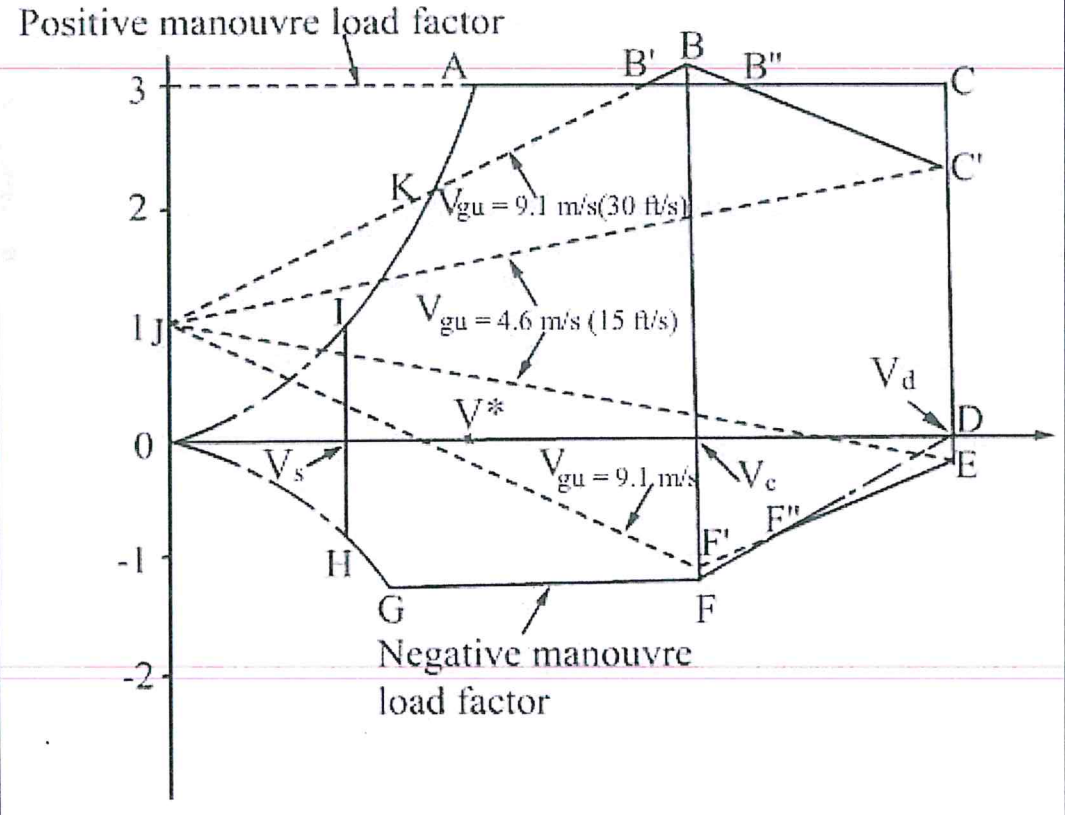
MODEL ANSWER PAPER

Name of Examination: Mid Term - 1 Date of Examination: 27.02.2018

Subject Aircraft Design Batch 7,8,9 & MT - 1 Semester VI

Q. NO.	ANSWER	MARKS
Ans. 1.		





Q. NO.	ANSWER	MARKS
	A V-n diagram shows the flight load factors that are used for the structural design as a function of the air speed. These represent the maximum expected loads that the aircraft will experience. These load factors are called as limit load factors. These diagrams are used primarily in the determination of combinations of flight condition and load factors to which the airplane structure must be designed. For purposes of structural sizing, analysis is performed at four extreme loading conditions on the V-n diagram. The Positive High Angle of Attack (PHAA) is the loading condition represented by the intersection between the positive operational load limit line and the positive maximum lift curve. The Positive Low Angle of Attack (PLAA) is at the intersection between the positive operational load limit line and the dive speed. The Negative High Angle of Attack (NHAA) and Negative Low Angle of Attack (NLAA) are defined similarly except are for the negative loads. Should the gust envelope extend beyond the manoeuvring envelope in any of these four locations, the load factor of the gust envelope is instead used for the extreme loading condition. The high angle of attack conditions are characterized by a high coefficient of lift and high drag. The low angle of attack conditions are characterized by a high lift force. Designing to accommodate these four extreme loading conditions will guarantee that the wing will not undergo structural damage so long as operational load limits are not exceeded. The control of weight in aircraft design is of extreme importance. Increase in weight requires stronger structures to support them, which in turn lead to further increase in weight & so on. Excess of structural weight means lesser amounts of payload, affecting the economic viability of the aircraft. Therefore there is need to reduce aircraft's weight to the minimum compatible with safety. Thus to ensure general minimum standards of strength & safety, airworthiness regulations lay down several factors which the primary structures of the aircraft must satisfy. These are, *f*æ **LIMIT LOAD**: the maximum load that the aircraft is expected toexperience in normal operation. **PROOF LOAD**: product of the limit load and proof factor *f*æ **ULTIMATE LOAD** : product of limit load and ultimate factor **There are two types of V-n diagram:** The V-n maneuver diagram The V-n gust diagram	

Q. NO.	ANSWER	MARKS

Ans 2.

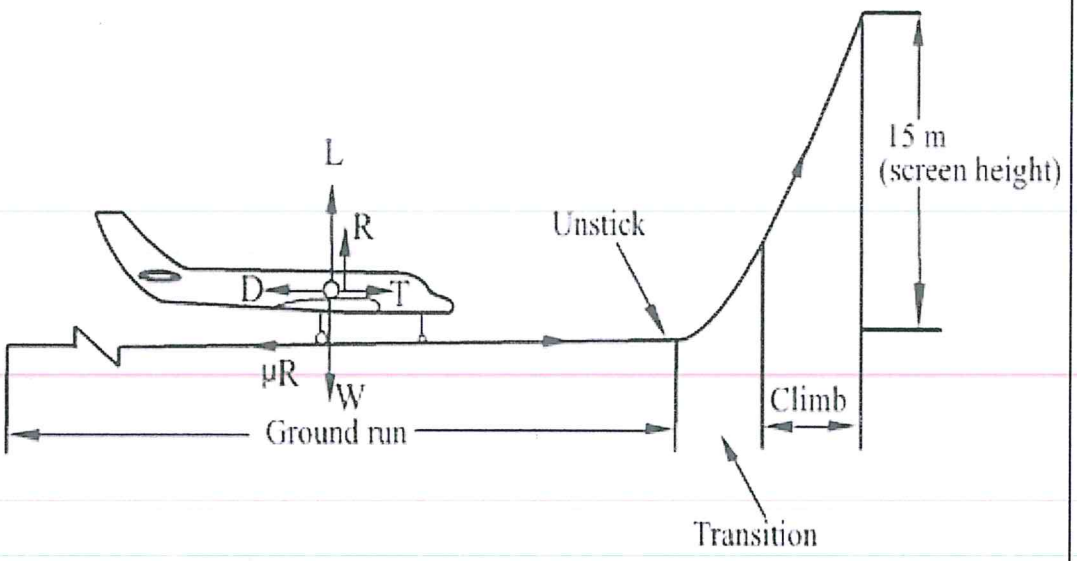


Figure above shows the phases of take-off flight. It also shows the forces on the airplane during the ground run.

The equation of motion during the ground run is:

$T - D - \mu R = (W / g)\, a$

Ground reaction = $R = W - L$, where 'μ' is the coefficient of friction between the ground and the tyres and 'a' is the acceleration.

Hence,

$$\text{ground run} = s_1 = \int_0^{V_{t.o}} \frac{V dV}{a} = \frac{W}{g} \int_0^{V_{t.o}} \frac{V\, dV}{T - D - \mu(W - L)} \qquad (3.20)$$

$$V_{t.o} = k \sqrt{\frac{2W}{\rho S C_{L_{max}}}}$$

where, k = 1.1 to 1.3. Hence, higher the value of $V_{t.o}$, longer is the take off run. Consequently, for reducing the take off run, low W/S, high C_{Lmax} and high T/W (or P/W) are required. The take-off distance (s_{to}) is proportional to take-off run (s_1). Hence, for a jet airplane,

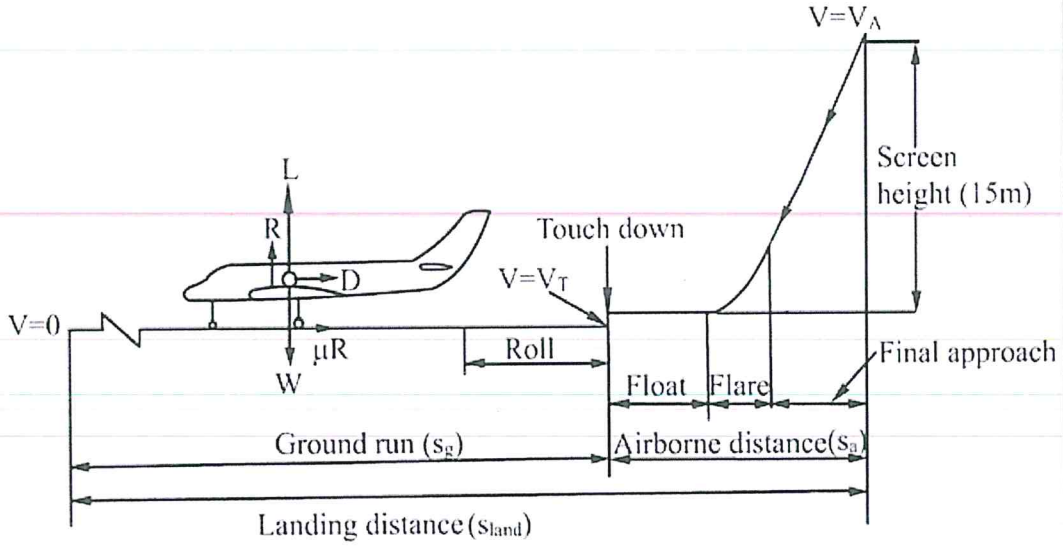
$$s_{to} = f(T_a/W, C_{Lmax}, \text{polar}, W/S, \mu) \qquad (3.21)$$

For an airplane with engine-propeller combination,

$$s_{to} = f(W/P_a, C_{Lmax}, \text{polar}, W/S, \mu) \qquad (3.21a)$$

It may be noted that the take-off distance is generally prescribed at sea level and hence 'ρ' is not included in Eqs (3.21) and (3.21a).

Q. NO.	ANSWER	MARKS
	Landing distance (s_{land}) Figure below shows the phases of landing flight. The estimation of landing distance (s_{land}) is more complicated than that of s_{t0}. However, it depends on the square of stalling speed in landing configuration (V_s) and the type of braking system.	



The stalling speed is given by :

$$V_S^2 = \frac{2W}{\rho S C_{Lmax}}$$

Thus, for reducing the landing distance requires (a) low wing loading (W/S), (b) high value C_{Lmax} and (c) good braking system i.e.

$s_{land} = f(C_{Lmax}, W/S, \text{braking system})$ (3.22)

Ans 3.

A good estimate of the gross weight (W_0) is necessary for further progress in the design process.
The gross weight (W_0) is expressed as the sum of
(a) The weight of the crew (W_{crew}),
(b) The weight of payload ($W_{payload}$),
(c) The weight of fuel required for the mission (W_f) and
(d) The empty weight (W_e) i.e

$$W_0 = W_{crew} + W_{payload} + W_f + W_e \quad (3.23)$$

Q. NO.	ANSWER	MARKS
	(i) The payload is the weight for which the airplane is designed. For a passenger airplane $W_{payload}$ would be the weight of the passengers plus the baggage. For a cargo airplane $W_{payload}$ would be the weight of the intended cargo. For a trainer airplane $W_{payload}$ would be the weight of the trainee plus the instructor. For special purpose airplanes like agricultural airplane $W_{payload}$ would be the weight of the fertilizer etc. For a fighter airplane $W_{payload}$ would be the weight of the missiles, guns and ammunition. For a bomber airplane $W_{payload}$ would be the weight of bombs and associated equipment. (ii) The crew members are: (a) the flight crew, (b) cabin crew in passenger airplanes and special crew in airplanes like reconnaissance/patrol or for scientific measurements. (iii) In passenger airplanes the number of cabin crew is: (a) one cabin crew for about 30 passengers in economy class and (b) one cabin crew for about 15 passengers in first class. Presently the number of flight crew. would be two for commercial airplanes. On long range airplanes this number could be more to provide rest period for the pilot. (iv) As regards the weights of the passengers and baggage are concerned, a value of 110 kgf per passenger can be taken for long range airplanes (82 kgf for passengers plus the cabin baggage and 28 kgf for the check-in baggage). The value of 16 kgf for check-in baggage can be taken for short and medium range airplanes. (v) For long range airplanes the weight of flight and cabin crew can be taken as 110 kgf. For short range airplanes it could be 85 kgf. (vi) The weight of the trainee and the instructor in trainer airplanes can be taken as 80 kgf. In combat airplanes the weight of the pilot could be 100 kgf due to the additional weight of protection gear. (vii)In the approach, the empty weight is the gross weight of the airplane minus the weight of crew, payload and fuel. In some other approaches, in passenger airplanes, the weights of operational items like food, water etc., are not included in the empty weight of the airplane. Thus, W_{crew} & $W_{payload}$ are known from the design specifications. W_f & W_e depend on gross weight (W_0). Hence, Eq.(3.23) is rewritten as:	

Q. NO.	ANSWER	MARKS

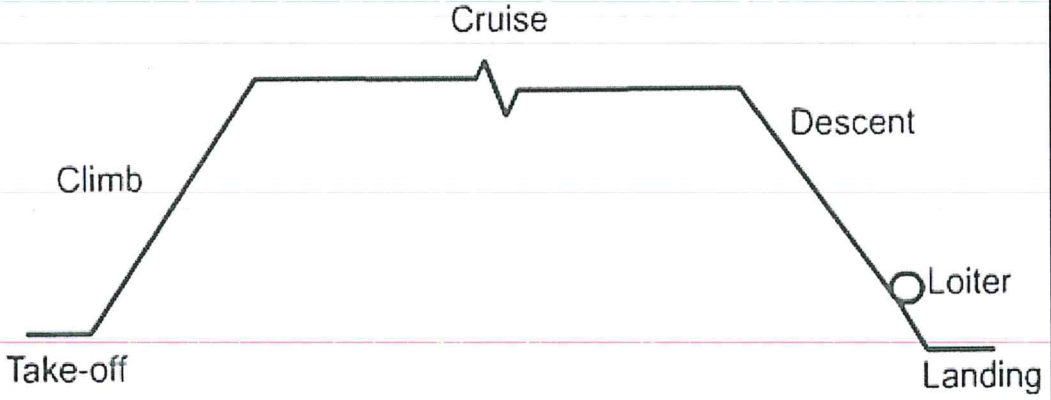
$$W_0 = W_{crew} + W_{pay} + \left(\frac{W_f}{W_0}\right)W_0 + \left(\frac{W_e}{W_0}\right)W_0$$

$$\text{Or } W_0 = \frac{W_{crew} + W_{pay}}{1 - \left(\frac{W_f}{W_0}\right) - \left(\frac{W_e}{W_0}\right)} \qquad (3.24)$$

Ans 4.

Mission profile

Simple mission: For a transport airplane the mission profile would generally consist of (a) warm up and take off, (b) climb, (c) cruise, (d) descent, (e) loiter and (f) landing(Fig.below). Sometimes the airplane may be required to go to alternate airport if the permission to land is refused. Allowance also has to be made for head winds encountered en-route.



(i) For a military airplane the flight profile could consist of (a) warm up and take-off, (b) climb, (c) cruise to target area, (d) performing mission in the target area, (e) cruise back towards the base, (f) descent, (g) loiter and (h) land. In the target area the airplane may carry out reconnaissance, or drop bombs or engage in combat.

As additional examples of the mission profiles, the following three cases can be cited.

(a) A trainer airplane, after reaching the specified area, may perform various maneuvers and return to the base.

(b) An airplane on a humanitarian mission may go to the desired destination, drop food and relief supplies and return to the base.

(c) In some countries the doctors from cities fly to the remote areas, examine the patients and fly back.

Q. NO.	ANSWER	MARKS

ii) The various segments of the mission can be grouped into the following five categories.

(a) Warm up, taxiing and take-off.

(b) Climb to cruise altitude.

(c) Cruise according to a specified flight plan. This item is covered under the topic of "Range" in "Performance analysis".

(d) Loiter over a certain area for a specified period of time. This item is covered under the topic "Endurance" in"Performance analysis".

(e) Descent and landing.

Ans 5.

Choose $V_\infty = 500$ ft/s.

At a standard altitude of 30,000 ft (see Appendix B),

$$\rho_\infty = 8.9068 \times 10^{-4} \text{ slug/ft}^3$$

$$C_L = \frac{2W}{\rho_\infty V_\infty^2 S} = \frac{2(73{,}000)}{(8.9068 \times 10^{-4})(500)^2(950)} = 0.6902$$

$$C_D = C_{D,0} + KC_L^2 = 0.015 + 0.08(0.69)^2 = 0.0531$$

$$T_R = D = \tfrac{1}{2}\rho_\infty V_\infty^2 S C_D = \tfrac{1}{2}(8.9068 \times 10^{-4})(500)^2(950)(0.053) = \boxed{5.617 \text{ lb}}$$

V_∞ (ft/s)	C_L	C_D	T_R (lb)
800	0.2696	0.0208	5.636

Ans 6.

$$\frac{W}{S} = \frac{73{,}000}{950} = 76.84 \text{ lb/ft}^2$$

$$\frac{L}{D} = \left(\frac{\rho_\infty V_\infty^2 C_{D,0}}{2W/S} + \frac{2K}{\rho_\infty V_\infty^2} \frac{W}{S} \right)^{-1}$$

$$= \left[\frac{(8.9068 \times 10^{-4}(400)^2(0.015)}{2(76.84)} + \frac{2(0.08)(76.84)}{(8.9068 \times 10^{-4})(400)^2} \right]^{-1} \qquad \boxed{\frac{L}{D} = 9.98}$$

Q. NO.	ANSWER	MARKS
Ans 7.	$V_{(L/D)_{max}} = \left(\frac{2}{\rho_\infty}\sqrt{\frac{K}{C_{D,0}}}\frac{W}{S}\right)^{1/2}$ $\frac{W_3}{W_2} = \exp\left\{\frac{-R \times BSFC}{3600 \times \eta_p \times (L/D)_{max}}\right\}$ Range =1740 np=0.85 BSFC=2.7N/Kw-hr $(L/D)_{max} = \frac{1}{2\sqrt{C_{DO}\,K}}$ $C_{D0}=0.03354S^{-0.1}$ $C_{D0}=0.0222$ $k = \frac{1}{\pi A e}$ K=0.0360 $(L/D)_{max}=17.7$ $\frac{w_3}{w_2} = 0.917$ $W_{PAYLOAD}=7000kg$ $W_{CREW}=420kg$	
Ans 8.	$\frac{W_4}{W_3} = \exp\left\{\frac{-E \times BSFC \times V}{1000 \times \eta_p \times (L/D)}\right\}$ $C_{Lmp} = \sqrt{\frac{3\,C_{D0}}{K}}$ $C_{Lmp} = \sqrt{\frac{3 \times 0.0222}{0.036}} = 1.36$	

Q. NO.	ANSWER	MARKS

$$V = \sqrt{\frac{2W_3}{\rho S C_{Lmp}}}$$

$$W_3 = \left(\frac{W_1}{W_0}\right)\left(\frac{W_2}{W_1}\right)\times\left(\frac{W_3}{W_2}\right)W_0 = 0.98 \times 0.99 \times 0.917\, W_0 = 0.889\, W_0$$

$$V = \sqrt{\frac{2\times 0.889\times 21500\times 9.81}{1.225\times 61.43\times 1.36}} = 60.56\ \text{m/s} = 218.01\ \text{kmph}$$

$\eta_p = 0.75$, BSFC = 2.85 N/kW - hr

Further, $(L/D)_{loiter} = 0.866\ (L/D)_{max}$

$= 0.866 \times 17.7 = 15.33$

$$\frac{W_4}{W_3} = \exp\left\{\frac{-0.5\times 2.85\times 60.56}{1000\times 0.75\times 15.33}\right\} = 0.992$$

$W_{PAYLOAD}$=4000kg

W_{CREW}=340kg

Note

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Dated 14/02/18. **Signature of Paper Setter** **Signature of Principal/HOD**

School of Aeronautics(Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

Fortnightly/Term : Mid Term -1 Date : 27. 02. 2018

Subject : CFD (Th) Batch : AE - 7,8,9

Faculty Name : Mr. Bipin Kumar Dwivedi Semester: VI

(Answer any FIVE Questions. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions	Unit Name / Topic
1.	Obtain the momentum equation for the model of an infinitesimally small elements of fluid. (9)	Unit No.: Topic Name: Source:
2.	Obtain the energy equation for the model of infinitesimally small elements of fluid. (9)	Unit No.: Topic Name: Source:
3.	What is Discretization? Explain. (9)	Unit No.: Topic Name: Source:
4.	Explain the following - a) Finite differences b) Finite volumes (9)	Unit No. Topic Name: Source:

Q.No.	Questions	Unit Name / Topic
5.	What is grid points? (9)	Unit No.: Topic Name: Source:
6.	Explain about the Taylor's series. (9)	Unit No.: Topic Name: Source:
7.	Explain the finite difference representation of the partial derivative. (9)	Unit No.: Topic Name: Source:
8.	Explain the following a) Truncation Error b) Forward difference c) Rearward difference (9)	Unit No. Topic Name: Source:

School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

Name of Examination: MIDTERM – I Date of Examination: _____

Subject Computational Fluid dynamics Batch 8 Semester VI

Q. NO.	ANSWER	MARKS
(1)	Net force in x direction.	

$$= \left[p - \left(p + \frac{\partial p}{\partial x}dx\right)\right]dy\,dz + \left[\left(\tau_{xx} + \frac{\partial \tau_{xx}}{\partial x}dx\right) - \tau_{xx}\right]dy\,dz$$

$$+ \left[\tau_{yx} + \frac{\partial \tau_{yx}}{\partial y}dy - \tau_{yx}\right]dx\,dz$$

$$+ \left[\tau_{zx} + \frac{\partial \tau_{zx}}{\partial z}dz - \tau_{zx}\right]dy\,dx$$

$$= \left[-\frac{\partial p}{\partial x} + \frac{\partial \tau_{xx}}{\partial x} + \frac{\partial \tau_{yx}}{\partial y} + \frac{\partial \tau_{zx}}{\partial z}\right]dx\,dy\,dz$$

in Y direction

$$= \left[-\frac{\partial p}{\partial y} + \frac{\partial \tau_{xy}}{\partial y} + \frac{\partial \tau_{yx}}{\partial x} + \frac{\partial \tau_{yz}}{\partial z}\right]dx\,dy\,dz$$

in Z direction

$$= \left[-\frac{\partial p}{\partial z} + \frac{\partial \tau_{zz}}{\partial z} + \frac{\partial \tau_{zx}}{\partial x} + \frac{\partial \tau_{zy}}{\partial y}\right]dx\,dy\,dz.$$

2- Rate of change of energy inside the fluid element = Net flux of heat into element + Rate of work done on element due to body and surface forces.

Q. NO.	ANSWER	MARKS

The net rate of work done by Pressure in the x-direction.

$$\left[uP - \left(uP + \frac{\partial(uP)}{\partial x}dx\right)\right]dy\,dz = -\frac{\partial(uP)}{\partial x}dx\,dy\,dz$$

$$\left[u\tau_{xx} + \frac{\partial(u\tau_{yx})}{\partial y}dy\right]dz\,dx = \frac{\partial(u\tau_{yx})}{\partial y}dx\,dy\,dz$$

(a) The net rate of work on the moving fluid element in x direction

$$\left[-\frac{\partial(uP)}{\partial x} + \frac{\partial(u\tau_{xx})}{\partial x} + \frac{\partial(u\tau_{yx})}{\partial y} + \frac{\partial(u\tau_{zx})}{\partial z}\right]dx\,dy\,dz$$

Total work done

$$= \left[-\frac{\partial(uP)}{\partial x} - \frac{\partial(uP)}{\partial y} - \frac{\partial(uP)}{\partial z}\right] + \frac{\partial(u\tau_{xx})}{\partial x} + \frac{\partial(u\tau_{yx})}{\partial y} + \frac{\partial(u\tau_{zx})}{\partial z}$$
$$+ \frac{\partial(v\tau_{xy})}{\partial x} + \frac{\partial(v\tau_{yy})}{\partial y} + \frac{\partial(v\tau_{zy})}{\partial z}$$
$$+ \frac{\partial(w\tau_{xz})}{\partial x} + \frac{\partial(w\tau_{yz})}{\partial y} + \frac{\partial(w\tau_{zz})}{\partial z} + \text{f.v.}$$

(3) The Basic aspects of discretization i.e. how to replace the Partial derivatives in the governing equations of motion with discrete numbers.

Descretization of the Partial differential equation is called finite differences.

Descretization of the integral form of the equation is called finite volume.

Q. NO.	ANSWER	MARKS

(4) - Finite differences.

A Partial derivative with a suitable algebric difference quotient i.e. finite difference. Most Common finite differ. representation of derivative are based on Taylor' series expansion.

$$u_{i+1,j} = u_{i,j} + \left(\frac{\partial u}{\partial x}\right)_{i,j} \cdot \Delta x + \left(\frac{\partial^2 u}{\partial x^2}\right)_{i,j} \frac{\Delta x^2}{L^2} + \left(\frac{\partial^3 u}{\partial x^3}\right)_{i,j} \frac{\Delta x^3}{L^3} \cdots$$

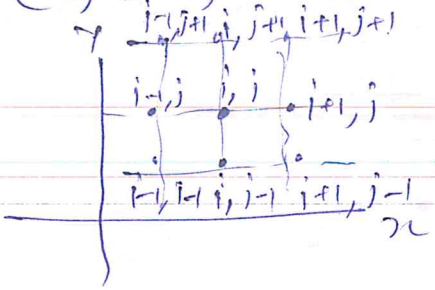
Finite Volumes :- The finite volume method is the technique by which the integral formulation of the Conservation law is descretized directly in the Physical Space.

The FVM is based on cell-averaged value. once the grid has been generated the FVM Consists in associating a local finite volume also called Control volume to each mesh point.

The essential advantages of the FVM is Connected to the Concept of Conservative discretization.

Q. NO.	ANSWER	MARKS

5- The grid points are identified by an index i which runs in the x direction and an index j which runs in the y-direction. Hence if (i, j) is the index for point P then the point immediately to the right of P is (i+1, j) and left is (i-1, j) and above is (i, j+1) and below is (i, j-1)



6- Taylor's series.

$$f(x+\Delta x) = f(x) + \frac{\partial f}{\partial x}\Delta x + \frac{\partial^2 f}{\partial x^2}\frac{\Delta x^2}{2} + \frac{\partial^3 f}{\partial x^3}\frac{\Delta x^3}{3} - \cdots \frac{\partial^n f}{\partial x^n}\frac{\Delta x^n}{n}$$

7- $$u_{i+1,j} = u_{i,j} + \left(\frac{\partial u}{\partial x}\right)_{i,j}\Delta x + \left(\frac{\partial^2 u}{\partial x^2}\right)_{i,j}\frac{\Delta x^2}{2} + \frac{\partial^3 u}{\partial x^3}\frac{\Delta x^3}{3} \cdots$$

$$\left(\frac{\partial u}{\partial x}\right)_{i,j} = \frac{u_{i+1,j} - u_{i,j}}{\Delta x} - \left(\frac{\partial^2 u}{\partial x^2}\right)_{i,j}\frac{\Delta x^3}{2} - \left(\frac{\partial^3 u}{\partial x^3}\right)_{i,j}\frac{\Delta x^3}{6} \cdots$$

Q. NO.	ANSWER	MARKS

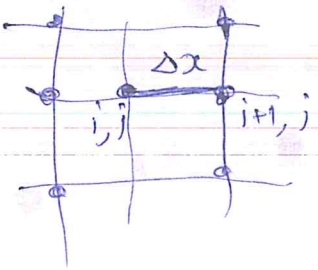
8 –

(a) $\left(\frac{\partial u}{\partial x}\right)_{i,j} = \frac{u_{i+1,j} - u_{i,j}}{\Delta x} - \left(\frac{\partial^2 u}{\partial x^2}\right)_{i,j} \frac{\Delta x^2}{2} - \left(\frac{\partial^3 u}{\partial x^3}\right)_{i,j} \cdot \frac{\Delta x^3}{6} - \cdots$

Finite difference. Truncation Error.

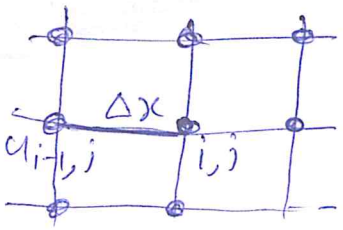
(b) First order forward difference.

$$\left(\frac{\partial u}{\partial x}\right)_{i,j} = \frac{u_{i+1,j} - u_{i,j}}{\Delta x}$$



(c) Rearward difference.

$$\left(\frac{\partial u}{\partial x}\right)_{i,j} = \frac{u_{i,j} - u_{i-1,j}}{\Delta x}$$



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School of Aeronautics(Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

Fortnightly/Term : Mid Term -1 Date : 27. 02. 2018

Subject : **Aircraft rules & Regulation - II (Th)** Batch : AE-7,8,9 & MT-1

Faculty Name : Mr. D. Sukumar Semester: VI

(Answer any FIVE Questions. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions	Unit Name / Topic
1.	List down the documents to be carried on board in aircraft. (9)	Unit No.: Topic Name: Source:
2.	List down the information to be displayed by the operator to passengers on board. (9)	Unit No.: Topic Name: Source:
3.	What are the contents to be included in Aircraft, Engine, Propeller and Radio Apparatus Log Book? (9)	Unit No.: Topic Name: Source:
4.	List down the Log books should be kept and maintained in respect of all aircraft registered in India. (9)	Unit No. Topic Name: Source:

Q.No.	Questions	Unit Name / Topic
5.	What is a) Mandatory Modification b) Airworthiness Directive c) Foreign Airworthiness Authority (9)	Unit No.: Topic Name: Source:
6.	List down the documents to be needed for Registration of Aircraft. (9)	Unit No.: Topic Name: Source:
7.	Write about Location of Nationality or Common Mark and Registration Marks of Lighter-than-air aircraft. (9)	Unit No.: Topic Name: Source:
8.	Write short note duties of An Accountable Manger. (9)	Unit No. Topic Name: Source:

School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

Name of Examination: Mid Term - 1 Date of Examination: 27.02.2018

Subject: Aircraft Rules & Regulation- II Batch AE- 7,8,9 & MT - 1 Semester VI

Q. NO.	ANSWER	MARKS
Ans. 1.	No person in charge of any aircraft shall allow such aircraft to be flown unless the following valid documents, as applicable (in original or attested copies), are carried on board the aircraft: i. Certificate of Registration; ii. Certificate of Airworthiness; iii. Airworthiness Review Certificate (ARC); iv. A document attesting Noise Certification of the aeroplane/ helicopter; v. Air Operator's Permit; vi. Appropriate Licences for each member of the flight crew; vii. Aeromobile Radio operation Licence for Radio Communication apparatus; viii. Journey Log Book or equivalent documents approved by the DGCA; ix. Operations Manual; x. Minimum Equipment List; xi. Flight Manual ; xii. Cabin Crew Manual; xiii. Cockpit and Emergency Check List unless these form part of Flight Manual, carried on board; xiv. Aeroplane/ Helicopter search procedure checklist; xv. Maintenance Release/Certificate to release to service; xvi. LOPA (Layout of Passenger Arrangement); xvii. Emergency and Safety Equipment Layout; xviii. Route guides xix. Current and suitable navigation charts/maps for the planned flight route and all other routes along which it is reasonable to expect that the flight may be diverted; xx. Weight Schedule ; xxi. Load and Trim Sheet; xxii. If carrying passengers, a list of their names and places of embarkation and destination; xxiii. If carrying cargo, a manifest and detailed declarations of the cargo; and xxiv. If carrying dangerous goods, a list of such goods. This list must be specifically brought to the notice of Pilot-in-Command, before the flight.	

Q. NO.	ANSWER	MARKS
Ans 2.	All operators of passenger aircraft shall provide passenger safety information briefing card at every passenger seat location. Such card shall make use of symbology to convey the instructions in a clear and concise manner and shall at least cover the following instructions: (a) When seat belts are to be fastened. Illustration showing the fastening, tightening and unfastening of seat belts. (b) When and how Oxygen equipment is to be used. (c) Restrictions on Smoking. (d) Location and method of opening emergency exits. (e) Use of evacuation slides. (f) How to brace oneself while experiencing impact loads for all seat orientations. (g) Location and Use of Life Saving Rafts/Jackets for over water flights. (h) Routes from passenger area to emergency exits. (i) Restrictions on use of mobile phone, laptops, electronic devices, etc.	
Ans 3.	A manufacturer, in respect of each newly manufactured aircraft; engine or propeller may issue a logbook along with the release documents. If he does not, then the owner/ operator may raise a logbook on his own. Each logbook shall be in three sections: - The first section will contain records of a) Hours flown date wise, b) All routine inspection/maintenance, including "Flight Release" inspection and higher checks carried. c) Test flight d) Minor repairs and certification thereof, e) The information required in the vertical columns, i. The date of flight, ii. Total flight time since manufacture, iii. Time since last overhaul/major inspection, number of landings/cycles, etc. The second section will consist of differently coloured sheets, ruled horizontally. Each page will bear the caption, namely, "Replacement, Major Repairs & Overhaul". A detailed report of the Replacement, Major Repairs & Overhaul done under these headings shall be certified in this section. The third section will consist of a set of still differently colored pages also horizontally ruled, and each page will bear the heading, namely, 'Modification Record'.	

Q. NO.	ANSWER	MARKS
	Details of the modifications/service bulletins including mandatory modification (s) complied with and certified should be recorded along with date and time of compliance in this section. A total DGCA mandatory modifications status of the aircraft, engine and its components shall be reflected even though they are not applicable.	
Ans 4.	i. Journey Log Book or an equivalent document acceptable to DGCA. ii. Aircraft Log Book, iii. Engine Log Book for each engine installed in the aircraft. iv. A propeller Log Book for every variable pitch propeller installed in the aircraft. v. A Radio Apparatus Log Book, for aircraft fitted with radio apparatus. vi. A Flight Log Book as notified in CAR Series 'C' Part II vii. Any other logbook required by the Director General.	
Ans 5.	**Mandatory Modification:** Mandatory Modification means the modification incorporated in an aircraft, aircraft component and items of equipment after type certification to maintain it in an airworthy condition. **Airworthiness Directive:** An airworthiness directive means a document issued or adopted by DGCA which mandates actions to be performed on an aircraft to restore an acceptable level of safety, when evidence shows that the safety level of this aircraft may otherwise be compromised. **Foreign Airworthiness Authority:** Foreign Airworthiness Authority means the airworthiness authority of the country responsible for the issue of type design certification for the aircraft including their accessories.	
Ans 6.	The owner or his authorized representative may apply for registration of the aircraft in the prescribed form CA-28 (Appendix 'A') completed with the following documents at least five working days for aircraft on outright purchase and ten working days for aircraft on lease, before the expected date of issue of Certificate of Registration. i. Customs clearance certificate / bill of entry of the aircraft. ii. Certificate of deregistration from the previous registering authority. iii. An evidence to the effect that the aircraft has been purchased or wholly owned by the applicant. For this purpose, a copy of invoice shall be accepted. iv. For aircraft purchased from a previous owner, an affidavit as required. v. In case the aircraft is taken on dry lease a copy of the lease agreement.	

Q. NO.	ANSWER	MARKS
	vi. In case the aircraft is owned by a company or corporation, a document of registration of the company and the names, addresses and nationalities of the Directors. vii. A copy of the import license issued by Director General Foreign Trade or permission for import issued by the Ministry of Civil Aviation/DGCA. Where the aircraft is imported for private use, it will be registered in the name of the person or company to whom the import license has been issued. viii. In cases where the aircraft has been mortgaged/ hypothecated, the owner/operator shall submit his consent for the same and the papers to this effect. Such a mortgage/hypothecation shall be endorsed on the Certificate of Registration. ix. Fee for registration as prescribed in Rule 35 paid by web based online transaction system of DGCA (Bharatkosh).	
Ans 7.	**Lighter-than-air aircraft:** **a) Airships:** The marks on an airship shall appear either on the hull, or on the stabilizer surfaces. Where the marks appear on the hull, they shall be located lengthwise on each side of the hull and also on its upper surface on the line of symmetry. Where marks appear on the stabilizer surfaces, they shall appear on the horizontal and on the vertical stabilizers; the marks on the horizontal stabilizer shall be located on the right half of the upper surface and on the left half of the lower surface, with the tops of the letters towards the leading edge; the marks on the vertical stabilizer shall be Located on each side of the bottom half stabilizers, with the letters placed horizontally. **b) Spherical Balloons (other than unmanned free balloons):** The marks shall appear in two places diametrically opposite. They shall be located near the maximum horizontal circumference of the balloon. **c) Non-Spherical Balloons (other than unmanned free balloons):** The marks shall appear on each side. They shall be located near the maximum cross section of the balloon immediately above either the rigging band or the points of attachment of the basket suspension cables. **d) Lighter-than-air aircraft:** The side marks on lighter-than-air aircraft (other than unmanned free balloons) shall be visible both from the sides and from the ground. **e) Unmanned free Balloons:** The marks shall appear on the identification plate.	

Q. NO.	ANSWER	MARKS
Ans 8.	An Accountable Manger acceptable to DGCA shall be nominated by the organization. He can be either a Chief Executive/ Managing Director / President/ Vice P r e s i d e n t / Dy. MD/or any other person acceptable to DGCA who has the necessary financial authority to ensure compliance of safety requirements. The Accountable Manager may delegate his authority in writing to another person in the organization having the necessary financial authority, such person then becoming the Accountable Manager for the purpose of this CAR. **The duties of the Accountable Manager shall encompass the following:** a) Ensure that all activities including quality monitoring, are organized, managed and supervised. This also includes contracting and surveillance regarding sub-contracting work. b) Ensure that appropriate instructions are developed, maintained, documented and followed for compliance with the requirements including payment of any charges. c) Ensure that all personnel are appropriately trained and qualified to accomplish the work. d) Ensure that suitable facilities (workshops and equipment) and necessary material (components, spare parts etc.) are available, enabling the organisation to work as per the scope of approval granted. e) Also to ensure that the necessary corrective action is taken promptly on the Deficiencies observed by DGCA/Internal audit.	

Note

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Dated 14/02/18 . **Signature of Paper Setter** **Signature of Principal/HOD**

School of Aeronautics(Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

Fortnightly/Term : Mid Term -1 Date : 24. 02. 2018

Subject : **Principles of Management (Th)** Batch : MT- 1

Faculty Name : Dr. V. S. Bajpai Semester: VI

(Answer any FIVE Questions. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions	Unit Name / Topic
1.	What do you understand by organization? (9)	Unit No.: Topic Name: Source:
2.	Explain line and staff organization with help of a typical organization chart. (9)	Unit No.: Topic Name: Source:
3.	Define management and explain the statement that management is science as well as art. (9)	Unit No.: Topic Name: Source:
4.	What do you understand by systems approach to the management process? (9)	Unit No. Topic Name: Source:

Q.No.	Questions	Unit Name / Topic
5.	What are the responsibilities of a manager? (9)	Unit No.: Topic Name: Source:
6.	What are the skills required by a manager? (9)	Unit No.: Topic Name: Source:
7.	Define international and multinational corporation (MNC). (9)	Unit No.: Topic Name: Source:
8.	Define planning process and explain various types of planning. (9)	Unit No. Topic Name: Source:

School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

Name of Examination: I Date of Examination: _____

Subject Principles of Management Batch MT-1 Semester 6

Q. NO.	ANSWER	MARKS
1	Organization structure depends on the organization's objectives and strategy. In a centralized structure the top layer of management has most of the decision making power and has tight control over departments and divisions. Explanation of organization.	
2.	In a line type of formal organisation only direct and vertical relationship exists. There is unity of command. In staff or functional authority there are line and staff positions. These positions are advisory in nature.	

Q. NO.	ANSWER	MARKS
3	Management or managing is the administration of an organization, whether it is business, NGO, or government body. Management consists of six following functions: (a) Planning (b) Organizing (c) Leading or Commanding (d) Coordinating (e) Controlling. 4. Systems approach is based on the generalization that everything is inter-related and inter dependent. It looks upon management as a system or as an organized whole.	

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Dated _____. Signature of Paper Setter Signature of Principal/HOD

Q. NO.	ANSWER	MARKS
5.	A manager plays various roles in an organization. The ~~seven~~ nine major roles are: 1. Planning 2. Organizing 3. Staffing 4. Directing 5. Leading 6. Coordinating 7. Reporting 8. Budgeting 9. Controlling	
6.	The following skills are required by a manager: 1. Technical skills 2. Human " 3. Conceptual " 4. Design " 5. Communication skills	

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Dated _____. Signature of Paper Setter Signature of Principal/HOD

Q. NO.	ANSWER	MARKS
7.	International Management deals with the management of business operations of an organization that conducts business in more than one country. MNC is a corporate organization that owns or controls production of goods or services in two or more countries other than their home country.	
8.	Management planning is the process of looking at the company's goals and creating plans. Types of planning: Three major types of planning can help managers achieve their organizational goals :- 1. Operational plans 2. (a) Single use plans (b) Continuing or ongoing plans 2. Tactical plans 3. Strategic plans.	

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Dated 06.03.2018 Signature of Paper Setter Signature of Principal/HOD

Annexure No. SA/14

School of Aeronautics(Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

Fortnightly/Term : Mid Term -1 Date : 24. 02. 2018

Subject : **Micro Controller & PLC (Th)** Batch : MT-I

Faculty Name : Ms. Nivedita Kumari Semester: VI

(Answer any FIVE Questions. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions	Unit Name / Topic
1.	With neat diagram explain programmable logic controller. With an example explain ladder logic used in PLC. (9)	Unit No.: Topic Name: Source:
2.	(a) Explain analog BCD input and output systems. (b) Explain analog input signal path and values. (c) Explain module addressing. (d) Explain I/O terminal addressing scheme. (9)	Unit No.: Topic Name: Source:
3.	(a) Draw the schematic of input modules of PLC. (b) Discuss about the programming formats of PLC. (9)	Unit No.: Topic Name: Source:
4.	(a) What is the significance of Cascaded sequencers in PLC programming? Explain. (b) Explain operation of Industrial three axis robot control. (9)	Unit No. Topic Name: Source:

Q.No.	Questions	Unit Name / Topic
5.	Draw the interfacing diagram of DAC0808 with 8051. (9)	Unit No.: Topic Name: Source:
6.	With a neat diagram explain how an 8051 µC can access a 4 KB external RAMWith neat sketch. (9)	Unit No.: Topic Name: Source:
7.	Explain the architecture of an 8051 microcontroller (9)	Unit No.: Topic Name: Source:
8.	Explain serial data communication. (9)	Unit No. Topic Name: Source:

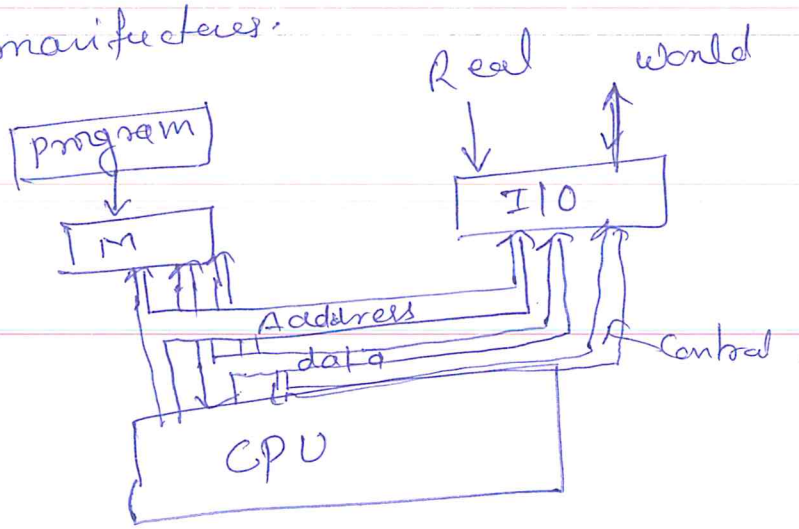
School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

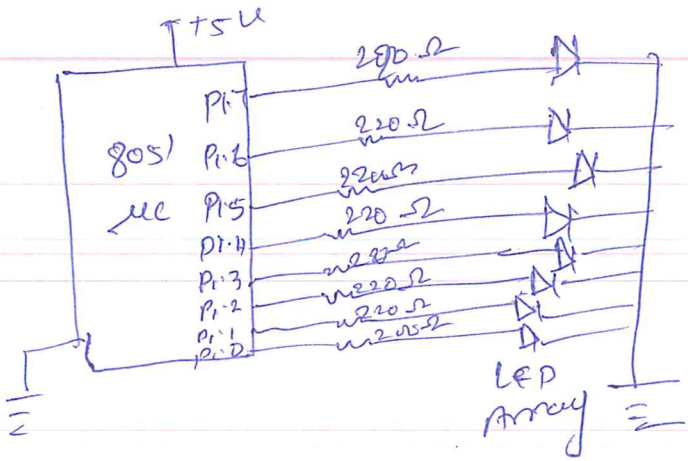
Name of Examination: Mid-term-1 Date of Examination: 24/02/12

Subject Microcontroller & PLC Batch MT-1 Semester 6

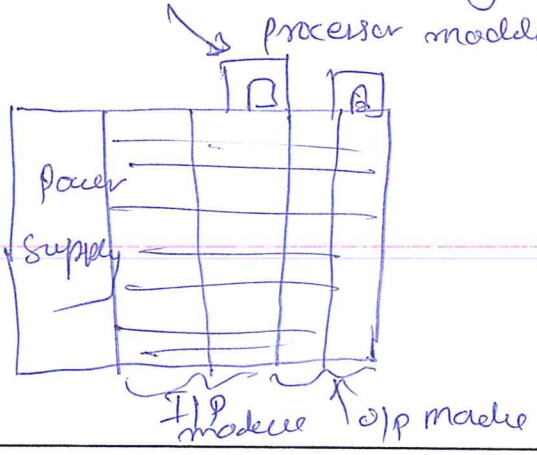
Q. NO.	ANSWER	MARKS
(1)	- An open Archr design allows the sym to be Connected easily to devices and programs made by other manufacturers. - A closed Architr or proprietary sym, it's one whose design makes it more difficult to Connect devices and programs made by other manifecteres.  Archr of PLC.	
(2)	A binary Counter is just like any other Counter which Counts the numbers in binary form. An 8-bit binary Counter Counts from 00000000 to 11111111. This binary Counter can be realized by interfacing 8-LED to the	

Q. NO.	ANSWER	MARKS

port of the MC. By sending the Continuous pulses through the port, the LED are glowing Continuously one after the other. the glow of an LED indicates the binary 1 and No Glow it denotes 0.



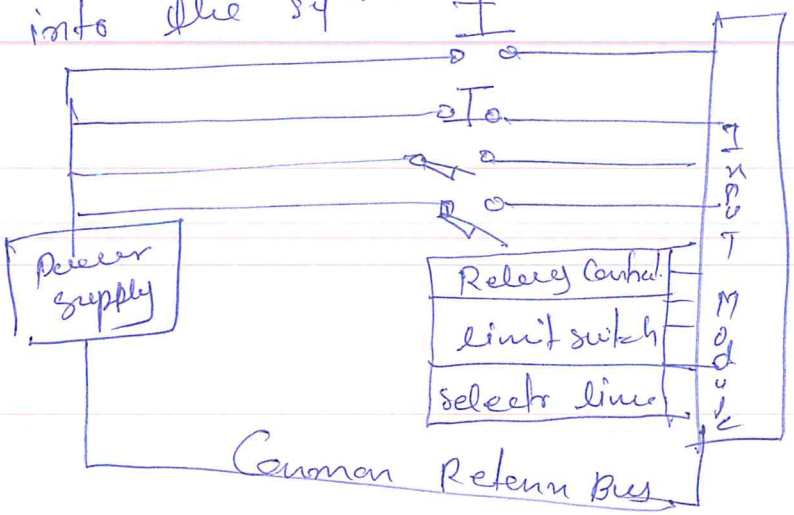
(3) It is divided by Compartements into which Seperate modules Can be plugged. This feature greatly increase your options and the unit is flexibility. you can Choose from all the modules available and mix them in any way you desire.



Q. NO.	ANSWER	MARKS

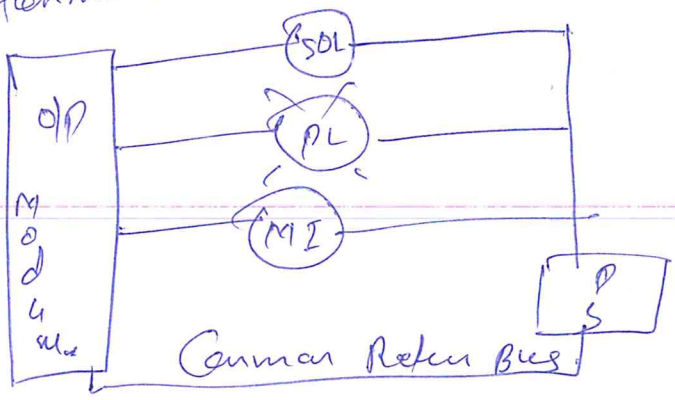
(4) Forms the i/p by which i/p field devices are Connected to the Controller.

the terms 'field' and 'real world' are used to distinguish actual external devices that exist and must be physically wired into the sys.



- Forms the interface by which o/p field devices are Connected to the Controller.

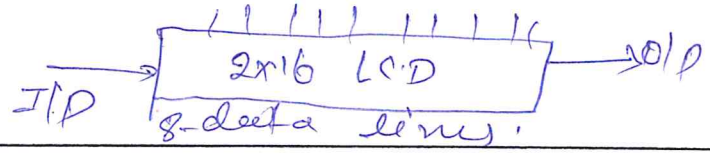
PLC is employed an optical isolater which uses light to electrically isolate the internal Components from the i/p and o/p terminals.



Q. NO.	ANSWER	MARKS

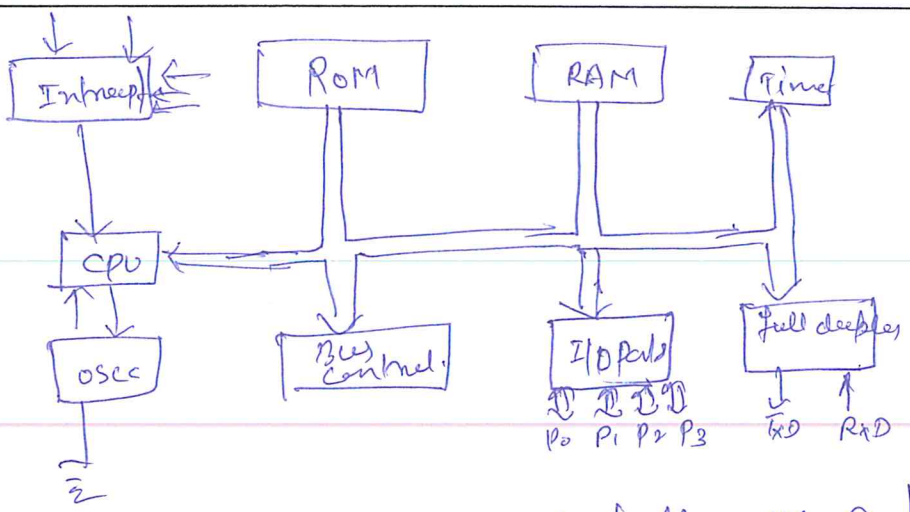
(5) Significances :—
Number of i/p & o/p's (I/O count)
Cost . Physical size
Nano PLC : Smallest sized PLC
Handles upto 16 I/p points.
Micro PLC : Handles upto 32 I/O points
PLC size Classification :—
Allen - Bradley SLC - 500 family
Handles upto 960 I/O points.
Allen Bradley PLC - 5 family Handles several thousands I/p points.

(6) The interfacing of LCD module to 8051 uC is shown below. The 8-data pins are connected to port 1 and control pins are connected to port 2 pins. The busy flag must be checked before the data i/p send to the LCD. With the help of 10K potentiometer the contrast of the LCD display is adjusted.



Q. NO.	ANSWER	MARKS

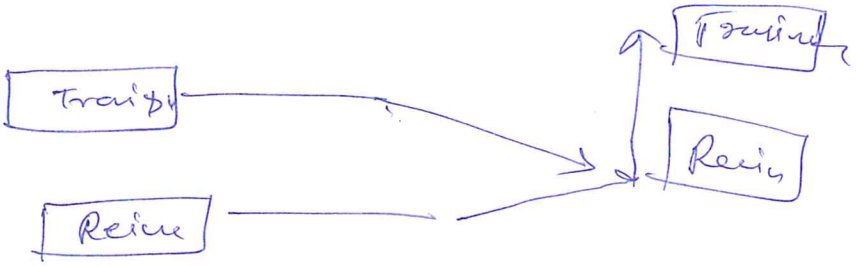
(7)



→ 8-bit CHMOS CPU. most of the MC Contain 3 multiple mode. 16-bit time/Counters. It has Boolen process capibilies.

(8) It is generally three types Communication

(1) General Communication
(2) Half duplex Communication
(3) full duplex Communication.



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Dated 1/03/18. Signature of Paper Setter 1/03/18 Signature of Principal/HOD

School of Aeronautics(Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

Fortnightly/Term : Mid Term -1 Date : 24. 02. 2018

Subject : **Applied Hydraulics&Penumatic (Th)** Batch : MT-1

Faculty Name : Mr. Manbeer Singh Semester: VI

(Answer any FIVE Questions. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions	Unit Name / Topic
1.	Explain the pressure relief valve and sequence valve. (9)	Unit No.: Topic Name: Source:
2.	Explain the hydraulic components and pumping theory. (9)	Unit No.: Topic Name: Source:
3.	Explain the balanced and unbalanced vane pump. (9)	Unit No.: Topic Name: Source:
4.	Discuss the hydrostatic and positive displacement pump also Explain reciprocating pump. (9)	Unit No. Topic Name: Source:

Q.No.	Questions	Unit Name / Topic
5.	Define the actuators also explain RAM and single acting cylinder. (9)	Unit No.: Topic Name: Source:
6.	What is motors and discuss the piston motor and vane motor. (9)	Unit No.: Topic Name: Source:
7.	What is the classification of direction control valve. (9)	Unit No.: Topic Name: Source:
8.	Explain the 3/2 way valve and 4/2 way valve. (9)	Unit No. Topic Name: Source:

School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

Name of Examination: Mid Term -Ist Date of Examination: _____

Subject Applied Hydraulic and Pneumatic Batch MT-1 Semester VI-th

Q. NO.	ANSWER	MARKS
Q.1	Ans Relief valve :- Relief valves are most Common type of pressure control valve. The relief valve function may vary depending upon systems needs. They can provide over load protection for circuits components. or limit the force or torque exerted by linear actuator or rotary motor. Sequence valve :- A sequence valve is a Normally closed pressure control valve. Their position is the one that differentiate it's functionality. If the system pressure reaches the maximum. and the flow through primary port of the valve is diverted through the secondary port to tank. It is named as Relief valve.	
Q.2 Ans	Hydraulic components :- There are six Basic components of Hydraulic system. (1) Tank (Reservoir) to Hold the liquid usually Hydraulic oil.	

Q. NO.	ANSWER	MARKS

(2) A pump to force liquid into the system.
(3) An electric motor to derive the pump.
(4) valves to control liquid direction, pressure and flow rate.
(5) An actuator to convert liquid energy into useful work (linear force or Rotary Torque)
(6) Piping to carry liquid to all locations.

Q.3 Ans Balanced vane Pump :- These are constt volume positive displacement pumps. The disadvantage of unbalanced vane pump is that it experiences axial thrusts. Changing the shape of cam ring elliptical instead of circular can eliminate side thrust. In which there are two sections and two discharge ports. placed at equal and opposite directions. (quadrands) Two pressure or discharge ports cancel out their forces and thus side thrust is eliminated.

Unbalanced vane pump :- The unbalaced vane pump have a rotor connected to the rotating shaft

Q. NO.	ANSWER	MARKS

which is coupled with the prime motor. The rotor has radial slots into which there are vanes that move in and out while rotating due to the centrifugal force. The cam ring is circular in shape. which limits the outward movement of the rotors.

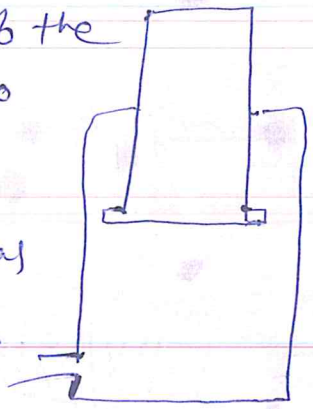
Q. 4 Ans Hydrostatic Pumps :- These Pumps ejects a fixed volume of flow into the Hydraulic system per revolution. of pump shaft rotation. These pumps overcome external pressure from mechanical loads and Resistance to flow due to friction. and are small and compact in size.

Reciprocating Pumps :- In Reciprocating Pumps (Piston and cylinder arrangement) The piston moves away at inlet valve resulting in Partial vaccume. This pushes the fluid into the cylinder from Reservoir. as the atmospheric pressure is large. when the piston is Reversed the valve that opened during Suction is closed and this increase in pressure opens the discharge valve and pushes the fluid into the discharge line.

Q. NO.	ANSWER	MARKS

Q.5 Ans Actuator :- The actuators are the devices, which convert the hydraulic energy into mechanical energy. The pressurized fluid passed through actuator converts fluid energy into linear or rotary motion.

Ram :- These are simplest cylinder and vertical in shape. The fluid is passed on bottom side of the cylinder to push up and do work. The Retraction is achieved by gravity. It has only one fluid chamber.



Single acting cylinder :- This cylinder has one fluid chamber placed either vertical or Horizontal or at any position. The fluid is pressurized on the piston side and on rod side it is pushed by spring. The fluid pushes the piston out to do and it retracts by spring force.

Q. NO.	ANSWER	MARKS

Q. 6 Ans

Motors :- These are called Rotary actuator. Their construction is similar to pumps. Their functionality is reverse of the pumps their principle of operation is Instead of pushing the fluid as pumps, pressurized fluid push the internal surface area that develops torque and Rotation. Both the input and output are pressurized and Hence most of the motors are Internaly drained.

The most common motors are

(1) Gear motors (2) Vane motors.
(3) Piston motors (4) Bent axis piston motors.

Torque = Force X Radius

Large displacement and large radius produce more torque.

Q. 7 Ans Classification of direction control valve

Path of flow	Two way valve	Allows a Total of two possible flow path in Two extrem spool positions.

Q. NO.	ANSWER	MARKS
Q.7 Contd.	four way → Allows a total of four possible path flow in Two extreme spool positions. Control Type :- manual operated :- Hand lever is used to shift the spool. Solenoid operated :- Solenoid action is used. Position Type :- Two position :- spool has Two extreme positions of dwell. Three positions :- spool has Two extreme positions plus one intermediate or centre position. Spring offset :- spring action automatically returns the spool to normal offset position as soon as shifter force is released. No spring :- Spool is not spring loaded it is moved only by shifter force. Spool Type → open centre, close centre | Tandem centre, partial closed centre, semi open centre.	

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Dated _____ . **Signature of Paper Setter** **Signature of Principal/HOD**

Q. NO.	ANSWER	MARKS
Q.8	Ans 3/2 way valve :- The 3/2 way valve is signal-generating valve, with the chesacteristics that a signal on the output side of valve can generated and cancelled. This valve has three ports and two positions. The addition of exhaust ports enables the signal generated via the passage through 3/2 way valve to be cancelled. 4/2 way valve :- This valve has four ports and two positions. in which one valve Normely closed and the other normaly open. The valve has a non-overlapping exhaust connection and is returned to its start position by the spring. The valves are used for controls employing double-acting cylinders. The actuating methods consists of push button, single air pilot, double air pilot and roller lever actuated.	

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Dated 20/02/18. Signature of Paper Setter Signature of Principal/HOD

Annexure No. SA/14

School of Aeronautics(Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

Fortnightly/Term : Mid Term -1 Date : 26. 02. 2018

Subject : **Design of Mechatronics System (Th)** Batch : MT-1

Faculty Name : Mr. Saurabh Malpotra Semester: VI

(Answer any FIVE Questions. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions	Unit Name / Topic
1.	What do you understand by system modelling?What are the various application of system modelling? (9)	Unit No.: Topic Name: Source:
2.	What is model transformation techniques in system modelling? (9)	Unit No.: Topic Name: Source:
3.	How to develop model in system modelling? (9)	Unit No.: Topic Name: Source:
4.	What is the model validation and verification in system modelling? (9)	Unit No. Topic Name: Source:

Q.No.	Questions	Unit Name / Topic
5.	What do you understand by word "Ergonomics"? (9)	Unit No.: Topic Name: Source:
6.	What is mechatronics system? How it is important for automation industries? (9)	Unit No.: Topic Name: Source:
7.	What is electro-mechanics system design?	Unit No.: Topic Name: Source:
8.	What are the various types of design in mechatronics system? Explaineach design with suitable example? (9)	Unit No. Topic Name: Source:

Annexure No. SA/35

School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

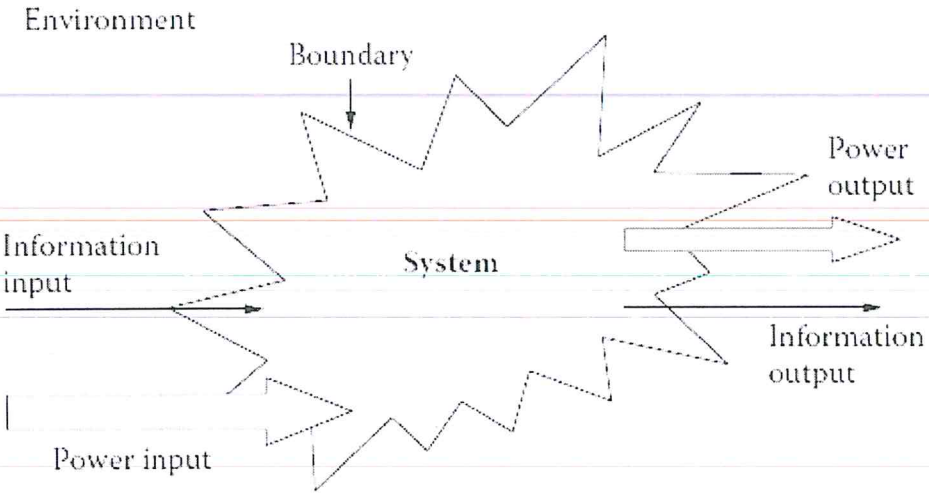
Name of Examination: Mid Term - 1 Date of Examination: 28.02.2018

Subject: Design of Mechatronics System Batch MT - 1 Semester VI

Q. NO.	ANSWER	MARKS
Ans. 1.	The word mechatronics was coined by Japanese engineers sometime in the mid- 1960s and is derived from the words mechanical and electronics. Mechatronics has now become synonymous with multidisciplinary engineering systems that comprise mechanical, electrical, hydraulic, magnetic, and so forth, components working together in a synergistic manner. One vital ingredient in a mechatronic system that is not part of the term itself is a computer or brain (or decision maker). A Mechatronic system, therefore, contains multidisciplinary components integrated through a computer or decision maker. The most commonly used definition for a mechatronic system is: a synergistic combination of precision mechanical engineering, electronic control, and intelligent software in a systems framework, used in the design of products and manufacturing processes. It is hard to pinpoint the origin of this definition since it is found in so many different sources, including the 1997 article in *Mechanical Engineering* by Steven Ashley (1997). Giorgio Rizzoni, professor at Ohio State University, defined it as "the confluence of traditional design methods with sensors and instrumentation technology, drive and actuator technology, embedded real-time microprocessor systems, and real-time software" (Rizzoni 2004). Systems may be made of interacting parts such as subsystems, and subsystems are made of components. For example, an automobile can be considered an engineering system that interacts with the surroundings. It receives input from the surroundings such as input from the driver, friction from the road, and wind drag; it releases exhaust and heat, makes noise, and so forth. The automobile is made of many subsystems such as the drive train, transmission, brakes, and more. These subsystems are in turn made of components such as pistons, gears, bearings, and pumps, for example. While systems are made of components (or subsystems), a system is much more than just the sum of all its parts. Even though the parts that make up a system can be well designed and work well independently, it does not necessarily mean that the system will function well when these components are all put together. Ensuring that the system functions well after assembly is not a trivial task and has to be done well. For a successful final product, a "systems viewpoint" is therefore very important.	

Q. NO.	ANSWER	MARKS

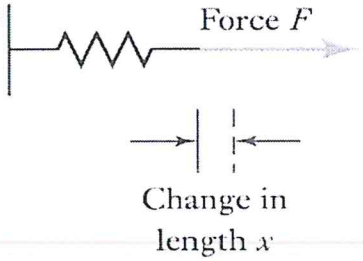
Systems are dynamic as nature; that is, with the passing of time their behavior changes in response to varying external inputs. So understanding any system's dynamic behavior is much more important than knowing its static behavior. An understanding of system behavior is a core requirement of taking a "system viewpoint." Models of systems are very useful tools for understanding dynamic behavior of systems.

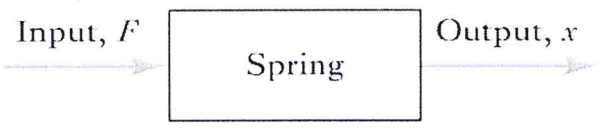


Schematic showing system, system boundary, and inputs and outputs.

Mathematical system models and their solutions become powerful tools in the hands of system designers. They can be used for answering different questions such as:

- Analysis: For given input and known system (and state variables), what would be the output?
- Identification: For given input history, the output history is known; What would the model and its state variables be?
- Synthesis: For given input and a desired output, can a system be designed (along with its state variables) such that the system performs the way desired?

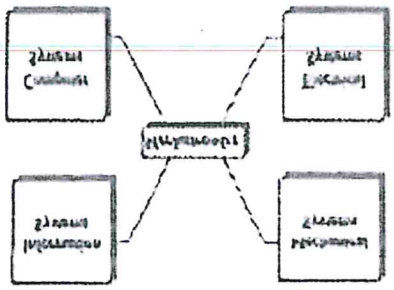




Q. NO.	ANSWER	MARKS
Ans 2.	**MODEL TRANSFORMATION: -** **1. CIRCUIT TRANSFORMATION :-** In a circuit simulator the formulation of transformed models classically takes place in a hardware description language. This approach is the main theme of the present work and will be described comprehensively in the following chapters. Alternatively, it is also possible to draw up equivalent circuit diagrams for mechanical components. We can initially differentiate between two possibilities here. **2. PETRI/LOGIC NET SIMULATOR :-** Predicate/transition networks (Pr/T networks), represent an extension of Petri nets and are often used for the modelling of software and/or digital electronics. They permit a system description on a very abstract level in which the use of hierarchies permits particularly compact representations. The strength of Pr/T networks lies in the effective consideration of parallel processes. Pr/T nets consist of places, transitions, and directional edges between these. Places can contain identifiable markings, which represent the state of the network. If a marking is sufficiently high at the inputs of a transition and if these satisfy any additional conditions, then the transition can 'fire'. In this case the markings in question are cleared from the input places, new markings are generated at the output places and predefined actions may be performed where applicable. **3. MULTI-BODY SIMULATOR :-** In this section two approaches will be introduced: Firstly the equations of electronics will be obtained using the Lagrange principle, so that they can be seamlessly incorporated into a multibody simulator based upon the Lagrange principle. The other method is based upon object orientation, thus allowing the non-mechanical components to be modelled more or less independently of the system as a whole. **4. FINITE ELEMENT SIMULATOR :-** One possibility for system simulation using a FE simulator is to fuse the equation system of electronics together with the equation system of finite elements. The resulting equations include the sought-after unknowns from electronics and mechanics. The complete system can thus be processed using a standard solver. Particularly important in this context is the work of Bedrosian, who expanded a finite element simulator for the calculation of electromagnetic fields so that it could process both analogue circuits and also the kinematics of rigid bodies.A significant aspect of this is to obtain a few desirable properties of FE matrices.	

Q. NO.	ANSWER	MARKS
Ans 3.	System modeling is the process of developing abstract models of a system, with each model presenting a different view or perspective of that system. „c System modeling has now come to mean representing a system using some kind of graphical notation, which is now almost always based on notations in the Unified Modeling Language (UML). „c System modelling helps the analyst to understand the functionality of the system and models are used to communicate with customers. „c Models of the existing system are used during requirements engineering. They help clarify what the existing system does and can be used as a basis for discussing its strengths and weaknesses. These then lead to requirements for the new system. „c Models of the new system are used during requirements engineering to help explain the proposed requirements to other system stakeholders. Engineers use these models to discuss design proposals and to document the system for Implementation. „c In a model-driven engineering process, it is possible to generate a complete or partial system implementation from the system model. 1. UML diagram types 2. Use of graphical models	
Ans 4.	**MODEL VERIFICATION: -** The most direct form of verification takes place as early as the implementation stage and aims to ensure that, where possible, the errors to be identified by verification do not occur at all. This requires intervention into the methodology of model implementation. In this context, the same boundary conditions often apply as those for the development of software since, in this field too, a formal description based upon syntax and semantics is used for the formulation of a given technical content. Accordingly, most of the mechanisms that are used for software development also come into play here in order to avoid implementation errors. Plausibility tests Plausibility tests can also make a contribution to verification (and validation), see also Kramer and Neculau. This is particularly true if they can be performed by means of simple manual calculations. They are based upon analytical considerations or the results of an initial simulation. The following criteria could possibly be drawn upon for plausibility tests: **Causality** The cause should precede effect in reality and in the model. Any deviation from this principle indicates serious deficits in the model. **Balance principles** The principles of the conservation of energy and matter apply not only to the physical reality, but also for the model itself.	

Q. NO.	ANSWER	MARKS
	Current/voltage laws Currents, forces and moments at a point add up to zero. Voltages and velocities add up to zero in a closed loop. These relationships apply for any electronic or mechanical system with concentrated parameters. **Value range** State and output variables and parameters are normally associated with an applicable range of values. Although this is not necessarily precisely defined, unrealistic values can be recognised very quickly. For example; areas, volumes, energies and entropies can never be negative. **Consistency of units** Model equations are generally formulated without units. Nevertheless, it is often worthwhile using the consistency of units as a criterion for verification. **MODEL VALIDATION :-** The validity of a model is always partially dependent upon the desired applications. This is clearly illustrated by the validation criteria listed below, see also. **Murray- Smith:** **Empirical validity** Correspondence between measurements and simulations. **Theoretical validity** Consistency of a model with accepted theories. **Pragmatic validity** Capability of the model to fulfil the desired purpose, e.g. as part of a regulator. **Heuristic validity** Potential for testing hypotheses, for the explanation of phenomena and for the discovery of relationships.	
Ans 5.	Derived from two Greek words: "Nomoi" meaning natural laws "Ergon" meaning Work. Hence, ergonomists study human capabilities in relationship to work demand. Ergonomics is the science and the art of fitting the job and the workplace to workers' needs. It is the study of work „S It is a way to make jobs/tasks fit the employees better „S It is a way to make work easier **TYPES OF ERGONOMICS:-** **Physical ergonomics** is the human body's responses to physical and physiological work loads. Repetitive strain injuries from repetition, vibration, force, and posture fall into this category. **Cognitive ergonomics** deals with the mental processes and capacities of humans when at work. Mental strain from workload, decision making, human error, and training fall into this category. .	

Q. NO.	ANSWER	MARKS
	Organizational ergonomics deals with the organizational structures, policies and processes in the work environment, such as shift work, scheduling, job satisfaction, motivation, supervision, teamwork, telecommuting, and ethics. **OBJECTIVES :-** The objective is to improve the efficiency of operation by taking into account a typical person's size, strength, speed, visual acuity, and physiological stresses, such as fatigue, speed of decision making, and demands on memory and perception. „S To maximize productivity while lowering the risk of Musculoskeletal Disorders (MSDs). MSDs develop as a result of long term exposure to a combination of ergonomic risk factors such as repetition, high forces and awkward postures. Examples of MSDs include carpal tunnel syndrome, tendonitis and back disorders.	
Ans 6.	Mechatronics is a methodology used for the optimal design of electromechanical products. Multi-disciplinary system design has employed a sequential design-by-discipline . The mechatronic design methodology is based on concurrent, instead of sequential-approach to discipline design, resulting in products with more synergy approach. 	
Ans 7.	In engineering, electromechanics combines electrical and mechanical processes and procedures drawn from electrical engineering and mechanical engineering. Electrical engineering in this context also encompasses electronic engineering. Devices which carry out electrical operations by using moving parts are known as electromechanical. Strictly speaking, a manually operated switch is an electromechanical component, but the term is usually understood to refer to devices which involve an electrical signal to create mechanical movement, or mechanical movement to create an electric signal. Often involving electromagnetic principles such as in relays, which allow a voltage or current to control other, usually isolated circuit voltage or current by mechanically switching sets of contacts, and solenoids, by which a voltage can actuate a moving linkage as in solenoid valves. Piezoelectric devices are electromechanical, but do not use electromagnetic principles.	

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Q. NO.	ANSWER	MARKS
Ans 8.	Piezoelectric devices can create sound or vibration from an electrical signal or create an electrical signal from sound or mechanical vibration. Before the development of modern electronics, electromechanical devices were widely used in complicated systems subsystems, including electric typewriters, teleprinters, clocks, very early television systems, and the very early electromechanical digital computers.	

Conventional Design	Mechtronics Design
Added Components	**Integration of Components (Hardware)**
1. Bulky.	Compact.
2. Complex mechanisms.	Simple mechanisms.
3. Cable problems.	Bus or wireless communication.
4. Connected Components.	Autonomous units.
Simple Control	**Integration by information processing (Software)**
5. Stiff Construction.	Elastic construcion with damping by electronic feedback.
6. Feedforward conmtrol, Linear (analog) control.	Programmable feedback (nonlinear) digital control.
7. Precision through narraw tolerances.	Precision through measurement and feedback control.
8. Nonmeasureable chanfge arbitrarilky.	Control of nonmeasureable estimated quantities.
9. Simple monitoring.	Supervision with fault diagnosis.
10. Fixed abilities.	Learning abilities.

Note

1. Paper Setter is required to carefully write the answers for the questions, after consulting all the relevant books.
2. For any discripencies found in answers, paper setter will be held responsible for playing with the career of the students,and doing breach of trust with them, and accordingly action can be taken by the disiplinary committee in this regard.
3. Principal before signing for the correctness of the answer shall ensure the same from relevant books. Point No. 1 & 2 above are applicable to Principal also in case any discripencies are found in answers

Dated 12/03/2018. **Signature of Paper Setter** 12/03/2018 **Signature of Principal/HOD**

Annexure No. SA/14

School of Aeronautics(Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

Fortnightly/Term : Mid Term -1 Date : 26. 02. 2018

Subject : **Object Oriented Programming (Th)** Batch : MT- 1

Faculty Name : Mr. Rajendra Singh Semester: VI

(Answer any FIVE Questions. All Questions carry equal marks) **Total Marks: 45**

Q.No.	Questions	Unit Name / Topic
1.	What is polymorphism. (9)	Unit No.: Topic Name: Source:
2.	Explain the concept of late and early bindings. (9)	Unit No.: Topic Name: Source:
3.	Describe the advantages and disadvantage of oop's. (9)	Unit No.: Topic Name: Source:
4.	What is the difference between a keywords and an identifier. (9)	Unit No. Topic Name: Source:

Q.No.	Questions	Unit Name / Topic
5.	Describe different types of operators in C++. (9)	Unit No.: Topic Name: Source:
6.	Write a c++ Program to find greatest no. from 3 integer number. (9)	Unit No.: Topic Name: Source:
7.	What is looping in c++ explain using example. (9)	Unit No.: Topic Name: Source:
8.	Program to print Triangle in c++. (9)	Unit No. Topic Name: Source:

Annexure No. SA/35

School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

MODEL ANSWER PAPER

Name of Examination: Mid Term - 1 Date of Examination: 27.02.2018

Subject Object Oriented Prog. Batch MT - 1 Semester VI

Q. NO.	ANSWER	MARKS

Ans. 1.	The word **polymorphism** means having many forms. Typically, polymorphism occurs when there is a hierarchy of classes and they are related by inheritance.
	
	C++ polymorphism means that a call to a member function will cause a different function to be executed depending on the type of object that invokes the function.
	
	Consider the following example where a base class has been derived by other two classes "
	
	`#include <iostream>`
	`using namespace std;`
	`class Shape {`
	`protected:`
	`int width, height;`
	`public:`
	`Shape( int a = 0, int b = 0){`
	`width = a;`
	`height = b;`
	`}`
	`intarea() {`
	`cout<< "Parent class area :" <<endl;`
	`return 0;`
	`}`
	`};`
	`class Rectangle: public Shape {`
	`public:`
	`Rectangle( int a = 0, int b = 0):Shape(a, b) { }`
	`int area () {`
	`cout<< "Rectangle class area :" <<endl;`
	`return (width * height);`
	`}`
	`};`
	`class Triangle: public Shape {`
	`public:`
	
	`Triangle( int a = 0, int b = 0):Shape(a, b) { }`
	`int area () {`	

Q. NO.	ANSWER	MARKS

```
cout<< "Triangle class area :" <<endl;
      return (width * height / 2);
    }
};

// Main function for the program

intmain() {
  Shape *shape;
  Rectangle rec(10,7);
Triangle  tri(10,5);
  // store the address of Rectangle
  shape = &rec;
  // call rectangle area.
  shape->area();
  // store the address of Triangle
  shape = &tri;
  // call triangle area.
  shape->area();
  return 0;
}
```

When the above code is compiled and executed, it produces the following result "

```
Parent class area :
Parent class area :
```

The reason for the incorrect output is that the call of the function area() is being set once by the compiler as the version defined in the base class. This is called **static resolution** of the function call, or **static linkage** - the function call is fixed before the program is executed. This is also sometimes called **early binding** because the area() function is set during the compilation of the program.

But now, let's make a slight modification in our program and precede the declaration of area() in the Shape class with the keyword **virtual** so that it looks like this "

```
class Shape {
  protected:
int width, height;
  public:
```

Q. NO.	ANSWER	MARKS

Ans. 2.	Most of the function calls the compiler encounters will be direct function calls. e.g.,
	
	intsum(**int** a,**int** b){**return** a + b;}**int** main(){std::cout<< sum(2,3);// This is a direct function call return 0;}
	
	Direct function calls can be resolved using a process known as early binding. Early binding (also called static binding) means the compiler is able to directly associate the identifier name (such as a function or variable name) with a machine address. Remember that all functions have a unique machine address. So when the compiler encounters a function call, it replaces the function call with a machine language instruction that tells the CPU to jump to the address of the function.
	
	LateBinding
	Compiler doesn't know until runtime which function to invoke.
	In some programs, it's not possible to know which function will be called until runtime. This is known as *late binding* (or *dynamic binding*). In C++, one way to get late binding is to use function pointers or the other way is the use of virtual functions in inheritance. e.g.,
	
	int add(**int** x,**int** y){**return** x + y;}**int** subtract(**int** x,**int** y){**return** x - y;}**int** main(){**int** x, y;std::cin>> x >> y;**int** operation;std::cout<<"choose 0 for add & 1 for subtract\n";std::cin>> operation;**int**(*p)(**int**,**int**);// Function Pointer // Set p to point to the function the user chose switch (operation) { case 0 : p = add; break; case 1 : p = subtract; break; } // Call the function that p is pointing to std::cout<< "The answer is: " << p(x, y) <<std::endl; return 0;	

Ans. 3.	This reading discusses advantages and disadvantages of object-oriented programming, which is a well-adopted programming style that uses interacting objects to model and solve complex programming tasks. Two examples of popular object-oriented programming languages are Java and C++. Some other well-known object-oriented programming languages include Objective C, Perl, Python, Javascript, Simula, Modula, Ada, Smalltalk, and the Common Lisp Object Standard. **Some of the advantages of object-oriented programming include:** 1. Improved software-development productivity: Object-oriented programming is modular, as it provides separation of duties in objectbased program development. It is also extensible, as objects can be extended to include new attributes and behaviors. Objects can also be reused within an across applications. Because of these three factors modularity, extensibility, and reusability –	

Q. NO.	ANSWER	MARKS

```
Shape( int a = 0, int b = 0) {
      width = a;
      height = b;
    }
   virtual intarea() {
cout<< "Parent class area :" <<endl;
      return 0;
    }
};
```

After this slight modification, when the previous example code is compiled and executed, it produces the following result "

Rectangle class area
Triangle class area

This time, the compiler looks at the contents of the pointer instead of it's type. Hence, since addresses of objects of tri and rec classes are stored in *shape the respective area() function is called.

As you can see, each of the child classes has a separate implementation for the function area(). This is how **polymorphism** is generally used. You have different classes with a function of the same name, and even the same parameters, but with different implementations.

Virtual Function

A **virtual** function is a function in a base class that is declared using the keyword **virtual**. Defining in a base class a virtual function, with another version in a derived class, signals to the compiler that we don't want static linkage for this function.

What we do want is the selection of the function to be called at any given point in the program to be based on the kind of object for which it is called. This sort of operation is referred to as **dynamic linkage**, or **late binding**.

Pure Virtual Functions

It is possible that you want to include a virtual function in a base class so that it may be redefined in a derived class to suit the objects of that class, but that there is no meaningful definition you could give for the function in the base class.

Q. NO.	ANSWER	MARKS

object-oriented programming provides improved software-development productivity over traditional procedure-based programming techniques.

2· Improved software maintainability: For the reasons mentioned above, objectoriented software is also easier to maintain. Since the design is modular, part of the system can be updated in case of issues without a need to make large-scale changes.

3. Faster development: Reuse enables faster development. Object-oriented programming languages come with rich libraries of objects, and code developed during projects is also reusable in future projects.

4. Lower cost of development: The reuse of software also lowers the cost of development. Typically, more effort is put into the object-oriented analysis and design, which lowers the overall cost of development.

5. Higher-quality software: Faster development of software and lower cost of development allows more time and resources to be used in the verification of the software. Although quality is dependent upon the experience of the teams, objectoriented programming tends to result in higher-quality software.

Some of the disadvantages of object-oriented programming include:

Steep learning curve: The thought process involved in object-oriented programming may not be natural for some people, and it can take time to get used to it. It is complex to create programs based on interaction of objects. Some of the key programming techniques, such as inheritance and polymorphism, can be challenging to comprehend initially.

Ans. 4. Comparison chart:

BASIS FOR COMPARISON	KEYWOR	DIDENTIFIER
Basic	Keywords are the reserved words of a language.	Identifiers are the user defined names of variable, function & labels.
Use	Specify the type/kind of entity.	Identify the name of a particular entity.
Format	Consider only letters.	Consider letters, underscore, digits.

Q. NO.	ANSWER			MARKS
	Case	Use only lowercase.	Lower and upper cases, both are allowed.	
	Symbol	No special symbol, punctuation is used.	No punctuation or special symbol except 'underscore' is used.	
	Classification	Keywords are not further classified.	Identifier are classified into further 'external name' & 'internal name'.	
	Starting letter	It always starts with a lowercase letter.	First character can be a uppercase, lowercase letter or underscore.	
	Example	int, char, if, while, do, class etc.	Test, count1, high_speed, etc.	
Ans. 5.	An operator is a symbol that tells the compiler to perform specific mathematical or logical manipulations. C++ is rich in built-in operators and provide the following types of operators " . Arithmetic Operators · Relational Operators · Logical Operators · Bitwise Operators · Assignment Operators · Misc Operators			

Ans. 6.	#include<iostream>
	usingnamespacestd;
	
	intmain()
	{
	float n1, n2, n3;
	
	cout<<"Enter three numbers: ";
	cin>> n1 >> n2 >> n3;
	
	if(n1 >= n2 && n1 >= n3)
	{
	cout<<"Largest number: "<< n1;
	}			

Q. NO.	ANSWER	MARKS

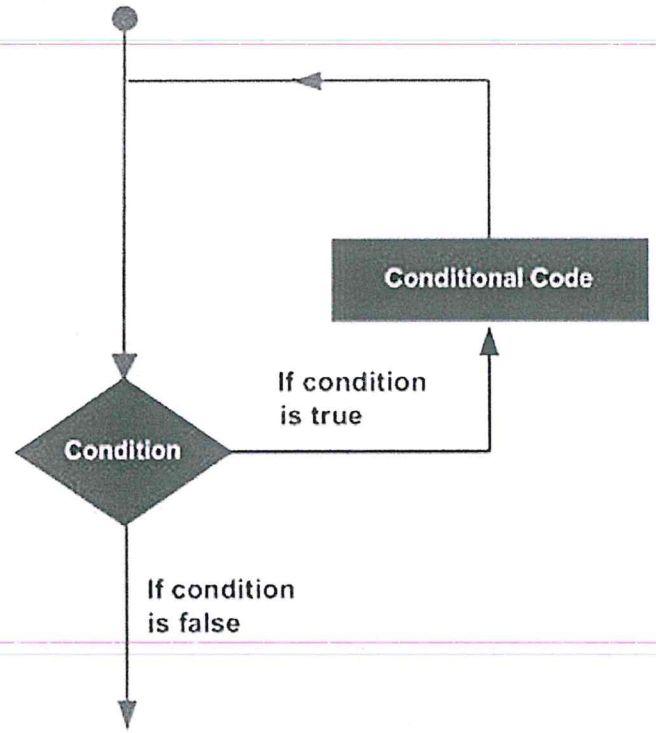
```
if(n2 >= n1 && n2 >= n3)
   {
cout<<"Largest number: "<< n2;
   }

if(n3 >= n1 && n3 >= n2) {
cout<<"Largest number: "<< n3;
   }

return0;
}
```

Ans. 7. There may be a situation, when you need to execute a block of code several number of times. In general, statements are executed sequentially: The first statement in a function is executed first, followed by the second, and so on. Programming languages provide various control structures that allow for more complicated execution paths.

A loop statement allows us to execute a statement or group of statements multiple times and following is the general from of a loop statement in most of the programming languages "



C++ programming language provides the following type of loops to handle looping requirements.

Q. NO.	ANSWER	MARKS

S.No.	Loop Type & Description
1.	**while loop** Repeats a statement or group of statements while a given condition is true. It tests the condition before executing the loop body.
2.	**For loop** Execute a sequence of statements multiple times and abbreviates the code that manages the loop variable.
3.	**do...while loop** Like a 'while' statement, except that it tests the condition at the end of the loop body.
4.	**nested loops** You can use one or more loop inside any another 'while', 'for' or 'do..while' loop.

Loop Control Statements

Loop control statements change execution from its normal sequence. When execution leaves a scope, all automatic objects that were created in that scope are destroyed.

C++ supports the following control statements.

S.No.	Control Statement & Description
1.	**Break statement** Terminates the **loop** or **switch** statement and transfers execution to the statement immediately following the loop or switch.
2.	**Continue statement** Causes the loop to skip the remainder of its body and immediately retest its condition prior to reiterating.
3.	**Goto statement** Transfers control to the labeled statement. Though it is not advised to use goto statement in your program.

The Infinite Loop

A loop becomes infinite loop if a condition never becomes false. The **for** loop is traditionally used for this purpose. Since none of the three expressions that form the 'for' loop are required, you can make an endless loop by leaving the conditional expression empty.

```
#include<iostream>
usingnamespacestd;
int main (){
for(;;){
```

Q. NO.	ANSWER	MARKS
	printf("This loop will run forever.\n"); } return0; } When the conditional expression is absent, it is assumed to be true. You may have an initialization and increment expression, but C++ programmers more commonly use the 'for (;;)' construct to signify an infinite loop. **NOTE** " You can terminate an infinite loop by pressing Ctrl + C keys.	

Ans. 8.	#include<iostream>
	usingnamespacestd;
	
	intmain()
	{
	int rows;
	
	cout<<"Enter number of rows: ";
	cin>> rows;
	
	for(inti = 1; i<= rows; ++i)
	{
	for(int j = 1; j <= i; ++j)
	{
	cout<<"* ";
	}
	cout<<"\n";
	}
	return0;
	}	

Note

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